

Compasses when there are no maps:

The growing importance of adaptive management to the development sector and the role of real-time data.



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Abbreviations

AAR	after action review
BC	British Columbia
BID	Better Immunization Data
CoPs	communities of practice
DDUMs	district data use mentors
DUP	Data Use Partnership
EIR	electronic immunization registry
IDM	Institute for Disease Modeling
IRC	International Rescue Committee
IT	information technology
KM	knowledge management
MACEPA	Malaria Control and Elimination Partnership
MDA	mass drug administration
MEL	monitoring, evaluation, and learning
M&E	monitoring and evaluation
NGOs	nongovernmental organization
NMEP	National Malaria Elimination Program
RRA	Rapid Result Approach
PDIA	Problem-Driven Iterative Adaptation
PEA	Political Economy Analysis
PPA	participatory poverty assessments
SP	scenario planning
ST	Strategy testing
UN	United Nations
USAID US	Agency for International Development

Introduction

In a world with dynamic population movements, outbreaks with cross-border implications, and increasingly politicized health issues, linear and inflexible approaches to global health programs is ineffective. Adaptive management has emerged as one possible approach that embodies iteration and adaptability in program design and implementation to help with navigating complex and dynamic environments. It entails iterative program timelines, funding mechanisms, monitoring and evaluation (M&E) plans, and implementation strategies that allow for a process of continuous “learning by doing.” It builds in explicit processes of testing, learning, and iteration throughout the project lifecycle and calls for an organizational culture that embraces flexibility and learns from its failures.

During the 2014 Ebola outbreak in West Africa, practitioners lacked the basic information critical to helping them determine how to respond to stop the outbreak. They were faced with missing, unclear, and contradictory outbreak data. At the height of the epidemic, when hundreds of people died every day, a culture of panic and mass hysteria contributed to widespread fear and misinformation surrounding the true causes of the virus. Initially practitioners knew little about Ebola’s primary form of transmission, and yet they had to act quickly to mitigate its spread. Decision-makers drew on the lessons of adaptive management in order to respond quickly and nimbly to the evolving global outbreak.

Rather than striving for the perfect solution from the outset, adaptive management introduces a structured decision-making approach to solving dynamic problems—such as the onset of an outbreak—and then refines that approach as more information becomes available and a clearer picture is established.¹

Adaptive programming is much more than managing in the face of failure. Though it draws on some of the same tenets, it is not to be mistaken with change management. At its core is a continuous process of improvement that provides the latitude to adjust direction and tactics as part of an iterative learning process. Under adaptive programming, interventions are treated as hypotheses, not static realities. In this way, the learnings from one experiment or iteration inform subsequent decisions.² Adaptive management follows a cyclic process in which decision-makers are consistently assessing their context, problems and desired goals, testing hypotheses, monitoring results, and then recalibrating approaches as needed. Increasingly, real-time data is recognized for its role in facilitating adaptive management. Digital initiatives—by enabling and improving the collection, analysis and use of data—can enable more rapid, effective and accurate decision-making.

This white paper challenges traditional project management in the global development sector. It encourages donors, policymakers, implementers, and ministries of health to set a new precedent of adaptive programming to:

- Holistically apply adaptive management approaches throughout the project lifecycle, instead of the ad hoc manner that is traditionally been used in programming.
- Realize the value and potential of real-time data to facilitate adaptive management.
- Develop learning-centered organizations that foster collaboration, nurture openness, and convert failures into lessons.

This paper is not intended to be an academically rigorous or peer-reviewed publication. Instead it synthesizes some of the interdisciplinary learnings around this growing field and presents several actionable steps for incorporating adaptive management into program design. We take a critical look both at the potential and the risks of adaptive management and assess where there are needs for

additional research. It also serves as a call to action, encouraging the field of international development to find new ways of working amid uncertainties.

Adaptive management has tremendous potential to usher in a new chapter in the development sector, in which programs and interventions evolve to fill the needs encountered in specific contexts, rather than imposing one-size-fits-all solutions. It is not a silver bullet for the complex challenges encountered in global health, but it can present a set of approaches and tools for navigating the inevitable unpredictability encountered in the development sector and within new and emerging health areas.

Adaptive Management

What is it?

Adaptive management is an approach that embodies intentional testing and learning to navigate change and uncertainty and apply resources and activities in the most effective way. Adaptive management has emerged from the interdisciplinary need and understanding that complex development issues and multi-stakeholder environments require agile solutions. As the development sector increasingly breaks down its siloes to bring about systematic change, traditional management is often not suitable for these new frontiers. While traditional management may facilitate compliance, efficiency and control, it often relies on prescribed objectives determined at the start, and limits strategic change. Adaptive management embraces complexity, instead of treating it as an obstacle to be sidestepped.³ It requires an explicitly experimental or “scientific” approach to managing development projects and can be defined by three core processes:⁴

- **Testing.** Not to be confused with random trial and error or ad hoc management changes, adaptive management begins with a set of approaches, determined by the best available information and expertise, and then systematically revisits those approaches as more or better information becomes available. Teams will closely and strategically monitor the effectiveness of the approaches.
- **Adaptation.** Based on the results of testing and monitoring, decision-makers must course correct. Adaptation involves changing assumptions and interventions to respond to the new information obtained through monitoring efforts. Adaptations are not arbitrary, but rather are based on the growing body of knowledge amassed from past action and evaluation.
- **Learning.** Change is not synonymous with growth. Truly adaptive programming documents both the process and the results achieved after each cycle of decision-making. Furthermore, documenting learnings can advance the field by helping other practitioners leverage previous successes and failures.

Traditional management and programming vs. adaptive management and flexible programming

The global health sector has long been defined by rigid funding mechanisms, project timelines and reporting requirements that treat development as a linear process (see Figure 1: Traditional vs. adaptive management). These parameters force implementers to forecast activities far in advance, implement those activities as original proposed to remain in compliance with funders, and to track and define only measurable results. But a growing number of donors and stakeholders are challenging the status quo with agendas that are problem-driven, flexible, and locally led. The [Doing Development Differently manifesto](#), for instance, represents an emerging community of development practitioners from 60 countries who are arguing for greater flexibility and country ownership within the sector. The [Principles for Digital Development](#) also draws on similar themes. The principles are a set of living guidelines to help practitioners apply digital technologies to development programming. They emphasize cycles of reuse and improvement, the importance of considering the broader ecosystem, and the need for collaboration across projects.

We argue through a series of case studies and the insights from key informant interviews, that flexible programming can help mitigate the challenges of traditional management when dealing with complex

problems, such as climate change, conflict, and emerging health issues. Programming governed by traditional management often faces:

- **Blueprint project plans.** Funding paradigms in the development sector often necessitate project planning well in advance and do not allow much flexibility if circumstances and context change. Even when practitioners refine their knowledge about the realities on the ground, activity-based agendas require that they stick to their previous plans. This approach of leading with solutions, before defining problems results in the ill-suited transplant of “best practices.”⁵
- **Outsourced solutions.** In order to reverse this method of program design, problems must be locally nominated and defined through the engagement of stakeholders at all levels. This may require shifting priorities or goals even midway through implementation.
- **Predefined outcomes.** Traditional management and programming often requires practitioners to identify outcomes far in advance. This is not a failure of monitoring and evaluation. Rather, it is a reminder that M&E is more than just a reporting mechanism, and that it should be used throughout to refocus strategies, goals, and processes.

The result is that development programs may not achieve their desired impact to the extent intended or in the most efficacious way. We are unable to change course, even if we can see we are no longer headed in the right direction. It also means we, the global development community, do not learn as much as we might about what works well and what does not in the contexts we work in.

Table 1. How does adaptive management compare to traditional management? ⁶

Traditional Management	Adaptive Management
Relies on fixed “best practices” and standardization determined at the start of a project	Reinforces participatory approaches, iteration, and flexibility throughout the project lifecycle.
Change is driven by the organization and donors.	Change is contextual, leading to flexible programming informed by the end-user and other key stakeholders.
Requires careful planning and repetition.	Allows time for strategic course correction and decision-making.

The traditional methods were designed to ensure accountability and compliance—in addition to impact—against ineffective or wasteful use of philanthropic or taxpayer funds for development. Adaptive management is intended to preserve accountability while improving the ability to achieve desired development outcomes.

How to do it: Using real-time data to advance adaptive management

The increasing availability of effective digital tools can help to underpin and strengthen adaptive management efforts. Meaningfully designed, real-time data initiatives have the potential to radically contribute to adaptive management but should be built into the project from the inception, and incorporated throughout the full project lifecycle. Because adaptive management requires constantly

revisiting and learning as new needs or opportunities arise, real-time data can contribute a steady set of insights.

Monitoring for success relies on the cadence of baseline, midline, and endline data that is used to ensure a project is on track. However, digital initiatives can contribute valuable data in real-time, throughout the lifespan of a project. Digital technology is enabling frequent feedback loops and evidence-informed decision-making. Real-time data becomes integrated information from multiple sources, allowing for increasingly precise analyses to drive behavior and planning. When combined with other, more traditional data sources, such as community focal points, it can help teams focus their work. Though adaptive programming can intuitively benefit from real-time data, its application is more theory than practice. It is important to acknowledge the potential burdens of digital systems, particularly as they risk creating extra or parallel workstreams for health workers, data collectors, and other decision-makers.

Why do it: The benefits of adopting an adaptive management approach

Adaptive management is not only necessary for the increasingly complex development landscape, but can lead to improved health outcomes, more innovation, and greater collaboration between stakeholders and partners. Despite the limited application of adaptive management in the development community, evidence from other sectors, particularly private industry, suggests that organizations that encourage a learning culture, including honest discourse around a team's failures, tend to perform better.⁷ A workplace environment reinforced by trust is also positively linked with certain adaptive behaviors, such as experimentation and the

Key features of adaptive management

1. Leadership must be willing to accommodate slow but measurable change.
2. It is critical to understand the formal hierarchies, the informal culture, and the personal motivations that dictate the flow, use, and application of information.
3. Data systems must foster feedback loops between end-users and decision-makers to allow for flexibility and responsiveness.
4. Real-time data may reveal programmatic issues or system failures but should be coupled with different kinds of data to create a more complete picture and ensure long-term change.
5. Incorporate adaptive management at all levels, including in monitoring, evaluation and learning frameworks, staff culture, and organizational learning.

THE BENEFITS OF USING REAL-TIME DATA FOR ADAPTIVE MANAGEMENT

Real-time data can help strengthen and advance adaptive management agendas by providing access to relevant and usable data at the appropriate times. Digital initiatives enable adaptive management by:

1. Identifying performance successes and failures.
2. Highlighting and defining emerging needs, interest, and opportunities among individuals and groups.
3. Surfacing unforeseen behaviors, events, and patterns.
4. Quickly reallocating resources when circumstances change.
5. Revealing new insights and ideas.
6. Facilitating reflection about project performance, direction and next steps.
7. Informing new discussions about an issue, process, or challenge.

Source: Bridging Real-Time Data and Adaptive Management: Ten Lessons for Policy Makers and Practitioners
<https://www.usaid.gov/digital-development/rtd4am/policy-design-lessons>

sharing of information. Within the development context, a study of World Bank staff found that employee empowerment was more correlated with strong project outcomes, than other features of the environment or project. An evaluation of more than 100 grant-funded projects by the U.S. Institute of Peace found that reflecting, learning, and recalibrating was key to success.

The history of adaptive management in the public and private sector

The origins of adaptive management in the private sector

Adaptive management has roots in both the public and private sectors. The basic concepts inherent to adaptive programming are not new. In fact, they have been reflected within the social sciences, business, conservation, and other sectors, for decades. Some of its earliest applications can be traced to the 20th century and the establishment of “scientific management,” later known as “Taylorism,” a managerial concept coined by the industrial engineer Frederick Winslow Taylor. Taylor was particularly interested in the productivity of organizations. Managers, he thought, were too fixated on predetermined outputs, and not the processes by which work was executed.⁸ Rather than incentivizing workers with promotions and wage increases, he pioneered time and motion studies, walking the factory floor with a stopwatch to determine the time it took each employee to complete a task. “The best management is a true science,” wrote Taylor.

Adaptive management has also taken cues from the public sector. Some of the earliest examples of its application can be seen in environmental conservation, to bridge the gap between science and practice in the face of changing environmental conditions. The British Columbia (BC) Forest Service manages 59 million hectares of unreserved public forest land, which is used for a combination of

Lessons from the private sector

The private sector can often be a source of inspiration for development. In this case, much of the historical application of adaptive management and the evidence of its value to organizational effectiveness has emerged from private industry. These include:

- **Shell Oil:** In the midst of the 1970s oil crisis, Shell used scenario planning to adapt to a rapidly changing global oil market. Scenario planning led Shell to diversify its investments and change its business practices to hedge against high oil prices. As a result of its findings, it chose to focus efforts on its shipping and refining operations. During the oil embargo of the 1970s, Shell’s strategic planning left it one step ahead of its competitors.
- **Toyota Lean Manufacturing:** The lean manufacturing management philosophy is most commonly associated with Toyota, though it also has roots at Ford. In essence, it seeks to eliminate waste by shifting the focus of manufacturing from individual machines, to the flow of the product through the full process. In the post-World War II manufacturing boom, Toyota used quality circles of workers performing similar tasks to identify, analyze, and address work-related challenges. This method of quality assurance led to team development and cellular manufacturing. Toyota also instituted small batch manufacturing that allowed for greater flexibility in response to customer demands and experimented with self-monitoring machines that informed and helped tailor later cycles of the manufacturing process.

purposes, ranging from recreation, to timber harvesting, and cultural heritage. The careful balancing act requires that the BC Forest Service regularly assess and define land use for a range of clients in

the face of shifting social values and persistent knowledge gaps around the effects of climate change.⁹ Local resource managers serve as the agents of adaptive management. Their deep understanding of the land and close proximity to it makes them ideal decision-makers. The BC Forest Service uses frequent pilot projects to facilitate quick learning and improvements. Based on the outcomes of these pilots and in partnership with a team of scientists, they regularly influence legislation, policy, and forest practice standards in the face of changing ecosystem functions.

The emerging application of adaptive management in the development sector

Within the development sector, adaptive management has emerged largely in humanitarian and crisis settings, where complex and volatile contexts require it. In these fragile states, development practitioners often face security challenges, complex cultural norms, and economic and political instability. In the Diffa Region of southeast Niger, the International Rescue Committee (IRC) has evolved its programming to meet the growing population of internally displaced people, spurred largely by the violence of Boko Haram. The IRC uses a network of informants to track the rapidly changing situation, including population movements. In March 2014, when these informants notified program teams about massive relocation to Lake Chad, the web of contacts helped the IRC assess the situation and revealed nearly 10,000 displaced people with unmet health and water needs. Thanks in large part to an organizational culture and infrastructure that allowed them to pivot, practitioners developed a proposal in just two days to respond to the escalating humanitarian crisis and within the week had begun programming.

Beyond these conflict settings, as development and health landscapes change, stakeholders must meet these challenges head-on with dynamic, responsive interventions.

Bridging adaptive management theory and practice using real-time data

In the past decade, there has been growing recognition that learning and change happen through an iterative process. The most challenging problems—particularly in complex political, economic, and health settings—require solutions that evolve with time. Adaptive management enables responsive and flexible approaches to development interventions through repeated cycles of conceptualizing, planning, building, implementation, and scale up.

1. Conceptualize: Defining development problems amid uncertainty

1.1. Engaging stakeholders and understanding local systems and contexts: Using real-time data to define and revisit problem statements

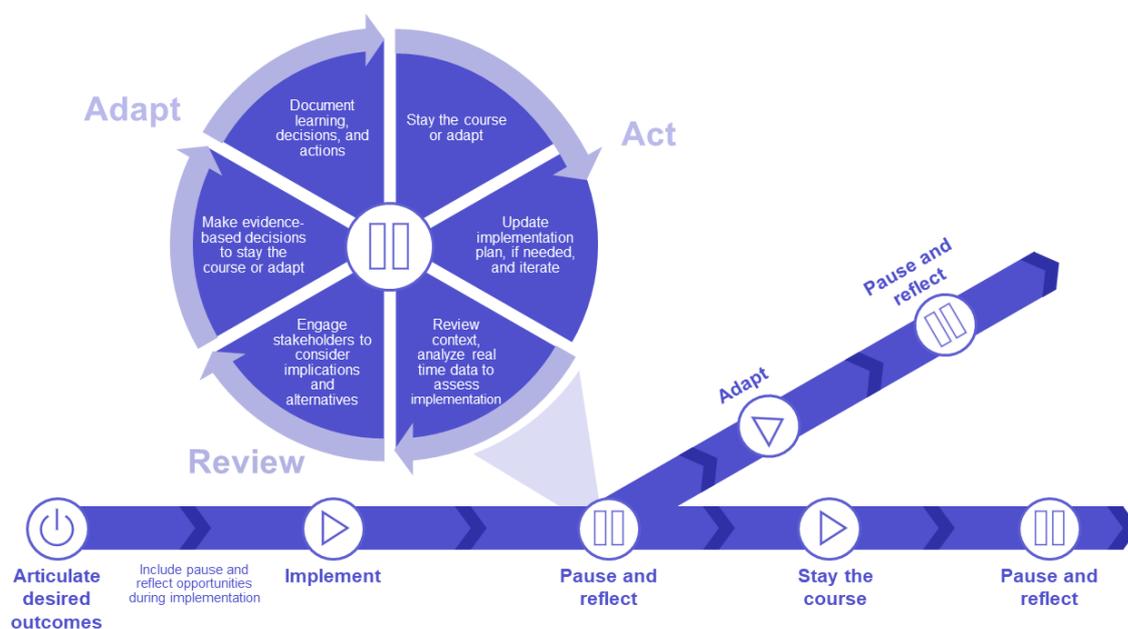
Adaptive management follows a cyclic process that begins first with assessment (see **Figure 1**). It requires that practitioners clearly define their problem statement with the understanding that their goals and approach may shift as more information is gleaned, or circumstances change. The complex range of issues facing the field means that practitioners rarely know how to achieve a development outcome from the outset. Though they may agree on their goal or desired outcome, adaptive management relies on steady decision-making cycles and inviting the right people, to the right tables to promptly and effectively identify these problems, then work to resolve them. Real-time data can be a powerful tool for these efforts, because it democratizes decision-making and can amplify the voices of those individuals who typically lack access and coverage. Real-time data can also help better

define the problem than traditional assessment mechanisms, by drawing on a diverse set of stakeholders and perspectives to collectively evaluate and plan for change. Digital platforms can support questioning of the problem definition and assumptions, often through faster and more far-reaching methods.

During the Ebola outbreak in West Africa, for instance, development agents quickly learned the importance of understanding the misconceptions and rumors surrounding the deadly virus. In order to provide timely and accurate information that would resonate with audiences with differing health literacy levels, the Health Communication Capacity Collaborative, in partnership with GeoPoll, implemented a SMS-based survey to guide the communication and behavior change response. The survey evaluated trusted sources of information, knowledge of disease transmission, and perceived risks, among other factors.¹⁰ SMS surveys provided near real-time data that allowed project teams to decide on immediate next steps and effective messaging, during the peak of the Ebola outbreak, when the emergency response required it. In doing so, practitioners were able to more accurately define the problem and establish infrastructure for additional inquiries and research as the Ebola response evolved.

1.2. Establishing governance structures for regular stakeholder engagement

Figure 1. The adaptive management cycle



Problem-driven solutions require the inputs of stakeholders at all levels, and from multiple spheres of influence. Stakeholder engagement is critical to defining and conceptualizing a problem. It helps to structure the decision-making process, increase transparency, and avoid conflict and competition.

Many adaptive management projects fall short because of the lack of stakeholder engagement and continued involvement.¹¹ When addressing the data quality and use challenges surrounding immunization service delivery, this may mean engaging field staff or frontline health workers, who are not typically invited to these tables. However, it is not enough to involve them in the initial landscaping and assessment. True ownership emerges only when individuals have the authority and voice to make decisions as well. Stakeholders must thus be involved in future experimentation and planning. The iterative nature of adaptive programming means that each phase presents an opportunity to involve and learn from different stakeholder groups. When developing an electronic immunization registry (EIR), for instance, this may mean involving frontline health workers who are responsible for

data collection in defining the system functions and design of the new EIR, then seeking their feedback in future software revisions.

To achieve this, [stakeholder governance structures and communication mechanisms](#) must be established from the outset of project design. Complex, multi-use systems depend on the inclusion of a diverse set of decision-makers for quality management decisions and effective feedback loops. And though final decision-making may lie with only a few individuals, involving stakeholders with an investment in the issue throughout the feedback process, promotes buy-in, reduces conflict, and generates awareness within the community.

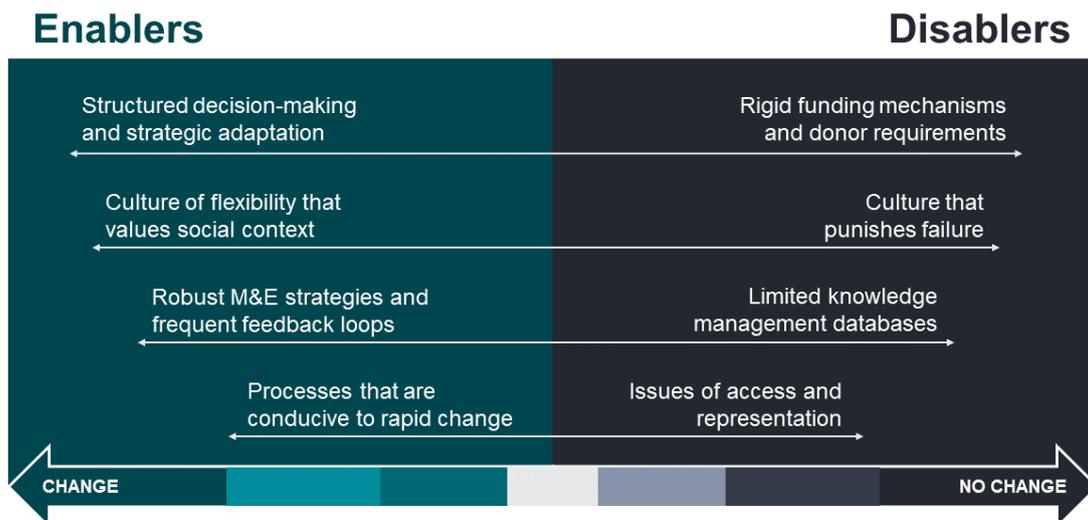
Of course, unaided stakeholder engagement is rarely helpful and may be counterproductive. Research suggests that structured decision-making is most effective at producing change. Balancing various stakeholder interests requires involving both agitators, individuals who are commonly not in positions of power but who are aware of the problems at hand, and decision-makers, who have the authority to execute change, but may be more removed from the issues.¹² Development agents should be aware of the power dynamics at play and should make a concerted effort to expand and deepen stakeholder participation.¹³ This means moving beyond standard participatory exercises and engaging a diverse set of agents in the change process.

Multi stakeholder engagement processes

Multi-stakeholder engagement processes are increasingly applicable to the complex issues faced by the development sector. They promote inclusive decision-making, greater transparency, joint implementation, and foster a sense of empowerment. Relevant processes may include:

- **Scenario building:** Scenario building exercises can help plan, forecast, and learn about the future, and the implications for decision-making in the immediate term. Typically, participants form small groups to elaborate on several possible scenarios. These are then reviewed and validated, allowing for different perspectives instead of consensus. Scenario building helps teams anticipate and plan for multiple outcomes.
- **Community dialogue spaces:** Community dialogue spaces are typically organized around national and global conferences, activities, and forums to tap into the global policy landscape. During the 2005 World Summit, for instance, the Equator Initiative created community dialogue spaces, called Community Commons, which convened participants from 44 countries, the United Nations (UN), nongovernmental organizations (NGOs), and academic institutions. The Community Commons provided space to exchange knowledge, inform decision-makers and policy processes, and develop capacity among local leaders. The [dialogue space model](#) can be adapted for other contexts as well.
- **Participatory poverty assessments (PPAs):** [Participatory poverty assessments](#) became popular in the 1990s, in response to the poverty reduction agenda of the World Bank. They are a method for amplifying the voices of the poor and marginalized. The earliest iterations included small-scale research exercises that accompanied traditional survey data, and often involved participatory methods for engaging lower income brackets. Later iterations of PPAs sought to understand poverty in its social, local and institutional contexts using a variety of methods, including flow diagrams, community mapping, matrix analyses, and more. PPAs further empower participants by providing clear follow-up action.

Figure 2. Enablers and disablers of adaptive management.



2. Plan: Using real-time data to accelerate responsive decision-making

2.1. Engaging stakeholders and understanding local systems and contexts: Using real-time data to define and revisit problem statements

Adaptive management is an ongoing process of learning-based management. It is defined by repeated cycles of decision-making, and structured periods of “pause and reflection,” also sometimes referred to as feedback loops. Under adaptive programming each “failed attempt” is an opportunity to learn and improve. Though there is not consensus on what these decision-making mechanisms look like, it should be a recurrent and rapid process—a constant cycle of monitoring and growth. Feedback loops are often characterized by a deliberative phase in which the components of adaptive decision-making are developed and refined, and an iterative phase in which those components are incorporated into a continuous cycle of decision-making, monitoring, assessment, and learning.

The frequency and timing of feedback loops will depend largely on the context. More “wicked problems” may require greater experimentation and iteration. In humanitarian settings, for example, where there is limited knowledge of a situation, no clear cause-and-effect relationship, and no precedent to draw from when designing interventions, development agents may benefit from repeated periods of pause and reflection.¹⁴ Though most of the literature on adaptive management focuses on more monumental examples of change, decision-making should be thought of as a spectrum. It is as much about a project lead changing her facilitation style to allow for greater participation, as it is about adding SMS messaging reminders to a suite of interventions to improve facility births.

Real-time data can help accelerate the frequency and quality of decisions by providing immediate insights and allowing for a shorter, more direct decision-making cycle. Digital platforms allow practitioners to monitor the pulse of the situation at any point in time. An EIR with stock management functions, for example, allows health workers to view the number of vaccine vials, needles, and other immunization supplies their facility has in stock, enabling them to preemptively avoid stock-outs and address supply chain issues. Similarly, real-time data on system use can help implementers determine if there is low uptake, and subsequently course correct, developing new messaging, training modules or features if the EIR does not appear to be meeting the needs of health workers.

2.2. Navigating change: Single vs. double-loop learning

Williams et al. describes two potential approaches to decision-making within adaptive programming. The first is a sequential approach, in which interventions occur singularly and one at a time. Stakeholders must reach consensus about which will be implemented next, before advancing. The second is a parallel approach, in which several interventions may be implemented simultaneously, allowing for multiple stakeholder recommendations. In both cases, programming remains adaptive by monitoring outcomes and incorporating findings into future decision-making.

Table 2. Tools for double loop learning and strategic decision-making

Tool	Description
Internal communities of practice	Internal communities of practice (CoP) are critical to knowledge sharing, as they can help to build relationships and trust. These may include electronic platforms or more traditional face-to-face peer learning networks. CoPs, however, do not inherently facilitate double-loop learning. A community of practice that is implemented just for sharing out best practices, leaves little room for the deeper reflection that must take place
Joint fact finding	Joint fact finding can help stakeholders work through disagreements by organizing issues into areas of consensus and areas of further dispute. Under this strategy, summary documents are used to synthesize areas of agreement, outstanding questions, and to reframe differences as opportunities for problem-solving rather than debate. Instead of focusing on all the available research, joint fact-finding exercises prioritize the information that is most pertinent to decision-making.
Scrum	Scrum emerged in the information technology (IT) sector, as a methodology that allows for iterative and faster software development. Instead of defining everything in the beginning, it uses sprints to develop and test different components of software, without delaying or waiting for final release. Sprints are defined periods of development that typically last 100 days. Like the use of many small pilots, it allows teams to learn fast and fail fast.
Scenario Planning	Scenario planning (SP), also known as predictive modeling, has largely been used in the environmental sciences to address the range of ecological and societal complexities that face conservation and the tradeoffs between different policy measures or interventions. It allows development actors to make flexible long-term plans by forecasting the future. Though the number and types of scenarios can vary, SP typically includes one negative, one positive, and one neutral scenario. SP can be a mechanism for challenging “groupthink” and conventional wisdom and helps to inform decision-making when faced with uncertainty. In 2011, for instance, US Agency for International Development (USAID) convened an interdisciplinary symposium to consider the future of development using scenario planning. ¹⁵
After Action Reviews	Despite the name, After Action Reviews (AARs) can be used at any point during a project lifecycle and may be a tool for evaluating progress and revisiting strategies. AARs are not intended to elicit punitive action or evaluate performance. Rather, they are open spaces to discuss the realities of implementation, mitigate unexpected events, and to identify key lessons. Their success relies heavily on strong facilitation.

It is also important to distinguish between tactical versus strategic decision-making, which can elicit different types of change. Tactical thinking offers a close-up view. It reinforces the status quo and primarily considers the current situation, enabling decision-makers to implement tasks and initiatives that consider existing opportunities and challenges under the assumption that current knowledge is valid. This tactical approach involves single-loop learning and is concerned primarily with “doing things right.” Strategic thinking be the widescreen view. It helps organizations plan by questioning underlying objectives and discerning emerging trends and patterns. It asks: “what are the right things to do?” Though a lengthier and more resource-intensive process, double-loop learning often produces deeper and more systematic change, revisiting everything from problem definitions, to project

Adaptive programming and the tenets of change management

Change management refers to a series of activities or approaches that move change from inception to delivery. It refers both to planned change and to change imposed both by circumstances and unexpected events. Though the two are often conflated, change management is not to be confused with adaptive programming. Whereas adaptive programming advocates for and creates pathways for continuous improvement—creating a constant state of learning and growth—change management tends to facilitate more singular examples of change. There is much to be learned from the field. In particular, digital interventions tend to overlook the socio-technical factors, or the human aspects of intervention adoption. Changing the status quo within organizations is especially difficult when the change involves the interaction of people and technology.

MACEPA case study: Spatial modeling for antimalarial drug campaigns in Southern Zambia

PATH'S Malaria Control and Elimination Partnership (MACEPA) has been working with malaria-endemic countries since 2005, to reduce malaria illnesses and deaths. MACEPA is accelerating progress and helping generate the evidence needed to end malaria by piloting new strategies, strengthening health systems, and scaling up the delivery of lifesaving tools.

Efforts to control and eliminate the disease have contributed to a 62 percent drop in global malaria deaths since 2000. Still, nearly half the world's population live in areas where they are at risk of contracting malaria. In order to eliminate malaria, programs must adopt responsive, adaptive strategies.

Malaria elimination relies on robust and responsive surveillance systems to track transmission, monitor progress, and evaluate success. Quality, real-time data drive MACEPA's adaptive approach and enable health workers at all levels of the health system to make faster, better informed decisions.

MACEPA partners with the Institute for Disease Modeling (IDM), the Imperial College of London, and the Swiss Tropical and Public Health Institute to help national programs understand what combination of interventions might be most effective and where, using models to explore the projected impact of different tools at varying levels of coverage. Implementers and ministries of health can thus understand the most effective and impactful strategy for malaria elimination.

The Zambian National Malaria Elimination Program (NMEP) is currently partnering with MACEPA and these modeling groups to analyze the operational effectiveness and impact of ongoing large-scale antimalarial drug campaigns in Southern Province. Using a spatial model of the region, modelers have projected the potential impact of switching to alternative drugs and distribution modes. Results indicate that it is most important to reach high levels of coverage. Based on modeling work, the NMEP has adapted its approach to mass drug administration (MDA) campaigns, now administering two—instead of three—rounds of antimalarial drugs in MDA-eligible communities. This course-correction amounts to significant cost and labor savings.

timelines, and the types of interventions implemented. Yet, research suggests that it can be an elusive process. In a review of knowledge and learning among 13 different international agencies, most knowledge occurred at the tactical level.¹⁶

Digital platforms may facilitate double-loop learning. Real-time data initiatives can help to capture local “best practices” and innovation not typically documented through traditional knowledge management. A review of a citizen-to-government e-participation model that used Facebook to advocate the local government’s recycling agenda found that while double-loop learning was not successfully applied within this case study, it had the potential to do so. Facebook posts were primarily used for educating citizens, but the social media platform had the potential to facilitate two-way communication, including providing an outlet for citizens to pose question or express their needs related to recycling behaviors.¹⁷

2.3. Acting on change – the final loop

Adaptive management provides a mechanism for addressing multiple needs and concerns, while overcoming gridlock. The final step, often overlooked by program teams and development actors, includes closing the feedback loop. An effective decision-making cycle requires that program leaders act or follow through on the feedback of stakeholders and M&E findings. If adaptive programming treats management actions as experiments in which both successes and failures can be leveraged, then change is only achieved when learnings are applied to the next round of planning and management. Often times, stakeholders are engaged but don’t feel heard, and issues are raised but not resolved. For feedback loops to enable change, they must be followed by action. After all, learning is just a means to an end. Its true measure is in how well it contributes to faster, continuous improvement.¹⁸

3. Build: Developing agile and integrated operations

3.1. The importance of knowledge management and documenting strategy adaptations

Strong knowledge management (KM) is critical for successful adaptive management. Continuous change without a mechanism for capturing the lessons behind each iteration, can be disruptive. Though most of the existing evidence has emerged from the private sector, research suggests that quality KM systems can significantly contribute to project performance.¹⁹ KM systems help generate, capture and transfer knowledge, driving creativity and resulting in more productive teams. But KM is not just about curating and sharing information after a project concludes. It ensures that information is captured during activities, not just at the end of a project. Good KM enables faster and better innovation throughout the project lifecycle, and centers the KM needs of low- and middle-income countries, instead of implementing organizations.

KM enables the periods of pause and reflection that are so critical to adaptive programming. It is especially important within adaptive agendas that are constantly evolving as the health landscape and digital platforms rapidly iterate, grow, and change. Multi-year and multi-partner projects often experience staff turnover and require that new team members be brought up to speed. Better documentation, organization, and sharing of information can mitigate the loss of institutional knowledge.

Real-time data and digital systems can help catalogue and share this collective knowledge, but it is critical not to conflate the use of technology with KM. Knowledge management is more often people-centered and is closely related to organizational culture and factors such as open-mindedness, trust-building, a commitment to learning, and participatory leadership.

If organizations and programs are living entities, their KM systems must be treated as such. Knowledge management may therefore look different at various stages of adaptive programming.

1. **Know the landscape.** During the earliest stages, when development actors conceptualize and define their problem statement, KM may include using and sharing information from a variety of courses. It is critical to know the political, health, and social landscape of a country—and at a more granular level—a community, before advancing implementation. This can help to avoid duplication and spare teams the failures of programs or interventions that have come before them.
2. **Embed KM in project management processes.** Incorporating KM systems requires that program teams determine certain processes early on, such as how information will be indexed and captured, and how individual team members will reflect on and learn from their work. During implementation, KM systems may include learning logs to capture development and the reasons behind shifts in strategy or interventions. Once those lessons are further crystallized, KM may take the form of more systematic sharing across programs and projects, while simultaneously monitoring the uptake and use of the knowledge shared. For example, many digital interventions that include a software development component have maintained Wiki pages to allow for findable, searchable repositories that are particularly useful for future software adaptations. Systematic periods of “pause and reflection” may also be established after certain project milestones. These exercises may include After Action Reviews, Strategy Testing, and the Nine Whys. It is important that all team members—not just senior leadership—participate.
3. **Integrate KM with the team’s communication strategy.** Both a project’s successes and failures should be documented and shared widely, as an extension of a project’s communication strategy. The [Principles for Digital Development](#) advocates for sharing information, insights, and resources across projects, organizations, and sectors. KM should be similarly collaborative to maximize the efficiencies and impact of projects. Though technical learning logs are critical, it is also important that lessons be translated for an audience

POTENTIAL TOOLS FOR ADAPTIVE MANAGEMENT

There are several methodologies and tools from both the public and private sector that could be applied to adaptive management environments. These include:

Strategy Testing (ST): The Asia Foundation developed ST as a monitoring approach that creates structured periods to “pause and reflect.”

Problem-Driven Iterative Adaptation (PDIA): PDIA is a highly iterative process that focuses on solving locally nominated and defined problems, as opposed to “best practice solutions.”

Political Economy Analysis (PEA): PEA examines how power is used to manage resources in each situation. It helps to identify incentives, and social and cultural norms, among other factors, that may either threaten or advance a project. It then uses this information to adapt the project accordingly. It encourages positive deviance, experimentation, and rapid feedback loops.

Rapid Result Approach (RRA): RRA is a results-focused learning process developed by the private sector to facilitate change. RRA employs small experiments or projects over a 100-day timeline to accelerate organizational learning.

Kaizen: Is a Japanese philosophy and process of continuous improvement that originated in the post-World War II era and is best known for its use in lean manufacturing and programming. Kaizen involves four steps: Assess, plan, implement, and evaluate.

with varying levels of health literacy. This may take the form of blog posts, conference presentations, briefing documents, or white papers.

Though most of the research around KM originates in the private sector, its benefits are well documented. Knowledge sharing has been associated with sales growth, job satisfaction, reductions in production costs, and improved project performance.²⁰ Many of the same factors critical to a culture of learning, such as open-mindedness, trust, and facilitative leadership are of equal importance to KM systems. Effective knowledge management enables transparency and learning, and builds trust and support amongst stakeholders.

4. Implement: Monitoring for growth, not accountability

4.1. Flexible M&E strategies for iterative, learning-based management

Adaptive management relies on steady feedback to inform its repeated cycles of learning and decision-making. Though M&E can be a powerful tool for learning-based management, it is often used for accountability instead of growth and improvement. To allow for an iterative review of projects throughout implementation, M&E may therefore look different within adaptive programming. Rather than treating evaluation as an end-of-project activity and monitoring as a mechanism for ensuring compliance with performance indicator targets, adaptive programming employs M&E for ongoing adaptation. Real-time data can facilitate these rapid improvement cycles by allowing for more frequent, accurate, and comprehensive data collection. Traditional M&E tools, such as paper surveys and questionnaires, can take months to deploy and analyze, whereas digital platforms permit rapid feedback. A digital initiative to introduce a phone-based e-commerce model for family planning products, for instance, may provide real-time data on which contraceptive methods are preferred, allowing program staff to promptly recalibrate efforts and revisit family planning education in response to the needs and purchasing habits of a population.

Table 3. Examples of adaptive M&E indicators²¹

Indicator	Description
Bedrock indicators	These foundational indicators are not likely to change over the project lifecycle and measure the program's end goals, even as other indicators are retired or evolve. These are likely to be outcome-level indicators.
Flexible indicators	Because interventions and their outputs may change over the project lifecycle, it is important to constantly revisit indicators, to withdraw those that are no longer relevant, and to establish new ones, as needed.
Complimentary indicators	Bundling similar indicators can address challenges around finding the perfect indicator, as no one metric is likely to be sufficient.
Concrete change indicators	Rather than specifying what change will look like during project design, open-ended "concrete change" indicators may predefine a number of improvements, rather than specifying what those outcomes will look like. Organizations may then work backward using an approach called "outcome harvesting" in complex scenarios where cause and effect is not well understood. ²²

If adaptive programming calls for non-linear and non-incremental change, then the indicators used within M&E plans must reflect this shift in thinking. An M&E plan grounded in real-time data for adaptive management integrates monitoring and evaluation into its programming, rather than treating

it as a discreet activity, and uses it to inform ongoing programmatic improvements through regular organizational assessments, a mix of qualitative and quantitative evidence, evaluations and reviews. Adaptive M&E plans must also measure more micro-level, day-to-day changes and decision-making, instead of only meeting funder reporting requirements.²³ Similarly, indicators must balance rigor with the flexibility needed to capture changing health contexts and iterative programming. This may require revisiting research questions and indicators at various stages of implementation. Different indicators may also be activated at various phases of implementation. Early during the rollout of an electronic health record, for instance, tablet use may be a simple indicator of the success of an intervention. However, as health workers become increasingly comfortable with data collection, a more telling

Data Use Partnership Case Study: Phase 2 and the application of phased indicators and learning questions in Tanzania

In many low- and middle-income countries, health data is siloed into different disease verticals, making it difficult for health workers to develop a comprehensive picture of patient health, provide a continuum of care, and allocate and direct resources to underserved areas. In 2016, PATH and the Government of Tanzania launched the Data Use Partnership (DUP) to assess and improve the use of data across the country's health system. During the first phase of DUP, PATH worked with over 80 government and development partners to assess the country's health information systems and support creation of a country-owned strategy to improve data use and health sector performance. Tanzania's [Digital Health Investment Road Map](#) outlines 17 priority investments, ranging from enhancing and scaling notifiable disease surveillance, to digitizing hospital data.

DUP is currently working to operationalize this road map, applying an adaptive management lens to implementation. It uses digital technologies and routine access to high-quality data to facilitate constant iteration and improvement within all levels of the health system. By accelerating the use of data for decision-making, the government will be able to identify underperforming health facilities, better respond to disease outbreaks, and more effectively manage complex health issues. Health workers will be able to course-correct as new issues arise and health trends evolve, allowing them to promptly respond to diseases spikes, direct resources, and staff to underserved areas, and shape integrated health information systems. DUP applies iterative decision-making cycles throughout—within its monitoring, evaluation, and learning (MEL) plan, agile software development, and learning-based rollout strategies.

For instance, to capture the various stages of behavior change behind data use, DUP will evolve its learning questions, M&E plan, and indicators throughout. As the timeline, interventions and activities shift, certain metrics may be activated or deactivated to orient M&E functions toward programmatic and strategic questions, rather than reporting. Initially DUP may measure how many times health workers log into a new registry—a simple way to quantify system usage. With greater demand for data, the M&E plan may shed process indicators to focus on data quality and outcomes. How many times health workers use data to inform actions, for example, may provide a more accurate measure of the system's long-term success. Qualitative measures will also help illuminate contextual influences, informing programmatic pivots based on what the data reveals.

DUP will also build systematic periods to pause and reflect into day-to-day operations. Weekly team meetings will create space to share lessons and habitually review relevant data that are available depending on implementation priorities. A monthly learning meeting will allow for broader dissemination among PATH staff and quarterly meetings with DUP government, donors and other stakeholders will allow for joint learning, informed decision-making and adaptive management based on the most up-to-date information available to everyone. To catalogue this knowledge, technical teams will document this growth in a learning log.

measure may be if and how health workers are acting upon the data available to them to allocate resources, refer patients, and provide services.

Adaptive M&E strategies also honor various forms of information. Though the development sector often favors quantitative data for its rigor, complex development issues, for which cause and effect relations may not be well understood, often require more qualitative research upfront to better define their problem statements, project goals, and objectives. This is particularly true of adaptive programming. Quantitative research and monitoring also often fails to capture any changes that are not part of the original study design, whereas qualitative data can help surface new information.²⁴ In this same vein, quantitative monitoring may take years to execute and analyze, but qualitative data can provide quick insights, allowing for more nimble cycles of decision-making. Finally, it is important to leverage multiple channels for decision-making. Even within real-time data initiatives, decisions may be arrived at through conversation, instead of strictly through data collection and analysis.

Of course, more monitoring does not necessarily translate into greater insights. Monthly or quarterly data review meetings and regular workshops may also accompany adaptive M&E plans and create the space needed for periodic reflection. The frequency of these meetings may hinge on how often new information is generated, and may also depend on changes in the political context, programmatic setbacks, and major external events.²⁵ Case studies about the use of real-time data for adaptive management also indicate that M&E plans have to be met with a culture of learning, or monitoring may be seen as an accountability measure, used to reinforce punitive action. A mobile nutrition program in Indonesia, developed by World Vision, helped improve the efficiency and quality of nutrition service decision-making in clinics. A smartphone app, called M-Posyandu, collected and processed growth and nutritional measurements. Though M-Posyandu improved data accuracy, some frontline health workers expressed concern that the real-time data systems were being used as an additional means of accountability, instead of a source of learning and growth.

Several development organizations have begun embracing adaptive M&E. The Global Health Knowledge Collaborative, for example, has developed a series of adaptive practice indicators which measure the use of adaptive management in a project or organization.²⁶ Indicators are grouped into three subcategories—prepare, reflect, and act—and promise to help build the evidence base for adaptive practices.

5. Scale: Encouraging and reinforcing adaptive management

5.1. Building a culture of learning and institutionalizing adaptive programming

Though real-time data can advance adaptive management, technology is only a tool or instrument for doing so. Adaptive management represents a dramatic break from the risk-adverse culture that characterizes most development organizations and requires an organizational culture in which the norms governing learning and management, communication, information sharing, and the leadership's vision, are underscored by flexibility. A conducive culture for adaptive management creates safe spaces to fail, so the team can quickly learn from these mistakes and apply different approaches. This means that real-time data is not used exclusively for accountability, as another upward reporting mechanism.

BID case study: Flexible rollout strategies to promote buy-in and learning in Tanzania and Zambia

The Better Immunization Data (BID) Initiative is working with the governments of Tanzania and Zambia to develop, test, and rollout interventions that address pressing routine immunization service delivery challenges, such as poor visibility into vaccine supplies and difficulty identifying children who default on immunization schedules. The five-year effort, led by PATH, is introducing a series of data quality and data use interventions, including an EIR, barcodes on child health cards to provide unique identification for children, and stock management dashboards.

BID uses real-time data to advance an adaptive management agenda both within the project and within national immunization programs. Learn fast, fail fast, share fast has been a core value of BID from the earliest days. BID did not predefine solutions or demonstration countries; instead, it partnered with countries to identify the most critical routine immunization service delivery problems.

Using a series of “touches” or visits in either country, BID staff initially led on-the-job training to health workers. But the time-consuming strategy took between two to four months to implement and allowed for rollout in only one district at a time. Health workers passively participated in the trainings, and felt little incentive to use the system. As rollout accelerated and BID worked to scale interventions in either country, the training method also became increasingly expensive. Realizing that this method was not sustainable, BID shifted to a training strategy led by district authorities, or district data use mentors (DDUMs). DDUMs provided prompt and localized support, and reinforced behavior change by allowing health workers to see their peers using the system. Rather than forcing a method that had garnered little traction, BID evolved its training to meet health worker needs.

Similarly, when BID learned that the timing between touches did not align with the realities on the ground, it course corrected. Initially, the duration between trainings was based on the size of the facility’s immunization program, or whether the facility had a high or low volume of patients. BID adjusted its timeline as it improved its understanding of nurse workflows and the technical support required by health workers. The time between Touch 2 and 3, for instance, was shortened to a week, as BID learned that nurses required prompt follow-up after receiving the new data entry tools.

Conclusion

The benefits of adaptive management extend far beyond program teams and implementers. With access to real-time data, health workers, program managers, and decision-makers at all levels of a health system can flex their approaches as circumstances demand it. Adaptive management has implications both at a health systems level, for how health workers respond to and act on patient data, and for program implementers, as they alter intervention strategies when new developments come to light. At a micro-level, it may entail the use of participatory facilitation techniques to invite alternative perspectives during team meetings; and at macro-level it may involve structured “time-outs” to reflect on program direction. At its heart is a continuous process of “learning by doing” and steady improvement.

To advance adaptive management, the development sector must continue to bridge theory and practice. Implementers must document their experiences with adaptive programming and donors must accommodate the flexibility and uncertainty required for steady experimentation. And among all development actors, adaptive management must be recognized as more than a lens through which to view implementation. Instead of static, five-year plans, project timelines must build in repeated cycles of reflection and decision-making, monitoring and evaluation must evolve with the various phases of a project, and organizations must build an employee culture that encourages collaboration.

Considerations for applying adaptive management: Challenges for donors and implementers

Though there are many benefits to adaptive management, additional research is needed to bridge the divide between theory and practice. Adaptive management presents several obstacles:

1. **Measuring continuous change:** There remain persistent challenges around its measurement, including difficulties making causal attributions between adaptive management and organizational improvements, and challenges measuring the impact of adaptive interventions. To measure the nonlinear nature of change, indicators must balance the rigor required to track progress, with the flexibility needed to meet the changing realities on the ground.
2. **Issues of access and representation:** The use of technology and real-time data systems often leave some people out, either because of a lack of voice, access, or coverage. Relying on real-time data systems to inform decision-making cycles—even if they happen at a higher frequency—still excludes some users. Adaptive management must find more democratic ways of including stakeholders at all levels, from the health workers responsible for data collection, to the policymakers who allocate resources based on that information.
3. **Rigid donor requirements:** Implementing organizations often do not have the budget, time, or rapport with donors to give feedback when a change in approach is needed. Doing so would mean a cancelled grant, lost funding, or a bruised relationship. Similarly, most donors incentivize “best practice” solutions, or simple, replicable prescriptions for development, mistaking them for good governance.

References

- ¹ Tildesley M, Shea K, Ferrari M. How do we control an outbreak like Ebola if we haven't been there before? The Conversation. May 28, 2020. Available at: <https://theconversation.com/how-do-we-control-an-outbreak-like-ebola-if-we-havent-been-there-before-33765>.
- ² Foxon T, Stringer L, Reed M. Comparing adaptive management and transition management. *Ökologisches Wirtschaften - Fachzeitschrift*. 2008;23(2). doi:10.14512/oew.v23i2.571.
- ³ Denning S. The management revolution that's already happening. *Forbes*. June 7, 2013. Available at: <https://www.forbes.com/sites/stevedenning/2013/05/30/the-management-revolution-thats-already-happening/#26de87b47091>.
- ⁴ Salafsky, N., R. Margoluis, and K. Redford. Adaptive management: A tool for conservation practitioners. 2001. Washington, D.C.: Biodiversity Support Program.
- ⁵ Valters C, Cummings C, Nixon H. Putting learning at the centre: adaptive development programming in practice. ODI. March 1, 2016. Available at: <https://www.odi.org/publications/10367-putting-learning-centre-adaptive-development-programming-practice>.
- ⁶ Global Innovation Exchange. Learning to adapt: exploring knowledge, information and data for adaptive programs and policies. 2015. Available at <https://www.globalinnovationexchange.org/learning-adapt-exploring-knowledge-information-and-data-adaptive-programs-and-policies>.
- ⁷ USAID. What difference does CLA make to development? Key findings from a literature review. Available at: https://usaidlearninglab.org/sites/default/files/resource/files/eb4cla_litreview_briefer_rev0519.pdf.
- ⁸ Freedman DH. Is management still a science? *Harvard Business Review*. August 1, 2014. Available at: <https://hbr.org/1992/11/is-management-still-a-science>.
- ⁹ Taylor B, Kremsater L, Ellis R. British Columbia Ministry of Forests – Forest Practices Branch. Adaptive management of forests in British Columbia. 1997. Available at: <https://www.for.gov.bc.ca/hfd/pubs/docs/sil/sil426-1.pdf>.
- ¹⁰ Berman A, Figueroa ME, Storey JD. Use of SMS-based surveys in the rapid response to the Ebola outbreak in Liberia: opening community dialogue. *Journal of Health Communication*. 2017;22(sup1):15-23. doi:10.1080/10810730.2016.1224279.
- ¹¹ Irwin E, Kennedy KM. Engaging stakeholders for adaptive management using structured decision analysis. Available at: <https://pubs.usgs.gov/sir/2009/5049/pdf/Irwin.pdf>.
- ¹² Andrews M, Pritchett L, Woolcock M. Doing problem-driven work. December 2015. Available at: https://bsc.cid.harvard.edu/files/bsc/files/doing_problem_driven_work_wp_307.pdf.

- ¹³ Carlsson J, Wohlgemuth L. Learning in development co-operation. 1999. Stockholm: Almqvist and Wikse II International.
- ¹⁴ Ramalingham B, Barnett I, Levy A, et al. Bridging real-time data and adaptive management: case study report. USAID. October 2017. Available at: https://www.usaid.gov/sites/default/files/documents/15396/RTD4AM_Case_Study_Report.pdf.
- ¹⁵ Star J, Rowland EL, Black ME, et al. Supporting adaptation decisions through scenario planning: enabling the effective use of multiple methods. *Climate Risk Management*. 2016;13:88-94. doi:10.1016/j.crm.2016.08.001.
- ¹⁶ Ramalingam B. Implementing knowledge strategies: lessons from international development agencies. ODI. April 2005. Available at: <https://www.odi.org/sites/odi.org.uk/files/odi-assets/publications-opinion-files/166.pdf>.
- ¹⁷ Reddick CG, Chatfield AT, Ojo A. A social media text analytics framework for double-loop learning for citizen-centric public services: a case study of a local government Facebook use. *Government Information Quarterly*. 2017;34(1):110-125. doi:10.1016/j.giq.2016.11.001.
- ¹⁸ Williams B, Szaro R, Shapiro C. Adaptive management: the U.S. Department of the Interior technical guide. 2009. Available at: <https://www.doi.gov/sites/doi.gov/files/migrated/ppa/upload/TechGuide.pdf>.
- ¹⁹ USAID. Collaborating, learning, and adapting toolkit. Available at: <https://usaidlearninglab.org/qrg/understanding-cla-0>.
- ²⁰ Scarbrough H, Carter C. Investigating knowledge management. 2000. London CIPD.
- ²¹ Monitoring and Evaluating Flexible and Adaptive Programming. Itad. March 2, 2020. Available at: <http://www.itad.com/article/monitoring-and-evaluating-flexible-and-adaptive-programming/>.
- ²² Wilson-Grau, R. Outcome harvesting. *Better Evaluation*. 2015. Available at: http://betterevaluation.org/plan/approach/outcome_harvesting.
- ²³ Rogers P. Does evaluation need to be done differently to support adaptive management? *Better Evaluation*. March 15, 2017. Available at: https://www.betterevaluation.org/en/blog/evaluation_for_adaptive_management.
- ²⁴ Moot A. Closing the feedback loop. *Sustainable Northwest*. Available at: http://www.sustainablenorthwest.org/uploads/general/Closing_the_Feedback_Loop.pdf.
- ²⁵ O'Donnell M. Adaptive management: what it means for CSOs. 2016. Available at: https://www.bond.org.uk/sites/default/files/resource-documents/adaptive_management_-_what_it_means_for_csos_0.pdf.
- ²⁶ USAID. Indicators that measure adaptive practice. Available at: <https://indicators.globalhealthknowledge.org/taxonomy/term/5>.