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Complexity-Aware Monitoring and Evaluation

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Background: Addressing today's sustainability challenges requires adopting a systemic approach where social and ecological systems are treated as integrated social-ecological systems. Such systems are complex, and the international development sector increasingly recognises the need to account for the complexity of the systems that they seek to transform.

Purpose: This paper sketches out the elements of a complexity-aware monitoring and evaluation (M&E) system for international development programmes in the area of sustainable development.

Setting: Not applicable.

Data Collection and Analysis: The authors draw on existing literature on complexity and evaluation and on their own experience from working in the field of M&E.

Findings: An M&E system should not be seen simply as a tool to track compliance against a pre-determined theory of change. Instead, it is most useful as a real-time approach, constantly defining and re-defining narratives for change that help push systems along trajectories of interest. Dealing with complexity involves embracing uncertainty; and this challenges established notions of accountability—something which funders and implementers must begin to redefine together.

Keywords: *monitoring; evaluation; complexity; social-ecological systems; international development programmes; narratives for change; theory of change*

Introduction

We cannot reduce complexity. It will burst out elsewhere if we try (Sterman 2006); but if we embrace it, we can gain highly relevant learning and meaningful results. And with these, we can engage in truly sustainable development. Through this paper, we hope to spark dialogue and inspire ideas about monitoring and evaluation (M&E) approaches that are suited to complexity, and to provide a rationale that can support beneficial and robust conversations with donors.

Why is it Important?

M&E frameworks are used to monitor, measure, and evaluate programmes. A common approach is to track initiatives according to predefined implementation plans. Programmes are designed using logic models, such as logframes, or result-based management frameworks. These typically define outcomes, outputs, and activities and support their achievement with indicators or milestones. An undergirding theory of change relates activities, outputs, and outcomes in a theory about causal relationships, showing how objectives should be achieved. M&E then measures whether the theory of change has effectively reached predefined outputs and outcomes. Such M&E frameworks are designed to track what has been defined before implementation. But this is not suited to all systems.

The Cynefin framework (as discussed, for example, by Kurtz and Snowden 2003) defines four types of systems: simple, complicated, complex, and chaotic. Causal relationships and corresponding systems dynamics are very different in each. In simple and complicated systems, they are knowable and predictable, in principle, while in complex and chaotic systems, *they are partly or fully unknowable and unpredictable*. Thus, a theory of change should look different in each context.

How, then, should we think about a theory of change? M&E frameworks tend to assume that causal relations can be anticipated; but as noted, above, while this is appropriate for simple and complicated systems, it is ill-suited to complex ones. Designing a theory of change as if causal relationships were known and then implementing in a complex system, is both unlikely to yield desired results and likely to generate undesired consequences. The COVID-19 situation has demonstrated this dramatically. The virus cannot be addressed without paying attention to a whole array of intertwined and continuously changing issues, ranging from health to social inequalities, food security, working conditions, wages, international supply chains, and so much more. We know that having a narrow, linear focus on reducing transmission, for example, is far from sufficient [1] and can even increase transmission (such as in cases where employees without benefits continue working even when they feel ill, because they cannot afford to lose wages for sick days off work).

At the same time, and especially within the international development sector, a so-called counter-bureaucracy has been noted, which strongly emphasises measurability, accountability, and short-term results (Natsios 2010). Implementers are encouraged to design with a view to anticipating results through well-defined and measurable activities, outputs, and outcomes—and in short periods of time. In a complicated system, this might be possible and useful because the causal relationships that drive system dynamics are, in principle, predictable. However, in complex systems, this way of planning comes at the expense of necessary adaptability. Indeed, adaptability, as well as experimentation at all levels—activities, outputs, and outcomes—are *essential* for working in complex systems. In these contexts, causal relationships are rarely known. Instead, system dynamics

[1] https://www.theguardian.com/world/2020/mar/28/is-factory-farming-to-blame-for-coronavirus

need to be discovered *while* implementing and interventions adapted and re-adapted to the emerging context.

How can we deal with the tension between unknown causal relationships, the resulting unpredictability of system dynamics, and the desire to rely on predictions—particularly, when funders require prior definitions of success and measures of accountability for how funds will be spent?

Complexity thinking, as exemplified by the "complexity turn," offers guidance. The complexity turn refers to the rising importance of complexity thinking in disciplines such as physics, mathematics, biology, economics, ecology, and chemistry over the past three decades (Urry 2005). Inspired by these developments and building on existing work (Bamberger et al 2016, Boulton et al 2015, Burns et al 2016, Natsios 2010, Patton 2020, Patton 2018, Patsalides and Britt 2014, USAID's LER 2019, Williams 2016, Zazueta et al 2020), we seek to give M&E a more fundamental role—one which is rooted in complexity. M&E should not be seen simply as a tool to track compliance against a pre-determined theory of change. Instead, we argue that it is most useful as a real-time approach constantly defining and re-defining narratives for change (a term that we will introduce, below) that help push systems along trajectories of interest (another term we will introduce).

Social-Ecological Systems Understood as Complex Adaptive Systems

What are complex adaptive systems? Examples are everywhere around us: cities, stock markets, ant colonies, or the immune system, to name just a few. Social-ecological systems are a special class of complex adaptive systems in which the social and the ecological are inextricably intertwined (Folke 2004, 2016, Schlüter et al 2020). This is the most fundamental guiding principle for development and, therefore, for international development programmes operating in the area of sustainability: humans are inseparable from and dependent upon the biosphere and lasting development can only be achieved if this is properly addressed.

There are many different understandings of complex adaptive systems (Page 2015; Levin 1998; Levin et al. 2013; Holland 2014, Preiser 2018, Hertz et al 2020), but there is agreement on certain properties. Five key ones have relevance for M&E:

1. Heterogeneity: Complex adaptive systems are composed of many diverse elements.
2. Emergence: These elements interact to produce higher order (macro-level) structures and functions which may or may not feed back to micro-level interactions.
3. Adaptation: The individual elements, whether human or non-human, continuously adapt and adjust their behaviour to novel situations or pressures.
4. Context: The particular history of social-ecological interactions matters and is a process that creates strong path dependencies.
5. Openness: Complex adaptive systems are open and in constant interaction with other, connected systems.

Together, these properties lead to complex system dynamics. This means that, *while explanations of particular phenomena may be possible after the fact, predicting them is not*—due to the very nature of the complex adaptive system. We side with Bickhard (2000) who says that causality itself is *contingent and emergent*. Thus, it is impossible to uncover and understand causal relationships in advance, and the patterns or phenomena which arise from them. This means that in complex adaptive systems, one needs to be able to deal with unpredictability—and more, to thrive with it.

What demands does this place upon an M&E system? For example, it needs to be able to make sense of and enable appropriate responses to unpredictable outcomes as they arise—outcomes which might be both desirable and/or undesirable. Sudden social-ecological regime shifts (Biggs

et al 2012) are examples, where even small perturbations, that normally would not have any significant impact, can shift a system into a new regime (Scheffer 2009, GRAID 2018) A well-known example is the shift from a lake dominated by a clear water regime to an algae-dominated one.

Also, an M&E system also needs to pay attention to the *connectedness* of systems, in order to catch crucial cross-system and cross-scale interactions. For example, through complex interconnections, the recovery of fish stocks in Europe has led to increased fishing pressure in West African waters. Similarly, improved regulation of Chinese and European forests has resulted in increased Chinese and European biomass imports which, in turn, have led to deforestation in the tropics (Pascual et al 2017).

As a final example, an M&E system in complex contexts must come to terms with the fact that there is no overarching, neutral language to describe concrete experiences (Leach & Fairhead 1996). Language shapes experience and experience shapes language within a history of social-ecological interactions. In other words, there is no one representational system within which to formulate a causal pathway. Thus, an M&E system needs to be responsive to and live with the ambiguity of different meanings and worldviews. A powerful example of what happens if one neglects such differences is the arrival of the Green Revolution in Bali in the 1970s. The Green Revolution brought with it its own set of techno-scientific concepts by which the irrigation management systems for rice (Subaks) were reduced to pure irrigation systems. Subaks, however, are much more. They coordinate cropping and irrigation and organize construction and maintenance of irrigation infrastructure via social, cultural, and spiritual principles and interactions (Lansing 1987). The re-conceptualisation of this system through a techno-scientific vocabulary introduced governance based on notions of productivity and optimisation—concepts that could not capture the nuanced social, cultural, and spiritual aspects of the Subaks. This led to an outcome that was exactly *opposite* to that desired: a reduction in rice production and an increase in pest outbreaks.

Accountability, Measurability, and Complexity

Here, we come back to the notion of counter-bureaucracy. Natsios (2010)[2] maintains that it focuses on the compliance side of development programming. This leads to excessive emphasis on pre-defined results, measurability, and accountability and this, in turn, has had profound impacts on how development programmes are required to be designed. Natsios goes so far as to say that the actual beneficiaries of such programmes are not the people who *should* benefit from them, but rather, *the counter-bureaucratic bodies, themselves*. Programme energies are directed towards them.

M&E systems that are designed to meet the demands of pre-determined accountabilities do no justice to the complex systems in which they operate. This is not to say that there are no programmes that can and should be set up and evaluated in such terms—i.e., those dealing with simple or complicated systems—but these are not, mainly, the kinds of programmes in the area of sustainability in the international development space.

In what follows, we sketch elements of a M&E system more suited to the challenges of operating within complex adaptive systems. This involves abandoning classical terms such as "theory of change" and "outcomes" in favour of "narratives for change and "trajectories of interest" and redefining the role and function of M&E from a *progress tracking* tool to a *real-time learning and navigation approach for adaptation or transformation* where change

[2] Natsios (2010) credits William Gormley for the term counter-bureaucracy which he defines as "a set of U.S. government agencies charged with command and control of the federal bureaucracy through a set of budgeting, oversight, accountability, and measurement systems that have grown over several decades to a massive degree, with extraordinary layer upon layer of procedural and compliance requirements."

and emergence are embedded in programme conception and design.

M&E in Complex Adaptive Systems

Narratives for Change Versus Theory of Change

The properties of complex adaptive systems generate complex system dynamics. A system can, at any given moment, evolve according to several different trajectories and a development programme aims to influence the evolution of the system towards a desirable one. A theory of change describes how this influence is assumed to be realisable.

Preiser et al (2016) are amongst those who discuss the limitations of conventional theories of change; particularly, that they conceptualize change in advance, and in terms of a linear, causal chain of events. Evaluation usually assesses whether the theory of change was achieved after a phase or programme has ended.

However, in complex adaptive systems, not even the set of *possible* system pathways can be defined, in advance. So, a complex programme logic needs to consider multiple pathways towards a particular trajectory of interest. However, simply *defining* possible trajectories in advance will not be sufficient. The pathway that will be useful depends on how the context shifts over time and during actual implementation; and this, again, is something that is not predictable. Accordingly, M&E should not be conceived of as a tool to simply track and assess a previously agreed upon theory of change; instead, it must be an integral part of revising, adapting, and indeed, *defining* this very theory of change at any given moment: What is constantly changing must be constantly redefined and so, too, our engagement with it.

To distinguish the thinking developed here from conventional theories of change, we choose to talk, instead, about narratives for change. We argue that the term "narrative" is more appropriate because it conveys, better than theory, the emergent and speculative character of sketching ways to intervene in systems. Narratives emerge in real time via processes of co-creation and continuous adaptation of those involved, by 1) what they bring to the table and 2) the concrete extra-verbal context of the discussion. Both shape the narrative (Shotter and Tsoukas 2011) and determine its very meaning. Narratives aim to capture the complexities of concrete experience. They are a way to tackle complexity head on, instead of trying to *reduce* it via generalizations (Srnicek 2007).

Co-creative narrative building allows for rhizomatic meaning-making (Deleuze and Guattari 2002). The metaphor of the rhizome, taken from philosophy, highlights interconnectedness and irreducibility. In the rhizome there are no starting and ending points, since everything is connected, and nothing is more fundamental than anything else. Meaning cannot be reduced to linear relationships between concepts and empirical counterparts in reality. Rather, meanings emerge in the engagement process. The type of knowing that emerges from co-creative narrative building is open-ended and goes beyond what is possible to think of with isolated, context-independent content, i.e., what has been called the predictabilities of thought (Manning, 2013).

The terms and concepts we use to frame a particular problem *already* embody the space of their possible solutions (Hertz et al 2020). Consider, for example, the phrase "vulnerability to climate change" where vulnerability is seen as the problem and climate change the cause. The meaning of the term vulnerability is contested and differs significantly, not only within the same conceptual scheme[3] but also across them. For example, within languages drawing on

[3] Our languages are based on conceptual schemes. Different languages can be based on a same, or similar conceptual scheme. Translation is, thus, easily achieved. When conceptual schemes differ significantly, however, translation becomes difficult because, in the worst case, the underlying conceptual schemes are incompatible. In such a case, we are presented with what de la Cadena (2015) calls "radical difference."

the same conceptual scheme, different paradigms might define vulnerability in terms of outcomes or in terms of context (O'Brien 2007)[4]. Likewise, Indigenous and western interpretations can be fundamentally different and even incompatible.

These different meanings of vulnerability *already* embody different ways of addressing the problem. But in narratives, terms have no fixed identity. They are not once and for all but are open and in-the-making. And if the meaning of terms is not set from the outset—as they are in conventional theories of change—neither are the problems nor the solutions. Instead, they emerge in the process (Mancilla Garcia et al 2020). Solutions will depend on meanings, and if meanings co-constitute through narrative building, novel unforeseen solutions might emerge (Shotter and Tsoukas 2011). Language matters (Leichenko and O'Brien 2019, Lakoff and Johnson 2003). The process of narrative-building has the potential to unfold a problem-solving capacity that exceeds what can be generated through conventional theories of change formulated in advance.

Narratives for change emerge in real time through the dialogue of those involved: through them experimenting together, drawing on the complexities of their concrete experiences, and also shaped by the extra-verbal situation. The M&E approach needs to provide complex information to enable conscious choices for outcomes, without losing sight of the system in which the programme operates and the impacts on adjacent systems. It needs to support early detection of anticipated and unanticipated, desired and undesired consequences so that stakeholders can respond appropriately and in a timely way.

Trajectories of Interest Versus Outcomes

A dictionary definition of outcome is "the final result of a process,"[5] and in day-to-day use, including in programme management for international development programmes, this is how we usually think about it. According to this definition, a programme has been successful if it has reached the final result or new state[6] that has been envisioned in the theory of change. If the new state was not reached, the first thought should be to interrogate the associated theory of change (it was only a theory, after all); but instead, what can often happen is a search to find out who did what wrong.

We argue that in complex adaptive systems, it is necessary to think about outcomes and successes differently. A system trajectory is more realistic than what we might call an outcome in traditional results-based management frameworks. Crucially, a trajectory is always open-ended, since the end of a programme can *never* be a stable state. Complex adaptive systems are in constant evolution and are embedded within other systems (and other systems are embedded within them). M&E processes need to reflect this.[7] A trajectory does not refer to particular achievements, but rather to desirable *states*, with the attention on *key processes and relationships that maintain those states*. A desirable trajectory is, therefore, a trajectory that allows continuous adaptation of key processes. An example of what such a trajectory might look like could be:

[4] Outcome vulnerability "is interpreted as the negative outcome of climate change on any particular exposure unit—an outcome that can be quantified and measured, and reduced through technical and sectoral adaptation measures, as well as by reducing greenhouse gas emissions." Contextual vulnerability "is considered to be influenced not only by changing biophysical conditions, but by dynamic social, economic, political, institutional and technological structures and processes, i.e. contextual conditions." (O'Brien et al 2007)

[5] MacMillan online dictionary, https://www.macmillandictionary.com/dictionary/british/outcome.

[6] The notion of a final result or state is a backward-looking stance from a single, static point—a way of thinking that is ill-suited to complex adaptive systems.

[7] Developing a narrative for change can be part of deeper resilience processes, such as those described in Wayfinder, a process guide for resilience assessment, planning and action in social-ecological systems (Enfors et al 2018).

> We increase food security in our community while having the formal and informal capacities to continually ensure a decreasing environmental footprint of the food the community produces and consumes.

There is an inherent dilemma in such a statement (sometimes called stating a *wicked problem*[8]), and this is intentional—for it gets at the complexities involved; and in this example, both the social and ecological parts of the dynamic system are explicitly acknowledged.

Multiple narratives for change could lead to such trajectories, with some emerging and becoming possible while others close during the course of implementation. Focusing on one single narrative to reach a trajectory via a specific and unchangeable set of activities and outputs will be a barrier to seeing useful alternatives that emerge. The idea is to use the newest available information from multiple sources to formulate a broad trajectory of interest and identify a variety of narratives. Furthermore, through the process of narrative-building itself, problem conceptualisation constitutes as implementation unfolds. This might lead to a redefinition of the problem itself, and thus to a redefinition of desirable trajectories. Box 1 below provides some indications as to how and where to situate the potential role of narratives within the literature of complexity and evaluation.

This paper is about M&E in international development but some of its insights are also relevant to the wider field of complexity and evaluation. We want to highlight the potential for using narratives, focusing on two well-known scholars in the field, Michael Quinn Patton and Bob Williams. For example, a principles-focused approach, as put forward by Patton (2018) argues that in complex situations, a linear programme logic is inadequate. Principles, especially GUIDE principles (Patton 2018) are a way to orient, monitor, and evaluate a programme without prescribing a particular course of action via, for example, so-called best-practices. Narratives, as we have defined them above, might be useful for linking implementation and principle(s) in nonlinear ways. This is because narratives have the potential to 1) emerge from the concrete experiences of the stakeholders and 2) go beyond the descriptive, decontextualized, and representative accounts that characterize much of our work. Williams' work (Williams 2021, but particularly also Williams 2016) on systemic evaluation repeatedly emphasizes that evaluation methods *derive* from an evaluation design, they do not *precede* it. An evaluation on the basis of a conventional theory of change already orients an evaluation design, whereas narratives, as we have defined them, are emergent. Evaluation design also needs to be conceived of as emergent. We feel that this resonates with many of Williams' (2016) views and might contribute to them by drawing attention to the rich body of methods that are associated with narratives and which stem from the field of process-relational philosophy. They are particularly relevant because they aim to bridge many of the dichotomies that still guide our scientific and, sometimes, evaluation practices, such as separating the social and ecological (Mancilla Garcia et al 2020, West et al 2020).

Box 1. *Connecting dots: The literature of complexity and evaluation, and the potential role of narratives in M&E.*

[8] Wicked problems are contrasted against "tame" or "benign" problems which have a specific endpoint and a correct solution. Wicked problems are big, intractable, and cannot be solved; instead, they must be continuously addressed. This is because of interconnectedness, non-linearity, reinforcing feedbacks, multiple causations, and other characteristics of complex systems. They are wicked to deal with because of incomplete and contradictory knowledge, the number of people and perspectives involved; and their interconnectedness with other problems. (Rittel and Webber, 1973).

Principles for M&E in Complex Adaptive Systems

What does embracing or navigating complexity mean in practice? We identify some principles, based on the authors' long-standing practical and academic engagements, that we believe orient M&E for international development programmes. The core principle is to measure, reflect, learn, and implement learning in continuous iterations. We have elucidated it with a number of supporting principles.

Measure, reflect, learn, and implement learning in continuous iterations:

1. Continuously work towards a common system understanding through ongoing, co-creative dialogue.
2. Continuously explore systems dynamics—in particular, integrated social-ecological interactions and how they are shaped by rules and regulations, resource flows, meanings and values, and power dynamics.[9]
3. Accommodate novelty, i.e., being flexible about new things to pay attention to from the evolving understanding of problems and concerns.
4. Expect and document course changes. There will be unintended and unpredicted effects, both positive and negative.
5. Critically examine, in continuous iterations, the concepts, assumptions, and paradigms used to frame a problem and the social-ecological system from which it arises. This includes combining approaches beyond dichotomies (e.g., qualitative and quantitative, social and ecological, or research and action) and across disciplines to foster transdisciplinary learning and action.
6. Create safe spaces for all of the above, with humility, knowing that we are part of the very systems we seek to change.

We can organize the principles in the following way (see Table 1), according to what we need to do and how we need to do it.

Table 1
Principles for M&E in Complex Adaptive Systems

Measure, reflect, learn, and implement learning in continuous iterations.	
What we need to do	**How we need to do it**
1. Continuously work towards common systems understandings . . .	. . . through co-creative dialogue.
2. Continuously explore systems dynamics . . .	. . . by analysing social-ecological interactions, rules and regulations, resource flows, meanings and values, and power dynamics.
3. Accommodate novelty . . .	. . . always paying attention to new things that emerge.

[9] Moore et al 2018, Westley and Antadze 2010.

Measure, reflect, learn, and implement learning in continuous iterations.	
What we need to do	How we need to do it
4. Document course changes . . .	. . . you expect them.
5. Critically examine framings (concepts, assumptions, paradigms) . . .	. . . going beyond dichotomies, in a transdisciplinary fashion.
6. Create safe spaces for stakeholders to engage . . .	. . . humbly, knowing that we are part of the very systems we seek to change.

For activities to remain relevant in complex spaces, continuous adjustment is needed; and for this, organisations have to provide work settings that allow for ongoing learning, experimentation, and adaptation. To provide the information needed to successfully navigate the complexity of social-ecological systems, M&E needs to be a continuing, core activity and this goes beyond the duration of programmes, since their effects might unfold years or decades after completion. To learn about cause-and-effect relationships in complex systems, we argue that M&E should be an embedded part of organisations and not related simply to individual programmes. This involves practices such as making the purpose and value of M&E explicit within the organisation; helping *everyone* to understand M&E and their role in it; enabling the participation of a broader range of staff and partners in M&E (in designing it, doing it, learning from it, and using the learning); reviewing current organisational practices to identify ones which do not align with M&E as a core activity—and then working to address them; synthesising learning from individual programmes and experimenting beyond silos; and allowing longer time horizons for this.

M&E and Dimensions of Design in Complex Adaptive Social-Ecological Systems

We describe the dimensions of design of a development programme cycle in terms of four stages to exemplify how the principles for M&E can be applied concretely. The four stages are: formulating system trajectories of interest; formulating narratives of change; formulating new trajectories of interest; and evaluation. We see these relating to two dimensions: *the system of interest* and *adjacent systems*. It is not practical or feasible to distinguish between programme design and the principles for M&E identified in the previous section. It may make sense to treat them as separate in situations where cause and effect are known but, as we know, this is not the case in complex spaces. Here, they are entangled and mutually condition each other. Narratives for change are continuously defined *via* M&E. And conversely, we might say that M&E, at any moment, is defined *by* narratives for change. Taken together, the dimensions for design (described, below) and the principles for M&E amount to a complexity-aware M&E system (see Box 2).

Dimensions of design (system of interest and adjacent system) with four stages of the programme cycle	Principles of M&E
Formulating system trajectories of interest. Formulating narratives for change. Formulating new trajectories of interest. Evaluating to assess the meaningfulness of the trajectory.	Measure, reflect, learn, and implement learning in continuous iterations (with the six supporting principles from above)

Box 2. A *complexity-aware M&E system.*

The stages are not a sequence to follow in linear fashion. They are mutually constitutive, even rhizomatic. The image of the rhizome that we take from Deleuze and Guattari (2002) conveys that there is no one starting or ending point in the process. One can enter and exit at different points. For example, as we have discussed above, the collaborative process of developing and formulating narratives of change might lead to novel understandings of the problem and thus to a redefinition of the trajectory of interest. Similarly, narratives which connect the system of interest with other systems might provide valuable insights about relevant stakeholders in the system of interest.

The fact that we are intervening in social-ecological systems immediately adds another layer of complexity because more often than not, our approaches might be suited for analysing either the social or the ecological realm, but not both (much less both as an integrated whole). For concrete methods to inform the implementation of the principles and the overall M&E system, we point to the Routledge Handbook of Research Methods for Social-Ecological Systems (Biggs et al, forthcoming) which is the first of its kind in assembling and discussing concrete methods to address the complexities of social-ecological systems.

Dimension 1: The System of Interest

We argue that a key stage is to engage in a deep co-development process with a diversity of relevant stakeholders to **formulate trajectories of interest**. Who is a relevant stakeholder? They are those who have a key part in either trying to *change* the system or in *maintaining* it.

> Principle 6. Create safe spaces for stakeholders to engage, and humbly, knowing that we are part of the very systems that we seek to change.

Those who are trying to shift the system can be engaged as allies, but those who are keeping the system stuck in undesired patterns (perhaps because they benefit from the status quo) are part of the unfolding story, as well. We might tend to think of them as opponents—maybe even enemies; but they have a powerful role in producing the current reality and their involvement might be crucial for the system to shift. In the stages of implementation, it is not always possible or even desirable to engage actors whose goals are opposed to each other; but one can, for example, use networks to interact with them strategically.[10]

We begin with generating a common understanding of the system, relevant to reaching the trajectory of interest, and we do this in a deep and ongoing process with stakeholders.

[10] There are many approaches to help with this kind of engagement, for example, stretch collaboration, pioneered by Adam Kahane and Reos Partners.

Principle 1. Continuously work towards common systems understandings through co-creative dialogue.

This includes critically exploring the use of the terms and ideas that are used to conceptualize the system. This sensemaking process does not drive towards conclusion: there is no one answer (and no right answer) regarding the system identity and boundaries.

Principle 5. Critically examine framings (concepts, assumptions, paradigms), continuously, and beyond dichotomies, in a transdisciplinary fashion.

Complex systems do not exist independent of the observers (the stakeholders). It is likely, as well as useful, that different stakeholders will see the system differently and unearthing and interrogating the assumptions behind those differences is important to develop a common working model. As we know, models are only partial representations in limited time spans (Box, 1987), so as they are developed, one must constantly surface their limitations. Having spent a lot of time and effort to understand a system and develop a model, it is natural to become attached to it and even internalise it as a (now) unquestioned set of assumptions. Thus, an important role of M&E in a complex system is to raise awareness of and question these models on an ongoing basis.

Rather than striving for comprehensiveness, the aim is to gain a balance of knowledge about the system that is useful in relation to the trajectory of interest. What is viewed as a great solution from one perspective might not be so from another. So, it is useful to combine learning from different knowledge systems (Tengö et al 2014). As well, changes in the system might alter what is meaningful to emphasise. What was seen as a solution at one moment might not be in the next. Understanding the system from diverse stakeholder perspectives over time, though time-consuming and resource-intensive, is essential (Enfors et al, 2018).

Another key stage involves exploring system dynamics in order to **formulate possible narratives for change**; that is, different narratives that could lead towards a system trajectory of interest.

Principle 2. Continuously explore system dynamics by analysing social-ecological interactions, rules and regulations, resource flows, meanings and values, and power dynamics.

We can think of this as a trial-and-error process where mutual learning on the basis of discussion, experimentation, and speculation is encouraged—indeed, required. The narratives for change can be very different with respect to associated activities and outputs.

In the implementation phase of a programme, the critical importance of a complexity-aware M&E becomes tangible: It will enable ongoing learning, account for emergent phenomena, identify and select narratives, and develop new narratives under conditions of uncertainty.

Principle 4. Expect and document course changes.

Principle 3. Accommodate novelty by always paying attention to new things that emerge.

For this, it needs to be a continuous, real-time activity that is constantly informing the implementation of narratives for change—which, in turn, are being adjusted. This process might lead to novel narratives of change being developed; but also, more radically, to the **formulation of new trajectories of interest** as problem framings and understandings evolve. In this way, the value of a programme is not reduced to a priori agreed outcomes, but important emergent and novel phenomena can be captured and inform possible changes. **Evaluations** can be used to assess whether a particular trajectory of interest has been attained and whether the system can reasonably be expected to remain on that trajectory. However, the value of the programme should not be reduced to these dimensions (Williams 2016). An evaluation needs to take account and make sense of novel phenomena which have emerged. Not doing so reduces the programme to how it was pre-defined, while the context, due to complexity and emergence, will have

changed—perhaps significantly. In complex systems, a programme's impact rarely is visible directly after implementation. Effects can emerge years or decades later. Results might fall short of or turn out to be different from the desired trajectory; but they might still be better than what could have been expected without the programme. Figure 1 below provides a visualization of the process discussed so far.

Dimension 2: The Adjacent Systems

The system in which a programme operates is connected to other systems with which it constantly interacts. As a result, additional complexities are inevitably introduced. Results in one system may have positive or negative repercussions in adjacent ones. If the adjacent systems are not monitored, it is likely these effects will remain invisible. For example, in the short term, installing air conditioners in a community facilitates adaptation to rising heat due to climate change. At the same time, the material extraction and increased electricity consumption for the air conditioners increases CO^2 emissions and contributes to climate change, which negatively affects many other systems in the long term—including the system of the community itself. In conditions of complexity and uncertainty, the consequences of actions may be obscure or simply unknown. This is why the effects of a particular programme need be examined beyond the system of interest. And we contend that it is a minimum requirement to consider both social and ecological dimensions.

The aim is to formulate a narrative of how the programme could contribute to, prevent, or have other desirable or undesirable effects with respect to other systems; and then to adapt it during implementation, whenever necessary. Evaluation would, then, include: following the narratives and how they have changed; identifying, and if possible, assessing impacts on the adjacent systems, both desirable and undesirable; and drafting lessons learned that need to be communicated back to all stakeholders, including donor organisations. For this, the Blue Marble evaluation approach developed by Patton (2020) provides stimulating and useful ideas.

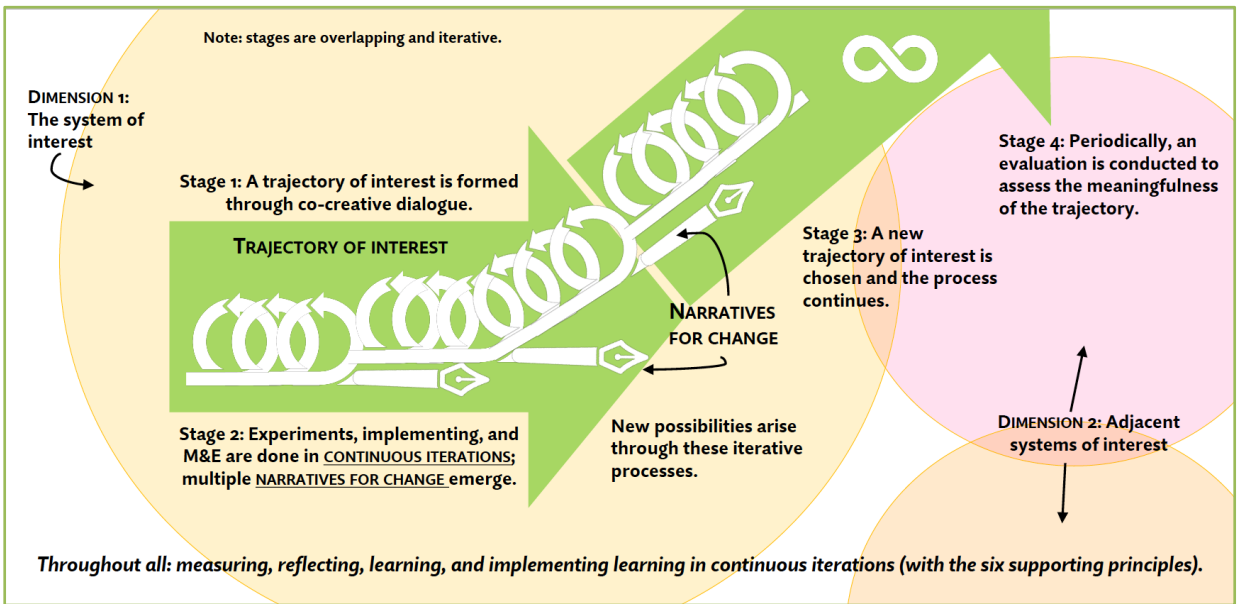

Figure 1. *Practising in complexity-aware M&E.*

Embracing Complexity

While many donors seem to prefer a theory of change with outcomes, outputs, and activities well-defined in advance, this cannot do justice to how complex adaptive systems work. Focusing on narratives which lead to desirable trajectories leaves more room for flexibility, experimentation, and innovation—and this approach, aligned with our complex realities, can catalyse transformative change.

This could mean thinking and communicating more in terms of multiple narratives for change, instead of one single theory of change. Among other strategies, this can be achieved by involving donors more, especially when developing common understandings of systems of interest and formulating narratives for change. Another aspect is having a common understanding of the necessity for longer timeframes.

Though particular system trajectories are likely to emerge only during implementation, it does not mean there should be lack of accountability for funds received. However, it requires a different approach: moving from tracking a plan that is established, in advance, *to reviewing how funds were spent, with respect to a trajectory of interest that emerged during implementation.* It is not about how closely implementers adhered to and achieved a pre-determined plan, but rather, whether they know why they did things the way they did and can provide a fulsome rationale. This includes explaining how the system was—or will be—reorganized so there is transformative potential (through changed relationships around rules and regulations, resource flows, meanings and values, and power dynamics, as noted in principle 2, above). When we try to implement against pre-determined plans, failures are inevitable, because of the nature of complex systems. Even when we take a complexity-informed, iterative approach which learns from experimentation, many experiments will teach us that our ideas were not fruitful.

We all know that unsuccessful experiments should be important sources of learning. In understanding complexity and emergence, we gain insight into *why* much more deeply. There are no foregone conclusions; no stand-alone programmes that don't impact or become affected by others—even, sometimes, ones that are very far away and at different scales; no way to make progress, except through experimentation and learning. Instead of making a programme *appear* to be a success because it complies with standard requirements of measurability and accountability, understanding unsuccessful experiments in-depth builds greater transformational capacity. Natsios (2010) suggests: "The counter-bureaucracy ignores a central principle of development theory—that those development programs that are most precisely and easily measured are the least transformational, and those programs that are most transformational are the least measurable."

There are always limitations: of time and capacity; of our ability to envision more emergent ways to work; of donors' tolerances for the inherent risks in navigating complexity. But refusing to navigate complexity doesn't make it go away. We live and work in complex, ever-unfolding contexts which constantly serve us surprises. It is understandable that donors want to have a final say on conceptual amendments of a programme; but understanding is not sufficient. Donors must also be brought along and, like everyone, constantly be learning and iterating as trajectories unfold. Experimentation and learning are not options in complex adaptive systems—it's the way such systems evolve. So, it's worth the risk of being more open-ended and learning M&E approaches that are suited to complexity. Then we can hope to engage in truly sustainable development.

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