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Bridging the Gaps Between Resilience, Complexity and Linear Programing

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Abstract

In a world where conventional approaches to dealing with humanitarian aid and development assistance have been questioned, resilience has captured the attention of many audiences because it is seen as providing a new perspective on how to effectively plan for and analyze the effects of shocks and stressors that threaten the well-being of vulnerable populations (RM-TWG, 2013).

There is a tendency, however, among development practitioners toprogramme interventions using a linear, systematic perspective, in which the system is viewed as something which is known or knowable and can be engineered to suit a particular purpose. There is good reason for this, in that linear causality and the associated plausibility of relationships between inputs and outcomes is more easily measured than the components of the complex systems and the higher level interactions between them that create system wide change involving a process of social learning and feedback. In addition, programming and subsequent measurement of development interventions inherently requires a focus on delivering outputs according to plan and controlling the interactions between system components so the project delivers according to contract with the donor. The dangers of this approach are over-control and too much focus on achieving targets within a given time frame.

The challenge for development practitioners is to devise methodologies for programming and measurement of investments which bridge the gap between the systemic and systematic approaches and complement the inherently messy or wicked problems associated with complex systems with the more manageable and better understood facets of a linear approach.

This paper will focus on the identification of tools for understanding and modeling complexity designed to produce a mental model of the main components of the system and the interactions between them. The purpose of these tools is to reduce complexity to a simple (but not simplistic) model of the primary drivers (reinforcing feedback) and balancing feedback that regulate a system. The paper will explore the perspectives provided by a series of blog entries (http://livestocksystems.ilri.org/category/resilience/) written between January and June 2015 for ILRI's Livestock and Environment programme and the Technical Consortium for Building Resilience in the Horn of Africa.

Keywords:

Resilience, linear, complexity, systemic, systematic, feedback, learning, measurement, modeling, development, humanitarian, system, adaptive, capacity, transformational, absorptive, food security, scale, impact, outcome, theory of change, indicator, M&E, livelihood, diversity, socio-ecological, pastoral, panarchy, attribution, gap, contribution

Introduction

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There is a tendency, however, among development practitioners to programme interventions using a linear, systematic perspective, in which the system is viewed as something which is known or knowable and can be engineered to suit a particular purpose. There is good reason for this, in that linear causality and the associated plausibility of relationships between inputs and outcomes is more easily measured than the components of the complex systems and the higher-level interactions between them that create system wide change involving a process of social learning and feedback.

In addition, programming and subsequent measurement of development interventions inherently requires a focus on delivering outputs according to plan and controlling the interactions between system components so the project delivers according to contract with the donor. Delivering outputs is the only thing that a project manager can control, and even here, problems can arise if others do not deliver their parts as necessary to meet the output targets. Beyond delivery of outputs, the outcomes of a project and its impact depend on complex interactions between project beneficiaries and the social-ecological environment within which they live. Outcomes and impacts cannot be predicted or controlled but can be influenced to some extent by project management skilled in social process, provided that project and beneficiaries can work together toward a common vision of a desirable future.The dangers of this approach are over-control and too much focus on achieving targets within a given time frame.

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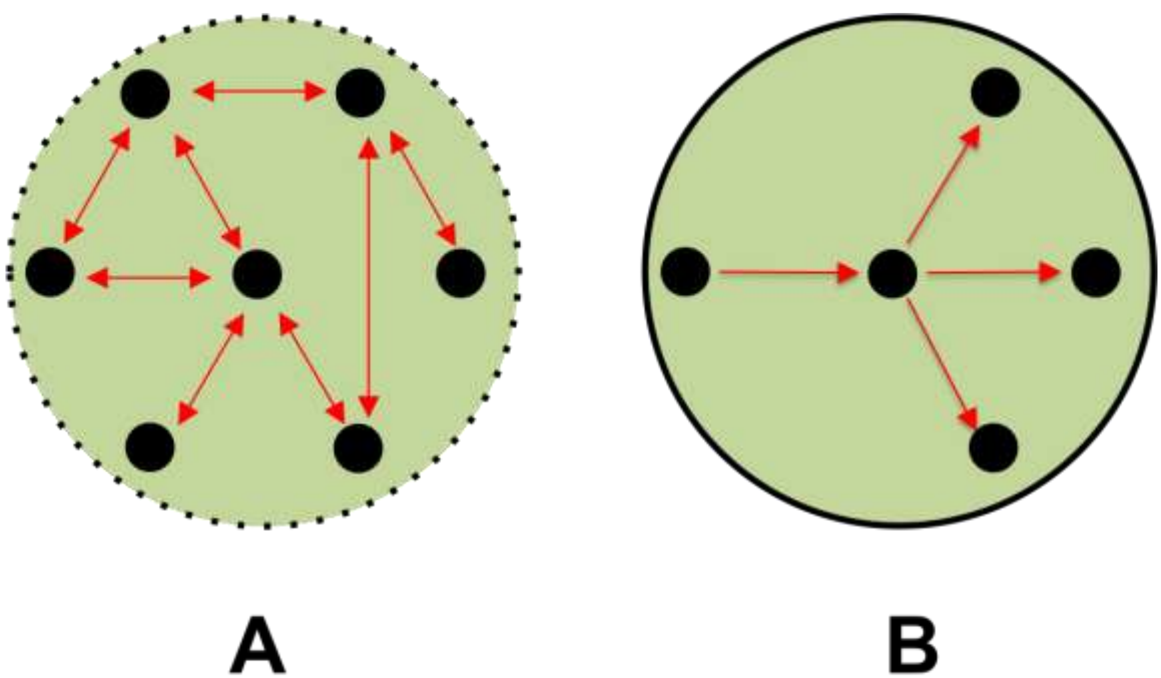
Horn of Africa.

Description of Systematic and Systemic Approachesto link Cause and Effect

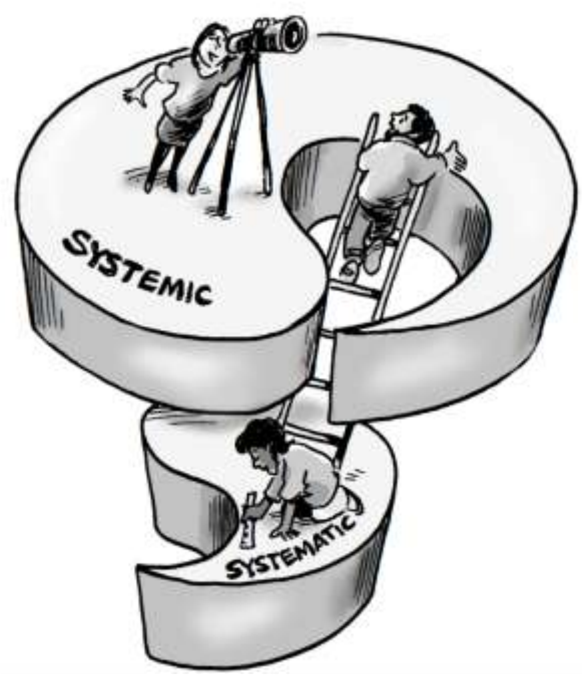
A systematic approach is derived from Newtonian physics and is based on the assumption of simple cause-effect relationships between entities within a system. A systemic approach is derived from complexity science and assumes that all entities within a system are connected either directly or indirectly through feedback interactions (Fig 1). A systematic approach is based on an engineering perspective: entities within a system can be created and re-organised so that the system behaves predictably; inputs lead to outputs, outcomes and higher level goals according to plan. A systemic approach is based on a complexity and uncertainty perspective, which recognizes that system entities may be influenced but not controlled. Outputs can be delivered, but outcomes and higher level goals may not be achieved because entities within the system interact in complex ways that are beyond the control of project management. A systemic perspective creates opportunity for learning about system process and adapting management accordingly (Holling, 1978).

Figure 1: Diagrammatic representation of the difference between: A, a complex adaptive system of living components connected directly or indirectly by feedback interactions and contained with an open boundary; and B, a system of inert components connected by simple cause-effect interactions and contained within a closed boundary.



The systematic can be viewed as a special case, or part of the systemic (Ison, 2010) and together they may be regarded as a duality (Fig 2). For project management purposes, this requires an ability to "zoom-in" to the detail of the systematic and to "zoom-out" to understand the interactions between the special case and the larger system within which a project intervention operates.

Figure 2: The systemic systematic duality (Ison, 2010)



In food security projects, much of the project system is complex and adaptive which means that the entities in the system self-organise, are hierarchical and are resilient to external disturbance (Meadows, 2008). Land, plants, animals and people all interact and evolve in complex ways that can be understood but not predicted from feedback models. Physical infrastructure, mechanical tools and technologies are simple devices that work in predictable ways and may have profound impactson the biophysical system of land, animals, plants and people. Managers of food security projects are inevitably operating from a position of uncertainty and require monitoring, evaluation, learning and adaptive functions to guide a development process. This is not easily achieved in a world conditioned to believe in simplicity and predictability, and where the institutions that govern organizational behavior demand strict fiscal accountability by project managers. Some of the difficulties of reconciling the stabilizing functions of institutions that force a false sense of security with the requirement for flexibility in the management of social-ecological systems are described in (Green *et al.*, 2015).

Background to Conventional Development Project Design

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(Natsios, 2010).

In his paper reviewing what he classifies as Obsessive Management Disorder (OMD), Natsios (2010), divides USAID development projects into three categories:

1. The delivery of goods and services, such as the distribution of food aid and humanitarian assistance, immunization and the building of schools,
2. The building of local self-sustaining institutions, such as those within government, private sector,and nonprofit—through the training of staff, construction of business systems, and development of regular organizational procedures and institutional cultures, and
3. The engagement of government personnel, local NGOs, civil society leaders in discussions on policy dialogue and reform., which means an ongoing discussion and debate about reform and policy changes,

He further points out that these three categories of development aid are governed by different temporal scales and therefore different potential for impact measurement; "the first of these missions—service delivery—includes outcomes that can be counted and seen and that are under the control of the USAID program implementers, while the latter two missions often are neither easily measured nor very visible, and require a long time horizon to achieve success; more important, they require the cooperation and consent of the power structure and leadership in the developing countries, which makes their outcomes more problematic and unpredictable" (Natsios, 2010).

As a result of the longer time frame required to achieve success or impact, and the complexity and unpredictably of implementation, and therefore impact, the latter two "missions" are increasingly underfunded and neglected, yet they are the most important in the long run, as they are more transformational and more central to what development—and state building—is all about.

If we accept, as Natsios suggests, the premise that, "development, is at its root an effort to build or strengthen institutions (public, private profit-making, and nonprofit civil society) in poor and fragile states with the ultimate goal of developing a capable state, market economy, and civil society that can manage public services, design good policies, create jobs, and protect human rights and the rule of law on areliable, sustainable basis after the aid program is over and funding ends," it then follows that "all construction orservice delivery projects should be subordinate to the larger institution-building task." (Natsios, 2010). The institutions are in effect components of the larger system, in which transformation is associated with changes in sustainable development outcomes, engendered by project inputs. It is the status of these institutions that is difficult to measure, hence why the health or performance of systems is often not taken into account in measurement of project impacts.

Ison (2010) citing various sources argues that systemic failure is due to:

- the target culture that is common in government and corporate bureaucracies;
- "projectification" as a widespread response to perceived problems where projects generally fail to meet long term needs and goals;
- project management as an activity based on weak theoretical assumptions; and
- use of projects as weak mechanisms for tempering top-down government with "participation".

All of these problems are associated with deeply entrenched systematic thinking about goals, targets and projects that are unsuited to adaption in a climate change world.

Tools for Articulating Inputs and Associated Impacts and Outcomes

Development practitioners are consistently faced with the challenge of justifying to a donor, how the money that was given to fund a certain project, has had the intended outcome. In order to be able provide evidence of this causal relationship, most resort to tools that infer causality plausibly.

These tools include Theories of Change, Logic Models, Programme Theory, and Impact Pathways, to name a few.

Theory of Change is commonly understood as an articulation of how and why a given intervention will lead to specific change. There are four main purposes of ToC – strategic planning, description, monitoring and evaluation and learning – although these inevitably overlap. The term 'ToC approaches' can be employed to identify the range of applications associated with this term. As highlighted inStein and Valters (2012),for some Theory of Change is a precise planning tool, most likely an extension of the'assumptions' box in a logframe; for others it may be a less formal, often implicit 'way ofthinking' about how a project is expected to work; or beyond this, an approach aiming toencourage a politically informed, reflexive and complex approach to development.Thesedifferent choices will reflect different ideas about what a Theory of Change approach istrying to achieve, as well as the underlying politics and ideology of those developing it.

Kail and Lrumley (2012), describe the theory of change as a tool that shows a charity's path from needs to activities to outcomes to impact. This offers a different approach that recognizes complexity and the importance of "enablers" (conditions or factors) that determine whether a project succeeds. Some enablers are internal and may be controlled within a community, others are external and beyond the community's control. The implication of this perspective is that project activists (managers and implementers) and their role as change agents have to be closely aligned with the beneficiary community. This approach has potential but requires development practitioners to invest in the time it takes to develop truly participatory approaches to development.

A programme theory explains how an intervention (a project, a programme, a policy, a strategy) is understood to contribute to a chain of results that produce the intended or actual impacts.

A programme theory can be a very useful way of bringing together existing evidence about a programme, and clarifying where there is agreement and disagreement about how the programme is understood to work, and where there are gaps in the evidence.It can be used for a single evaluation, for planning cluster evaluations of different projects funded under a single program, or to bring together evidence from multiple evaluations and research.

Impact or outcome pathways allow a development toward a defined outcome, with clear steps, influences and processes along the pathway to achieve the outcomes. It is not a linear process; instead there are multiple feedbacks, which occur. This takes into account dynamic change in behavior, relationships, networks, activities, people and organizations (Roduner *et al.*, 2008)along the timescale of the impact pathway. These potential changes illustrate 'cause and effect' shifts, and the value of the impact pathway is being able to iteratively evaluate and examine individual actions (and potential influencing factors) on both mid-term outcomes and final outcomes.

Key to the M&E of resilience strategies and interventions through an impact pathway, are indicators: qualitative or quantitative measures derived from a series of observed facts that can identify change over time and act as a benchmark (Nardo *et al.*, 2005). This use of indicators, however, implies a static property of the system, which is not essentially a good representation as it is merely a snapshot in time of one perspective of reality, when in fact there may be other valid perspectives(Ison, 2010),and the system is constantly changing.

Indicator-based analysis provides a useful methodology to assess the performance of a policy or project towards a set of goals (Chesterman & Ericksen, 2013), and enables a more empirically-informed process to justify and evaluate resilience investments (Miller *et al.*, 2010). Outcome-based indicators aim to define an explicit outcome or end point of the resilience intervention action, creating a 'downstream' approach where indicators are focused on the longer-term effectiveness of resilience interventions (Chesterman & Ericksen, 2013).

Indicators also enable resilience pathways to be more succinct, synthesising data in a digestible way that may have a direct influence on the quality of the interpretation (Deprez *et al.*, 2007) by possible investors, agencies and government bodies.

An Example of Linear Measurement of Project Impact: the USAID-funded Pastoralist Areas Resilience Improvement through Market Expansion (PRIME) project in Ethiopia

One of the challenges associated with the attribution of investments towards enhanced resilience is that resilience is difficult to quantify as a resultant entity, an aim which, according to those espousing a Complex Adaptive Systems (CAS) perspective, is unobtainable as resilience, per se, cannot be measured. At present, many agencies are using standard outcomes measures such as improved health, nutrition, living standards, educational standards – literacy, enrollment rates and examination pass rates, and consumption and expenditure figures to act as proxies for resilience while methodologies are being devised which actually quantify the contribution of investments to what are being defined as resilience capacities.

The recent work of TANGO in the creation of the baseline survey for the impact evaluation of the PRIME project goes some way to manifesting resilience capacities and has created indices which capture the dimensions of resilience capacities.

For the purposes of this evaluation, TANGO has defined resilience as a set of capacities that enable households and communities to effectively function in the face of shocks and stresses and still meet a set of well-being outcomes. In other words, in order to enhance resilience, individuals, households, and communities need to manage shocks and stresses in ways that lead to more positive outcomes than would otherwise be predicted without such capacities. The chapter in the study starts by reporting on households' perceived abilities to recover from shocks and the coping strategies they use to manage them. It then presents data on indicators of resilience capacity, including:

- Psychosocial measures of resilience
- People's aspirations and confidence to adapt
- Access to social capital (bonding, bridging, and linking)
- Livelihood diversity, ownership of productive assets, and access to financial resources
- Access to markets, services, infrastructure, and information
- Availability of disaster planning and response services

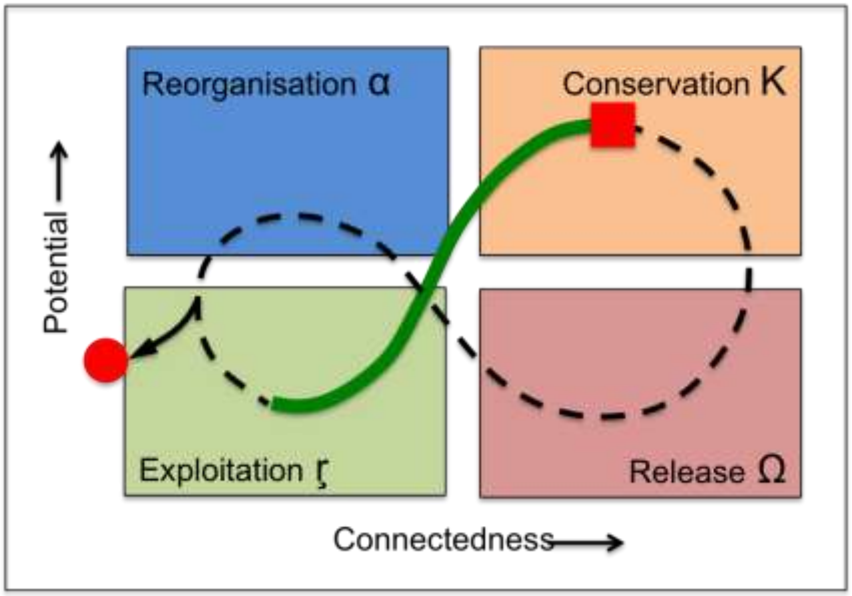
In this report, summary indexes of the three dimensions of household resilience capacity—absorptive capacity[1], adaptive capacity, and transformative capacity—are presented as well as a discussion. The chapter ends with a discussion of community resilience in the PRIME Impact Evaluation area(Smith *et al.*, 2015).

Social-ecological characteristics of pastoral systems

Pastoral systems are complex adaptive systems in that they evolve and change over time, their components are arranged hierarchically as sophisticated life forms and communities, and they are resilient to disturbances such as periodic drought and epidemic disease such as rinderpest. One way to understand evolutionary (or developmental) change in such systems is to apply Holling's(2001)adaptive cycle and panarchy metaphors as tools for reducing complexity to a manageable theory of change while recognizing that the system is influenced by multiple feedback links operating at different levels of scale and that its behavior cannot be predicted in the manner of simple mechanical systems. Such an approach was used for understanding change in Australian rangelands (McAllister *et al.*, 2006). Holling's original ideas are explained and expanded with examples of how "resilience thinking" works in Walker and Salt (2006) and further extended to practical application by Walker and Salt (2012). Contemporary literature on social-ecological systems discusses resilience as a useful characteristic that determines the health of the system (Cumming *et al.*, 2005), as the degree to which the system builds its capacity to learn and adapt (Carpenter *et al.*, 2001). Resilience is not always desirable for the social-ecological system, it can also be undesirable, demonstrating characteristics that decrease social welfare (Carpenter *et al.*, 2001) or lead to a degraded environment.

[1] The term "absorptive capacity" is not formally recognized as a component of resilience theory but can be regarded as a necessary early part of building adaptive capacity by rapidly restoring a system's potential for change following a collapse (see Fig. 3).

Figure 3: The Adaptive Cycle, a metaphor for understanding change within a system



Source: (Holling, 2001)

Key features of Holling's framework are illustrated in Fig 3. The adaptive cycle is both symbolic and descriptive. The "lazy-8" is the infinity symbol, while alpha and omega are the first and last letters of the Greek alphabet referred to in Revelations 22:13 with regard to the eternal nature of god: "I am the Alpha and the Omega, the first and the last, the beginning and the end." The r symbol for the exploitation phase and K for the conservation phase refer to life-strategies. For example, mice are short-lived animals that produce large numbers of offspring in a short period of time and can rapidly exploit an opportunity created by a fluctuating environment. Humans on the other hand produce relatively few offspring that require a relatively long period of environmental stability to become adult.

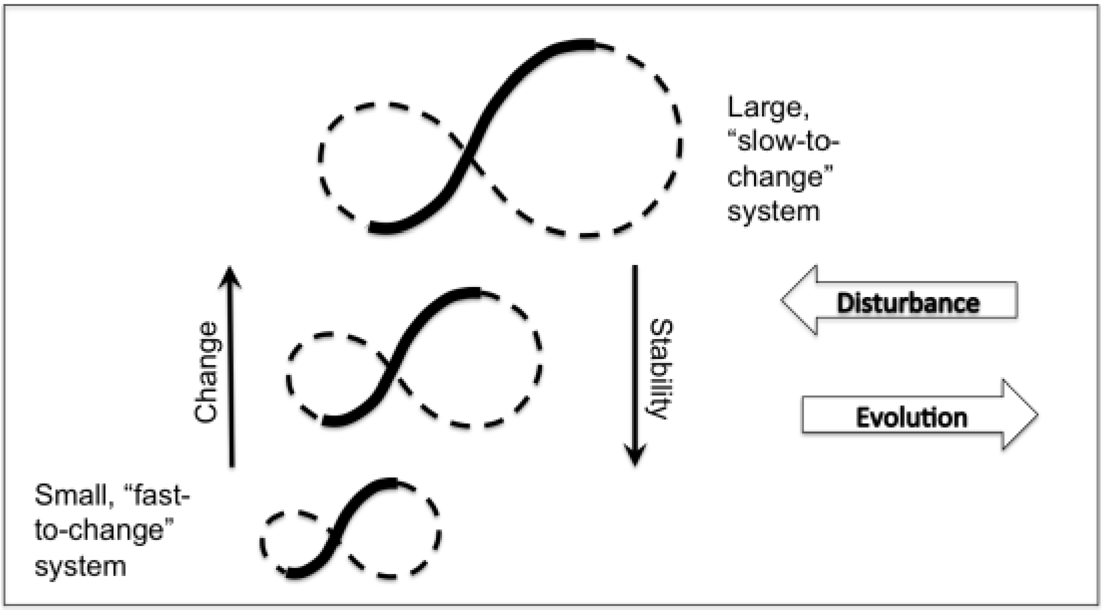
The adaptive cycle represents the way in which a living system responds to a disturbance event, reorganizes and returns to stability. The growth curve from exploitation to conservation is a relatively slow process while collapse and re-organization are relatively fast. **Potential** for change represents the amount of "capital" (for example, the five capitals of sustainability) that the system has accumulated. **Connectedness** represents the ecology of relationships within the system, the actors and the feedback interactions between them that regulate system behavior. Depending on the resilience of the system and the severity of the disturbance, the system may either return to its original state, or be transformed into something different. A simpler way of thinking about this is early rapid growth followed by maturity, senescence and death where the material remains of the dead are taken up and used by other systems. More simply still, the adaptive cycle is a model of “boom and bust”, a common phenomenon in business.

Maladaptation may occur at two points in the cycle represented by a red square and a red circle. The red square represents a rigidity trap: an unwillingness or inability to change in response to changes in the environment. Rigid systems have accumulated large amounts of capital, are over connected (over-regulated) and are over-resilient. They are brittle systems that have lost their ability to adapt. Large bureaucracies can be rigid and in society, rigidity traps are also known as “lock-in” traps characterized by “in-think” and “in-speak”. The global economy is an example of a rigid, over-connected system that is being maintained by tight fiscal policies, debt creation and money printing.

The red circle represents a poverty trap, a condition where the system has lost its resilience and lacks both the potential for change and the actors and interactions necessary for return to its original state, or transformation into a new system. Systems in poverty traps may either expire or persist on some kind of “life-support” system. The refugees displaced by war in the Middle East are people whose lives have been disrupted to the point where they are in a poverty trap and will be dependent on humanitarian aid until they can reorganize and rebuild their lives.

The panarchy (Fig. 4) shows how systems interact across different levels of scale. The diagram is a simple representation of multiple systems, nested one within the other, that occur in reality. The small “fast-to-change” systems exert an influence for change while large “slow-to-change” systems exert a stabilizing effect. If a forest stand is destroyed by disease or fire, surrounding forests provide the seeds and animals for regeneration of the original forest. If on the other hand damage to the forest is extensive, then some of the original species may be replaced by new species, and the relationships between new and original species create a new kind of forest. The counter intuitive point about the panarchy is that disturbance events are necessary to maintain the resilience of a system. If a system is protected against disturbance through measures designed to increase its stability, it will loose its ability to recover or transform after it is subject to a novel kind of disturbance.

Figure 4: The panarchy of feedback interactions across different levels of scale



The goal of sustainable development is to create and maintain prosperous social, economic, and ecological systems. These systemsare intimately linked: humanity depends on services of ecosystemsfor its wealth and security. Moreover, humans can transformecosystems into more or less desirable conditions (Folke *et al.*, 2002).

Holling's panarchy and adaptive cycle framework were found to provide an overarching theory of change that other sustainability sciences lacked (Mooney *et al.*, 2013).

The Attribution Gap

It is critical for donors and project implementers, that both attribution and contribution of individual projects, actions and processes are understood in their role toward achieving outcomes along designated impact pathways. The conceiving of these pathways needs to be supported by clear processes, actions and projects that can show verified contributions toward the pathway and transparent attribution in enhancing resilience. An impact assessment, once an individual project is completed, allows an understanding and 'plausible' bridge linking a project's direct benefits with wider level impacts. This requires a 'persuasive case', requiring triangulation with multiple data sources, quantitative analysis, qualitative data and verbal testimony to illustrate attribution toward resilience.

There are some points about resilience building projects and the attribution gap model that can be made from a resilience thinking perspective.

Resilience building may have one or two of three general goals.The design of a development intervention will depend on whether the project seeks to build adaptive capacity, transformational capacity or general resilience. These are different aspects of resilience and are defined by Folke *et al.* (2010) as:

Adaptability: The capacity of actors in a system to influence resilience

Transformability: The capacity to transform the stability landscape itself in order to become a different kind of system, to create a fundamentally new system when ecological, economic, or social structures make the existing system untenable.

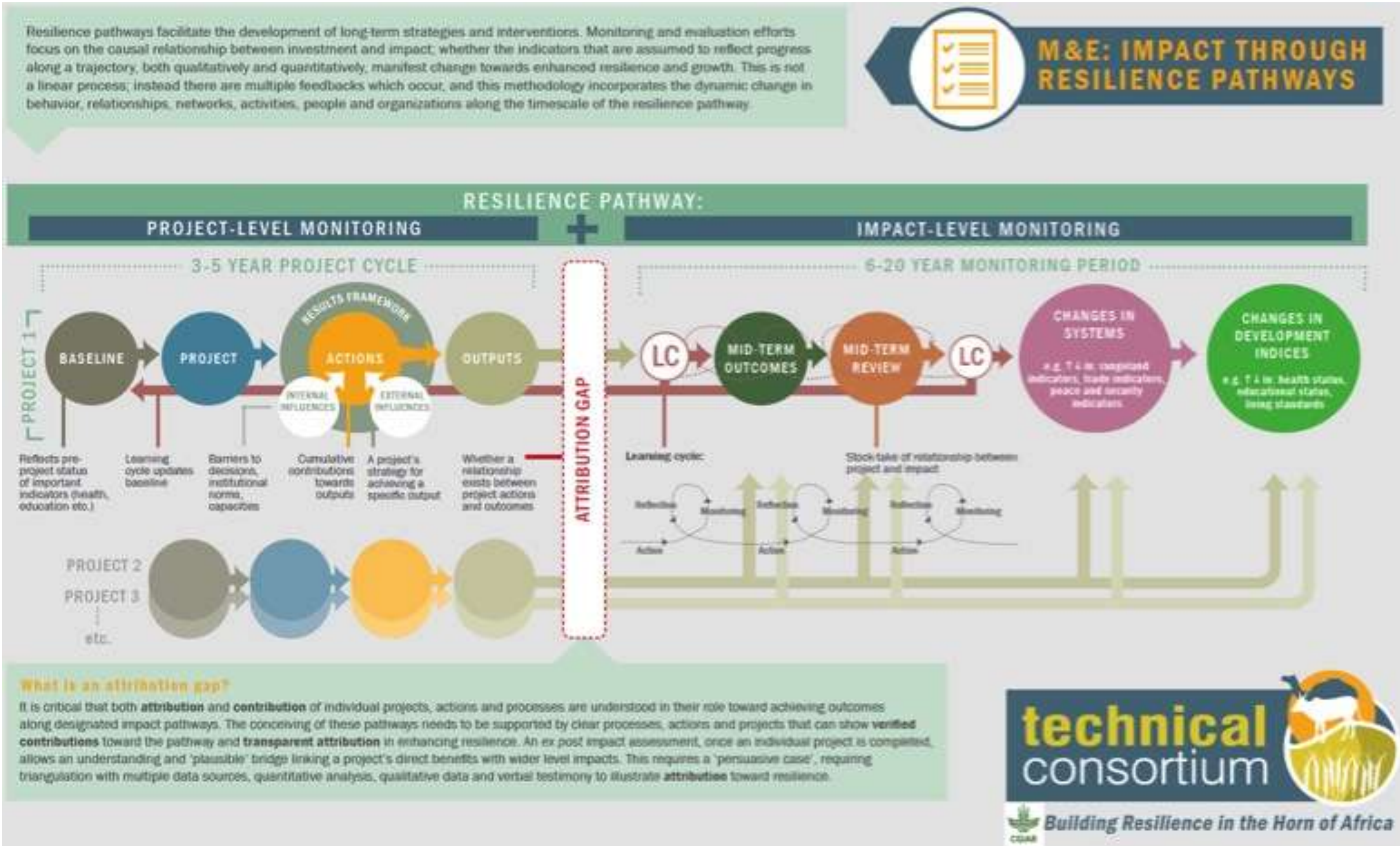
General resilience: The resilience of any and all parts of a system to all kinds of shocks, including novel ones.

The development of adaptive capacity will generally require a lower level of investment than transformative capacity. The decision to aim for adaptability or transformability is based on the findings of a specified resilience assessment (Walker & Salt, 2012) and the examination of alternative future states of a system, using scenario planning techniques. A specified resilience assessment identifies the resilience of what kind of system and whom, to what kind of disturbance event. It is based on an assessment of the risk of a system crossing a threshold from one system state to another and the desirability of the alternative system states from the perspective of the people who live in the system. Crucial features of the resilience assessment are the necessity to consider change processes operating across multiple levels of scale, and ability to focus the assessment on the scale of interest to management; and an ability to detect systems traps and the drivers (reinforcing feedbacks) that hold systems in those trapped states.

General resilience assessment can be based on a simple status and trend assessment of a series of attributes that are known to enhance the resilience of a system (Walker & Salt, 2006; Walker & Salt, 2012) and may lead to a variety of project interventions.

In all cases project outcomes and impacts are not predictable in the sense of conventional logical frameworks, because of the inherent unpredictability of living systems that are constantly evolving due to complex processes that are well beyond the control of project managers. Nevertheless, when interventions are applied with monitoring, reflection, learning and adaptation they are less likely to fail catastrophically, than projects applied according to a systematic linear logic.

Figure 5: Example of Impact Pathway and Attribution Gap



Case Study: Mapping Theories of Change to Pillars within the Ending Drought Emergencies Arid and Semi-arid Investment Plan in Kenya

The Government of Kenya has committed itself to ending drought emergencies in Kenya by 2022. This commitment is clearly spelt out in the Second Medium Term Plan (MTP) for the Vision 2030, in which Ending Drought Emergencies (EDE) is recognised as one of the key foundations for national development.

The EDE initiative reflects two significant changes in our understanding of drought emergencies in Kenya. The first is that they have their roots in poverty and vulnerability, and in the fact that Kenya's drought-prone areas are among those which have benefited least from past investment; drought emergencies will not end until the essential foundations for development (principally security, infrastructure and human capital) are in place. The second is that drought emergencies are complex challenges which can only be managed by strong and competent institutions, able to draw on new streams of finance as well as the skills and resources of all actors.

The EDE strategy was approved by the Cabinet in 2012, embedded within the national development plan (as a chapter within the Kenya Vision 2030 Medium Term Plan [MTP] II for 2013-17) and adopted by key parts of the national and county governments. The strategy was also integrated with the Intergovernmental Authority on Development's (IGAD) Drought Disaster Resilience and Sustainability Initiative (IDDRSI) Strategy and endorsed by development partners as a framework around which to align their assistance. The MTP has six pillars:

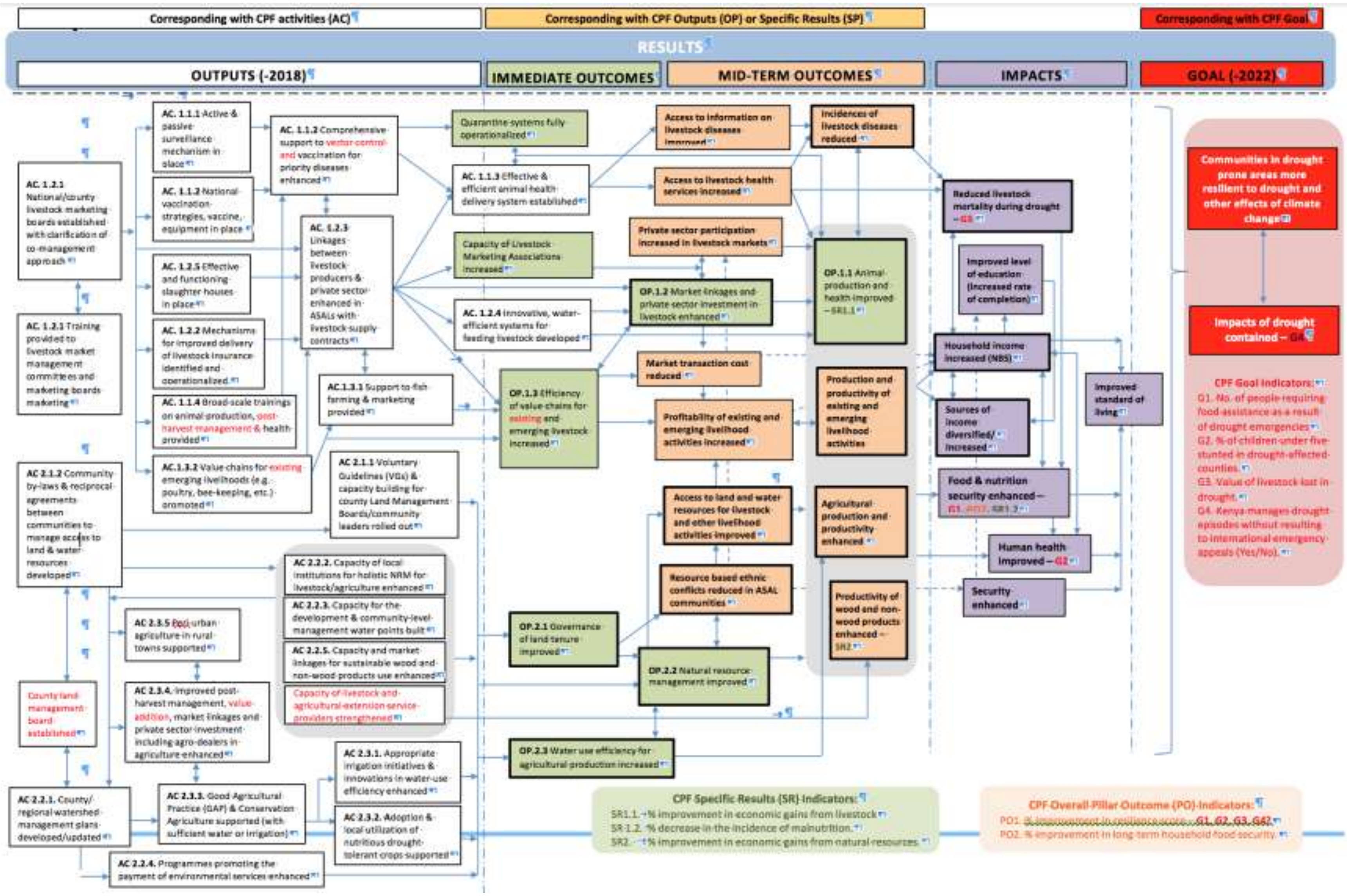
1. Peace and security;
2. Climate-proofed infrastructure;
3. Human capital;
4. Sustainable livelihoods;
5. Drought risk management (DRM); and
6. Institutional development and knowledge management.

Each of these pillars is being operationalised through a common programme framework (CPF) in order to harmonise the actions and resources of the Government of Kenya and its development partners.

Pillar 4 is the fourth of six common programme frameworks that have been developed to operationalise the Ending Drought Emergencies (EDE) Medium Term Plan. The overall goal of the EDE sustainable livelihoods pillar is to strengthen the resilience of livelihoods in arid and semi-arid counties to the effects of drought and climate change. This task is made more challenging by the deep-seated inequalities and vulnerabilities of the region, by the growing unpredictability of dryland environments and economies, and by institutional weaknesses at all levels.

In April 2015, a workshop was held in Naivasha, Kenya, the purpose of which was to formulate the Theories of Change (ToC) for all projects in each pillar, mapping their pathway from inputs to impact and outcomes that would signify their potential relationship and role in ending drought emergencies for Kenya. The products of the workshop were Theory of Change maps for each pillar. We intend to use the ToC for Pillar 4 as a case study as a demonstration of conventional project design and measurement metrics.

Figure 6: Kenya Ending Drought Emergencies ASAL Investment Plan: Pillar 4 Theory of Change Map



Project Design:

For the purposes of discussion, the land use and governance component of Pillar 4 can be considered by: 1) reflecting on some aspects of the ToC model from a complex adaptive systems perspective; and 2) by stepping back from the detail of the project and thinking about the Kenyan landscape, its people, climate change and what might be important for project design from a resilience perspective that takes scale and cross scale interactions into account.

Strictly speaking, none of the defined outputs in the ToC are deliverables under the control of project management. Some outputs imply the delivery of things like irrigation equipment and improved crop varieties but all the outputs make assumptions about the willingness of project beneficiaries to change their behavior and learn new skills. In more extreme cases, change may require people to change their beliefs and even their identity (for example, pastoralists becoming arable farmers or vice-versa). Such changes do not come easily or quickly and they cannot be forced. From this perspective, the "outputs" in the ToC are a mixture of outputs (things that the project delivers) and outcomes (the changes that occur as a consequence of the development intervention). Articulating assumptions about willingness to change, defining indicators and corrective activities for each output component, and then delivering on them would place a considerable burden on project management. This level of attention to detailed measuring and corrective would not address the attribution gap, because much of the anticipated change is dependent on the beneficiaries, how they respond as individuals and as members of a community.

Another difficulty with the ToC is the manner in which it deals with scale. From a complex adaptive systems perspective, development is a bottom up process that can be greatly enhanced by an enabling and supportive legal and policy environment. The desirable features of this top-bottom relationship are clearly articulated by Ruitenbeek& Cartier (2001) and the importance of the stabilizing influence of social values on policy is illustrated by the example of a resilience assessment of an irrigated agricultural system in Australia (Walker et al., 2009). Furthermore, Ruitenbeek& Cartier (2001) emphasize the need for adaptive policy that promotes the conditions necessary for "emergence" (self-organization of a complex adaptive system) innovation and social learning.The need for adaptive policy applies to the project, as well as the bi- or multilateral governments responsible for fiscal management and project oversight, as these all exert a command and control influence on the project and its outcomes, instead of the desirable conditions that promote evolutionary processes to emerge from the bottom.

In the ToC, county/regional watershed management plans and establishment of a county land board are interventions in large-scale systems, while things like capacity for community level water point management and conservation agriculture are local small-scale interventions. There is no indication of the potential feedback interactions between these two levels of scale, or the next level of scale down which might be represented by the psychosociological changes that individuals within the system are expected to make as a consequence of the intervention.

Outcomes in the ToC such as improved governance of land tenure and natural resource management seem to be the sum of the defined “outputs” rather than clearly defined changes that are expected to occur as a consequence of the development intervention. Other outcomes defined in the ToC such as reduction in resource based ethnic conflicts, enhanced productivity and livelihood improvements are more readily identifiable as outcomes.These are good candidates for attribution monitoring through the selection of a few key variables associated with each outcome. Issues of scale and the mix of outputs and outcomes would need to be resolved before other useful indicators of change can be identified.

Stepping back for the detail of a project design, and imagining a scenario of the Kenyan landscape in relation to increased severity of drought and flood under climate change provides another perspective on land use and governance.To a large extent, the social and ecological dynamics of Kenyan landscapes are driven by rainfall. More erratic rainfall with greater intensity and duration of wet and dry implies more variable conditions for pastoral and agricultural lifestyles. Pastoralists will become more mobile as they seek pasture for their stock, dry-land farmers will move upward into the mountains as they seek the greater stability of orographic rainfall. Pastoralists will follow in years of extreme drought. Conflict seems to be inevitable.

One approach to development in such a scenario is for interventions that focus on system attributes that are known to enhance the general resilience of a system. An exhaustive presentation and discussion of these is beyond the scope of this discussion but two sets are worth mentioning in relation to the ToC for Pillar 4.

Adaptive governance that includes social learning, innovation, leadership, conflict negotiation, the ability to collaboratively manage resources such as rivers that cross jurisdictional boundaries and devolution of decision-making authority to the lowest possible level of scale will be an important suit of measures for mitigating and managing conflict. The second set relates to the need to maintain the integrity of slow to change biophysical components of the landscape like soil, hydrological systems forests and savannas. These can be expected to change with climate change so the development challenge is to find innovative ways of land use that maintain the resilience of these systems and maintain human livelihood. Ecological and social restoration of those parts of these landscapes that have become degraded through over use, including the creation of “novel”landscapes from new assemblages of plants and animals will be appropriate in some situations.

Considerations of adaptive governance and land use that maintains the resilience of slow to change large-scale systems are not explicit in the ToC for Pillar 4, although measures such as conservation agriculture and water use efficiency imply their existence to some extent.

How do We Bridge the Gap:

The matter of how to bridge the attribution gap remains speculative and will vary with the specifics of each project environment. Projects that demand a high level of focus on quantitative indicators for targets defined from linear thinking because of donor policies related to fiscal accountability will be difficult to satisfy. Projects that have less rigid requirements in this regard will be more amenable to the kinds of evidence that can be acquired from triangulation of quantitative and qualitative data and narrative accounts that illustrate attribution.Furthermore, projects that demand high levels of attention to measurement in relation to targets seem more likely to be ineffective than those that are satisfied with plausible attribution based on triangulation from multiple sources of evidence. Ison (2010) refers to a case in the UK health service where an excessive focus or targets was literally fatal for a considerable number of patients.

In projects where there is a high level of collaboration between project activists and beneficiaries, reflexive management is both more likely to enhance the adaptive capacity of all involved and to enable the accumulation of qualitative and narrative accounts to supplement quantitative data for attribution purposes. In projects that are highly participatory, and that are designed with an understanding of scale influenceson change processes and adaptive governance systems, it seems that bridging the attribution gap will be relatively easy.

Perhaps what is needed are some trials with highly participatory projects designed from application of resilience assessment to determine both their efficacy in resilience building and their ability to generate evidence of attribution?

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