Chapter 4: Understanding the Intervention

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It is a curious fact that many implementation plans contain very limited information as to precisely how the intervention with which they are concerned will produce the expected results. They often provide very detailed accounts of the various inputs required and activities to be undertaken, together with an impressive list of potential outcomes. But many have what has been described as a "missing middle" (Lucas et al. 2004:21). They do not spell out the detailed process whereby the identified activities can be expected to achieve the intended goals.

For policy-driven interventions, there may be ideological reasons for such omissions. For example, if there is a conviction among policy makers that 'pay for performance' is an obvious way to improve services, they may not question too closely the precise mechanics of an intervention based on this approach. Where interventions are funded by an external donor, those seeking that funding may well focus their attention on ensuring that the discussion of the intervention and associated outcomes will appeal to that donor and spend less time on setting out the 'fine details' of their implementation plan. It may also be that some implementers sincerely believe that such details will almost certainly prove to be irrelevant when the implementation moves from the design phase to confront the complexities of the real world. This attitude may be seen as similar to that of Helmuth von Moltke, head of the Prussian army in the 19th century, when he suggested that "*No battle plan ever survives first contact with the enemy*".

An alternative view, also proposed by another war-time leader, Dwight D Eisenhower, was that "*Plans are worthless but planning is everything*". This latter sentiment seems much more useful from an implementation research perspective. It suggests that the more understanding you have of the implementation plan, including the underlying assumptions and potential risks, the more rapidly can you become aware of explicit or implicit modifications to that plan, whether these are driven by changing attitudes within the implementation team or by the external context.

1. The Implementation Dilemma

Interventions (policy changes, projects, programmes) can be seen as attempts to transfer health innovations that have demonstrated efficacy in the laboratory, clinical trials or small-scale pilot studies to benefit larger populations. Those involved in the development of such innovations are often very concerned that they should not be modified in ways that they fear may reduce efficacy. They focus on the issue of *Fidelity* (Carroll et al. 2007, Perez et al. 2011). On the other hand, local health experts will be primarily concerned with the effectiveness of the specific implementation that will affect the lives of the population they serve. They would see the potential for success of that implementation as being greatly enhanced by appropriate *Adaptation* to the local context.

There is therefore a basic dilemma which confronts all those who design the implementation of a promising intervention:

- The more rigidly implementation is controlled to ensure fidelity to the intervention, the more likely it will be that local factors (resource constraints, inadequate infrastructure, cultural factors, etc.) will reduce effectiveness.
- The more an implementation is adapted to local conditions, the more difficult it will be to argue that findings can be generalised to other localities or populations.

An additional problem faced by those who seek to promote the use of evidence-based interventions is that there may be considerable uncertainty as to the extent to which the intended intervention has been modified. The claimed degree of fidelity may be substantially less than the actual, as implementers make perfect sensible but often undocumented adjustments to overcome local barriers or bottlenecks.

Clinic research compared to implementation research

There is a long history of clinical trials that are often very convincing in terms of: 'what works?' or even 'what works best?' Experience with implementation research has been less encouraging – there are many interesting individual studies but limited accumulated knowledge that can be applied to new interventions. The underlying problem is that simple technical interventions typically involve complex social interventions that result in:

- Context dependency – low fidelity
- Outcomes that depend on detailed processes and pathways that are often not well understood.

In many cases it would seem that '*the intervention is the implementation*', i.e. we have a series of both successes and failures for what the implementers describe as the 'same' intervention but where there have in fact been considerable adaptations to local contexts, sometimes discarding or radically amending what might be regarded as essential features of the intended intervention.

Implications for IR

The above implies a need to seek an in-depth understanding of: (1) the intervention (for example identifying those elements seen as essential and those which could be modified without undermining the intervention objectives); and (2) the planned implementation process, with particular attention to modifications driven by a perceived need for adaption to a specific local context. This suggests a need for a monitoring system that can track changes in the implementation process where there are any deviations from the original plan. A useful starting point is to construct (or review if one already exists) a 'logical model' for the intervention (DFID 2011, W.K. Kellogg Foundation 2004, Gasper 1997). Such models are commonly required by international donors to provide a simplified explanation as to how a specific intervention is intended to further their objectives.

2.   The Logical Model

The logical model of an intervention is of the 'if-then' type, linking what are seen as the activities, outputs, purpose and goal of an intervention:

- If activities are undertaken then outputs should be produced.
- If outputs are produced then outcomes that serve the purpose should result.
- If outcomes result then they should contribute towards achieving the goal.

Note that those managing an intervention are seen as responsible for producing a defined and quantified set of 'outputs', as illustrated in figure 1. The output-to-purpose and purpose to goal steps rely on the validity of assumptions, based on existing evidence, made by those designing the intervention. Clearly, for each 'link in the chain' to function, a series of additional assumptions relating to the external context must also hold. The more certain we can be of the resilience of each of the links to changes in those external contexts, the more persuaded we will be as to the likely success of the implementation.

Figure 1: the components of a logical model
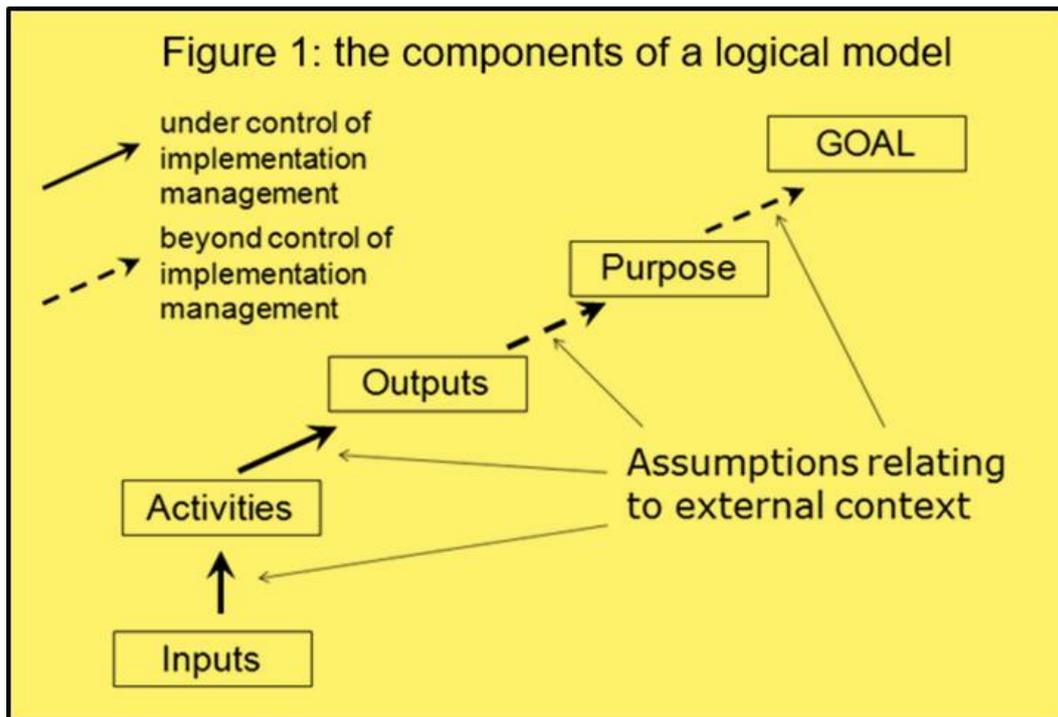
Logical Framework Analysis

A procedure based on the above, called Logical Framework Analysis (LFA), was originally introduced by international donor agencies as a management tool, designed to increase accountability and central control by imposing "*hierarchically ordered and quantified objectives*" (Gasper, 1997:3). Those objectives are often explicitly expressed as targets such as '70% of children immunised', '80% of households with an insecticide treated bed net'. It was seen, particularly by the recipients of funds, as a mechanism whereby donors assessed cost-effectiveness using Objectively Verifiable Indicators (OVIs) that were designed to allow progress monitoring and evaluation.

The framework can be set out in simple matrix format.

Table 1: The Logical Framework Matrix

Vertical Logic	Objectively Verifiable Indicators (OVI)	Means of Verification (MOV)	Assumptions
GOAL			
PURPOSE			
OUTPUTS			
ACTIVITIES	Inputs		

As indicated above, the 'Vertical Logic' of the matrix links activities and outputs, which the implementation team has contracted to deliver, with the purpose and goal of the intervention as agreed between that team and those providing the necessary resources. The four levels are defined as follows:

- *Goal*: The higher level objective towards which the intervention is expected to contribute (e.g. reduced IMR).
- *Purpose*: Outcomes expected to be achieved as the result of the intervention (e.g. increased child immunization rates).

- **Outputs**: Results for which the implementation management are responsible (e.g. improved access to immunization).
- **Activities**: The activities that will be undertaken in order to produce outputs (e.g. reform of provider incentives).

Objectively Verifiable Indicators (OVI)

One primary purpose of the Logical Framework from an implementation research perspective is to raise questions as to how the key implementation inputs, outputs and outcomes can be effectively monitored to assess the extent to which implementation is progressing as intended and generating the expected outcomes. The framework requires the identification of a set of objectively verifiable indicators at each level:

- Goal: Measures to verify to what extent goals are fulfilled.
- Purpose: Measures to verify extent to which outcome targets are achieved.
- Outputs: Measures to verify extent to which output targets are achieved.
- Activities (Inputs): Measures of inputs (resources) used to undertake the activities.

Assumptions

The framework also requires identification of important conditions or events outside the control of the implementation management that are seen as necessary:

- To contribute to the goal.
- For the achievement of the purpose.
- For the production of outputs.
- For the implementation to start.

Assumptions are of particular interest for implementation research because of their relevance in assessment of the possibilities for scaling up or relocating the intervention. Some key questions to be addressed would be:

- Are the stated assumptions plausible in the existing context and how specific are they to that context?
- Are there important implicit (unidentified) assumptions?
- What consequences might flow from an incorrect assumption?
- As the implementation proceeds, have any assumptions proved to be incorrect?

Possible uses of the logical framework matrix

In its simplest form, as illustrated by the example in in table 2, the logical framework matrix can be seen as a brief summary of the basic underlying logic of an implementation and should allow an initial assessment of its plausibility and the extent to which it is context dependent. Perhaps one of its most valuable uses to permit discussion between the members of the implementation team and selected stakeholders to promote a common understanding as to how the implementation is expected to deliver the intended outcomes. One important task of the implementation researcher is to question both the extent to which the logic is plausible and the degree to which it depends on the contextual assumptions. In particular, the implementation researcher should attempt to identify those assumptions which can be seen as potentially determining the relative success or failure of the intervention. This can provide a useful guide to key issues that will need to be addressed in exploring possibilities for scaling up or re-location.

The framework can also be used to jointly identify and agree potential process, output and outcome indicators that can be used to verify if the implementation is proceeding as planned and producing the expected results. This implies a simultaneous process of identifying sources of data that can be used to determine those indicators. Together these activities should provide a sound basis for the design of the implementation monitoring and evaluation system.

Finally, if this should indicate that progress is not being made as intended, the logical frame matrix can be revised to reflect any necessary modifications to the original plan required to get the implementation back on track.

Table 2: Outline example of a Logical Framework Matrix

|	Objectively Verifiable Indicators	Means of Verification	Assumptions
Goal: Reduced child malaria deaths	IMR, U5MR	Demographic and Health Surveys	Bed nets effective in preventing malaria in infants and young children
Purpose: Increased proportion of children under 5 sleeping under an insecticide treated bed net (ITN).		Demographic and Health Surveys	1. Communities persuaded of benefits. 2. No serious barriers to use within communities.
Outputs: 1. Mass distribution of ITNs 2. System to maintain & extend coverage 3. Communications activities to encourage appropriate use	ITNs distributed Distribution mechanisms established Number and types of communication activities	Implementation M&E system	1. Managers, providers released to attend training 2. No major delays in procurement process
Activities: 1.Procurement and distribution of ITNs 2. Establishment of sustainable supply system 3. Training for managers and providers 4. Production of communications materials Communications activities 5. Development of reliable information systems	Inputs	M&E system Accounting system	1. Support from local officials, providers, communities. 2. Financial resources provided on time

Criticism of Logical Frame Analysis has largely centred on its alleged rigidity in the context of what may well be a rapidly changing environment and for what is often characterised as a narrow and simplistic approach to interventions, particular when the frameworks are used to set often arbitrary targets. As indicated above, one response has been to emphasise the adoption of so-called 'process' Logical Frameworks, which can be modified during implementation. The main concern here is that the ordered world of the logical framework, which may indeed be useful for the limited task of clarifying inputs, outputs, objectives and aspirations, should not be confused with the much more complex, highly politicised and extremely fluid environment which characterises many health system interventions.

3. Logical Models and Theories of Changes

The basic logical framework matrix identifies intervention components and provides a useful summary of the 'chain of causality' linking inputs, activities and outcomes. A Theories of Change (ToC) model attempts to explain in much greater detail *how* the 'links in the chain' are intended to function – to develop 'an implementation theory'. (Vogel 2012, Mackenzie and Blamey 2005, Grantcraft 2006, International Network on Strategic Philanthropy 2005). Thus in the above example it was indicated that 'Communications Activities' would be used as a means to promote appropriate use of ITNs within target communities. A ToC model of this link might suggest, based on previous experience, that engaging with key opinion leaders and advertising in the local media prior to an open community meeting was likely to produce the desired outcome.

What is a Theory of Change?
The theory of change for an individual component of an implementation can be seen as a detailed flow diagram, as illustrated in figure 2, setting out the sequential processes required to achieve a given (intermediate or final) objective.

Figure 2: ToC for a behavioural change intervention
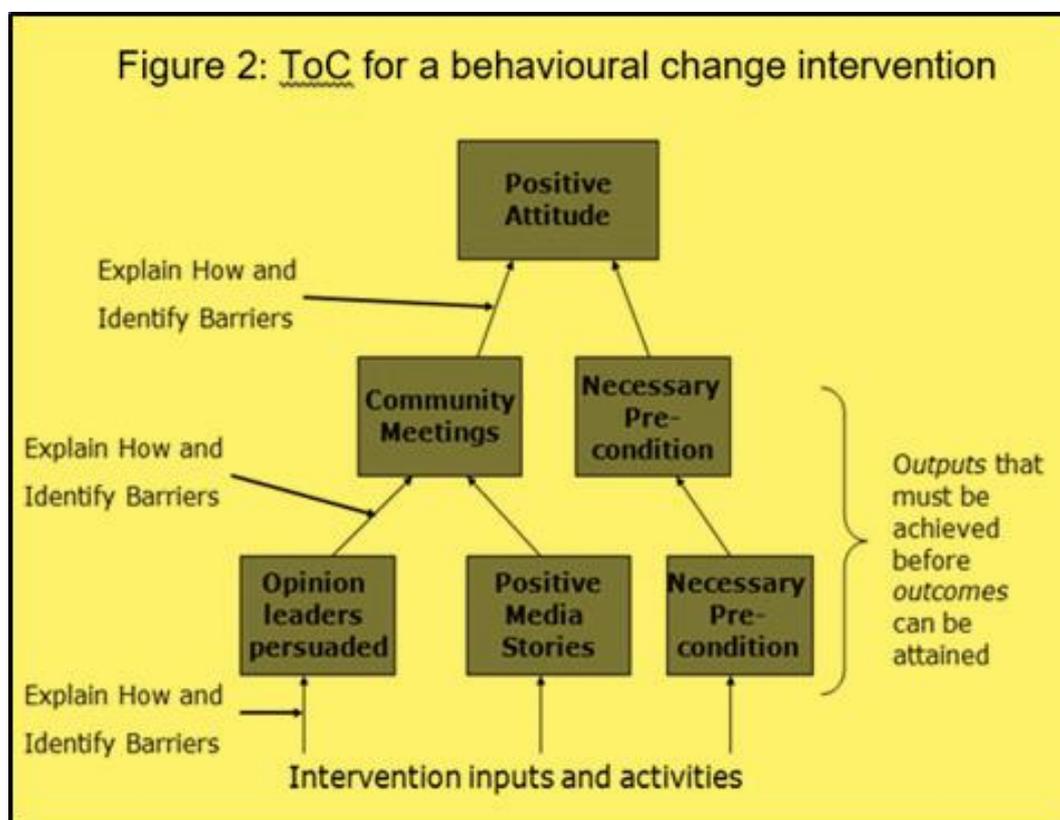
Testing ToC Models
ToC models should also specify quantified indicators that can be used to test the implementation theories. For example, in the above, it may be suggested that a majority of opinion leaders will have to be persuaded or that 75% of a community must be reached by the media publicity in order that the expected outcome will be achieved. Developing such ToC theories is a much more difficult and time consuming than constructing a Logical Framework. For example, figure 3 below shows the detailed ToC for a prevention and treatment program for patients with heart disease (Mackenzie and Blamey (2005):158). It should be kept in mind

that ideally such a ToC should be constructed in collaboration with representatives of all key stakeholders, which implies an extended and possibly contentious participatory process. The assumption is that by devoting sufficient resources to developing a shared understanding as to how an intervention is intended to work, we can design monitoring systems that will allow us to both test those theories and gain the knowledge that will allow us to adapt the implementation design if they prove incorrect.

Figure 3: Have a heart project – Theory of Change
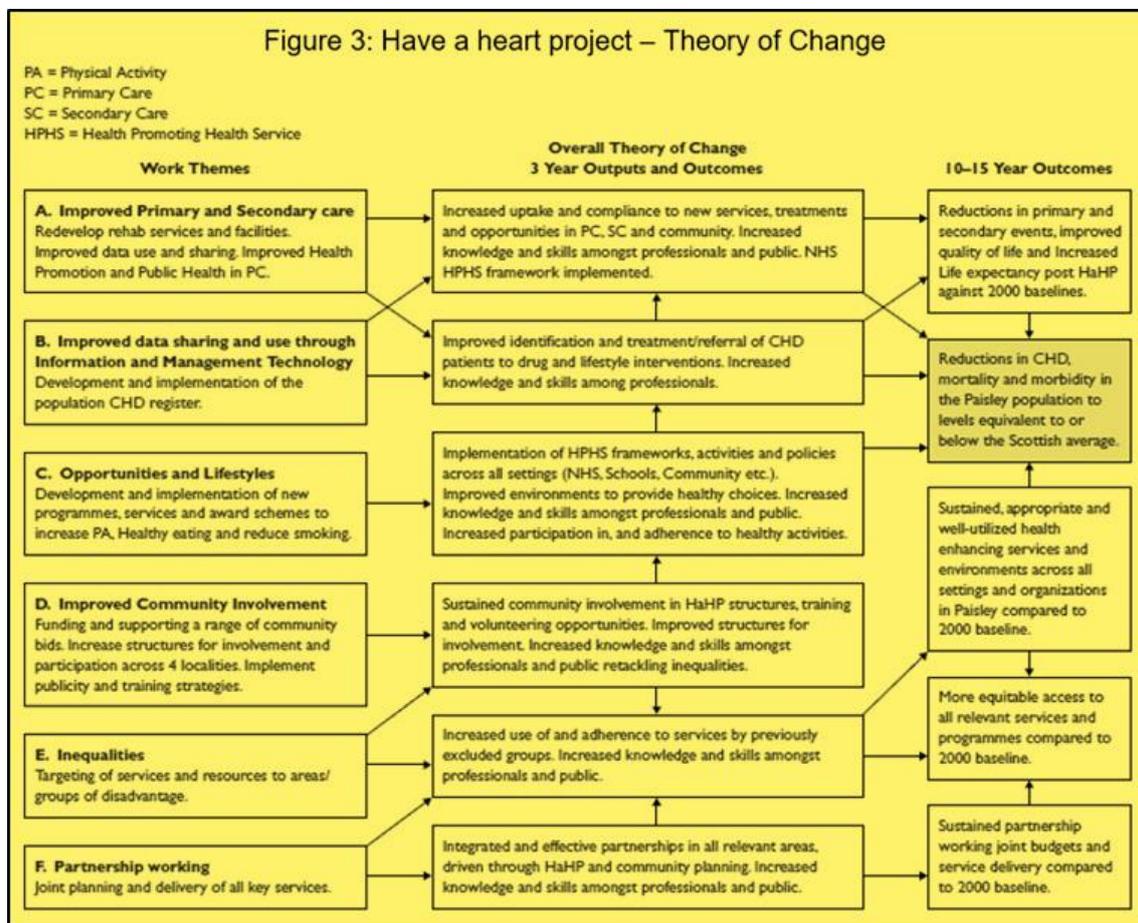
4. Complex Adaptive Systems

Theories of change can be extremely complicated if an intervention contains multiple components. However, as with the Logical Framework, there is an underlying assumption that if the inputs and activities identified in the ToC can be implemented as intended, they will result in the desired outputs and outcomes. Comparison is often made to the first moon landing. That was one of the most complicated projects ever attempted but successful because a myriad of component parts functioned as planned, resulting in the predicted outcome. This feat of engineering can be contrasted, for example, with many biological systems, which are inherently unpredictable. We cannot know precisely when a seed will germinate, where a tree will form its first branch or which genes a child will inherit from each parent. Similar considerations can be applied to social systems. For example, it seems impossible to determine in advance which individual will emerge as the most influential in a political party, which children starting at a new school will become close friends or which marriages will be successful. The notions of predictability and unpredictability are often used to distinguish between systems which are 'complicated' and those which are described as truly 'complex'.

It has been suggested that many health initiatives, mainly because they are dependent on the behaviour of human actors, give rise to what can be described as Complex Adaptive Systems (CAS)[i] (Ramalingam 2014, (Zhang et al 2014), Paina and Peters 2011, Craig et al. 2008, Rogers 2008, Leykum et al. 2007). Even apparently simple technical interventions can exhibit CAS behaviour as multiple stakeholder groups interact. A CAS will typically exhibit the following characteristics:

- There are a large number of interacting agents.
- Those agents have adaptive capabilities – they can modify their behaviour in ways that impact on the implementation process in response to external influences.
- They will adapt in response to the changing environment – and in particular to changes induced by the intervention and the responses of other agents.
- One common adaptation will be the formation of new alliances that are seen as advancing mutual self-interest.

The implication is that there is no easy way to 'control' or even reliably forecast agent behaviour. Unintended responses to the intervention are common, rendering these systems intrinsically unpredictable. Paina and Peters (2011) argue that the history of attempts at implementing potentially beneficial health systems innovations provides substantial evidence that they should be seen as having these characteristics. Many interventions that were very successful on a small scale, in a research setting, or in one country or region, have often failed when replicated elsewhere or on a larger scale. The implementation of these interventions has rarely proceeded according to plan and in many cases has had to be radically adapted to overcome unforeseen barriers resulting from a rapidly changing environment relating to emerging stakeholder perceptions, attitudes and behaviours. The ability of implementation managers to exercise control over the behaviour of providers, communities and even their own staff has often proved to be highly constrained. Many implementations have displayed a classic characteristic of CAS behaviour, with major inputs sometimes resulting in very limited outcomes or relatively small stimuli having major positive or negative consequences.

CAS Behaviour

As indicated above, CAS can display unexpected behaviours. Three types of behaviour that may be particularly relevant to health interventions are:

1. Feedback loops. An output of a process within a system is fed back as an input into the same system. Example: corrupt behaviour may provide the resources for a health provider to bribe officials, allowing that provider to increase their illicit income and bribe more officials. Example: improving service quality may lead to greater demand for services, which leads to increased facility income, which is used to incentivise staff, which results in improvements in service quality.

2. Path dependence. Processes may have similar starting points and procedures, yet lead to different outcomes, because those outcomes are sensitive not only to initial conditions, but also to the historical context and events that occur over the implementation period. Example: the introduction of rural health insurance works well in one area but not in another where communities remember a similar scheme that was introduced some years ago but failed due to poor management. Example: a brief period of civil unrest in a district when providers are being recruited deters women applicants and results in a health workforce that is overwhelmingly male. This severely constrains the implementation of an innovative reproductive health service for many years as women are reluctant to seek help from a male provider.

3. Emergent behaviour. When two or more agents join together, the resultant alliance may behave in ways which are totally unexpected. Example: health workers who feel they are adversely affected by an intervention come together to form an organisation that can exert

pressure on local politicians to delay key aspects of the implementation. Example: community leaders and local health centre managers are made jointly responsible for district drug stores to improve accountability. Many form alliances with traders to sell the drugs in local shops and share the profits. Emergent behaviours are often associated with feedback loops. In the first example, as the number of aggrieved health workers increases so will the number of conversations complaining about the intervention, which will lead to more aggrieved workers. Eventually the system may reach a 'tipping point', when the number of such workers emboldens them to protest formally by forming a new organisation.

4. The butterfly's wing effect. In a CAS, apparently very minor changes in implementation processes can have a substantial effect on outcomes. Example: what the project management team regard as a marginal amendment to an incentive payment scheme is seen as breaking an agreement with providers and is used by a group that opposes the intervention to gain support for withdrawal from the scheme.

> **Example**: In an exploration of the factors influencing immunization coverage in Uganda, Rwashana et al. (2009) use what they describe as a qualitative systems dynamics approach to illustrate the "*complexity and dynamic nature of the immunization process*" p95. They construct a model of the immunization process, identifying both supply and demand factors and the influences which determine those factors. Figure 4 shows a causal loop diagram illustrating the complexity of the demand side and in particular the multiple and interacting feedback loops that influence the level of demand.

Figure 4: Causal loop diagram - demand for immunization
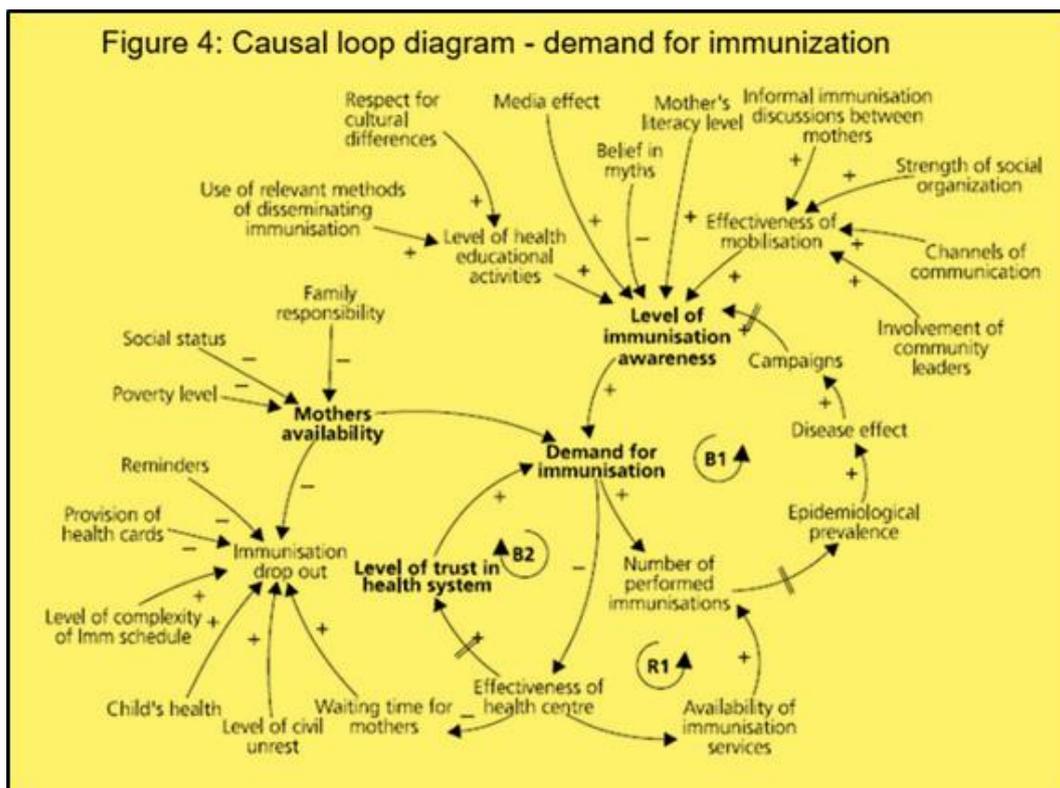
> **Example**: A study of performance-based contracting (PBC) in Uganda (Ssengooba et al. 2012) argues that previous evaluations focused on the effects of PBC (black-box), paying only limited attention to how these effects arise. Two related theories, complex adaptive system and expectancy theory were employed. A prospective study tracked the implementation of PBC while collecting experiences of participants at district and hospital levels. It was found that significant problems were encountered in the implementation of PBC that reflected its inadequate design. As problems were

encountered, hasty adaptations resulted in a de facto intervention distinct from the one implied at the design stage. For example, inadequate time was allowed for the selection of service targets by the health centres yet they got 'locked-in' to these poor choices. The learning curve and workload among performance auditors weakened the validity of audit results. Above all, financial shortfalls led to delays, short-cuts and uncertainty about the size and payment of bonuses.

Implications of CAS aspects of Health Interventions

From the perspective of the team managing an implementation, the possibility that they will have to address CAS behaviours emphasises the need for flexibility and a willingness to adapt procedures to address unpredicted developments, but only to the extent, as discussed in the opening section of this chapter, that such adaptations do not threaten key elements of the intervention. Defending those elements may require more 'thinking-outside-the-box' in terms of the nature of such threats. For example, rather than simply considering which individual stakeholders are in a position to disrupt or hinder core intervention components, there will be a need to think about the implications of potential alliances forming between two or more stakeholder groups.

As indicated above, feedback loops can be damaging or beneficial to the implementation process. One common mechanism for their emergence relates to informal communications between stakeholders, sometimes based on misunderstandings or exaggerations. By timely and effective communications management, it will often be possible to identify and defuse potentially damaging feedback loops and it may even be possible to encourage those which benefit the implementation. For example, there should be frequent exchanges of information on current and planned activities with affected stakeholder groups, using the communications formats most appropriate to each of those groups. A similar strategy may be applied to instances of emergent behaviour, exploring ways of promoting helpful self-organization and innovation, for example by providing opportunities for increased involvement in implementation management, and at least monitoring the development of alliances which may pose additional threats.

One evident implication of assuming that an intervention may result in CAS behaviours is an even greater need for the effective and timely use of data in planning, adaptation, and evaluation over the lifetime of an implementation. Given the probability that unexpected outcomes will occur, it is essential to establish monitoring systems that can identify when such outcomes start to emerge and track their development over time.

Possible IR concerns when health interventions involve CAS

Given the primary objective of IR as defined in chapter one, the provision of evidence-based insights into the advisability of scaling-up or relocating potentially successful interventions, evidence of CAS behaviour raises a series of additional challenges. There will be a need to assess the underlying determinants and extent of system complexity. For example, does it arise because of the number and heterogeneity of the stakeholder groups involved, from institutional factors relating to the relationships between those groups, or from the previously unrecognised but intrinsic characteristics of the intervention? Which of these are simply unavoidable and which might be mitigated by the design or more effective management of future implementations? There is also an issue as to how to assess the performance of such an intervention. To what extent should unpredicted outcomes, advantageous or detrimental to the intended beneficiaries, be seen as likely to be repeated at scale? Might it be possible to make modifications to the implementation design such that the former were encouraged and the latter discouraged?

The possibility that an intervention may exhibit CAS behaviours emphasises the need discussed in chapter one for long term engagement with the implementation by researchers

who work alongside the implementation team. Reconstructing the source and development of such behaviours after an extended interval can be extremely problematic, especially for an external observer. As indicated above, complexity typically arises not from the technical components of an intervention, but from the responses of the various stakeholders and the interactions between them. Typically unexpected developments will give rise to multiple narratives, each shaped by the perceptions, attitudes and motivations of those stakeholders. Only a researcher with in-depth experience of the implementation process and the actors involved might be in apposition to disentangle those narratives and make an informed judgement as to the actual sequence of events and the underlying mechanisms that initiated them.

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[i] See www.health-policy-systems.com/series/systemsthinking for a collection of readings on complexity and www.coursera.org/learn/systems-thinking/ for an online course addressing this topic.