**Working with Useful Theory of Change Models**

Theories of change (ToCs) are now widely used in evaluations. As many have noted, the specific models used vary greatly ([Vogel 2012](#_ENREF_28); [Valters 2014](#_ENREF_27)).). I have argued ([Mayne 2015](#_ENREF_13)) that behaviour-based ToCs provide:

* a well-established basis for ToC models,
* a framework and a process for building a useful ToC, and
* a structured way for analysing the ToC of an intervention.

Here I would like to expand on developing, working with and using these behaviour-based ToCs. This article discusses a variety of concepts, approaches and tools for working with these ToCs. The article begins with briefly introducing behaviour-based ToCs, in particular, the capacities, opportunity, motivation ToC model. A short discussion of risks vs. assumptions is followed by a discussion on implementation theory, a topic in behaviour-based ToCs not yet addressed.

Building ToCs is as much an art as a science, founded on experience. One issue is in particular a challenge: just how much detail to include in a ToC. One frequently sees extremely detailed ToCs that are hard for those not involved in their development to understand, much less use. On the other hand, almost as frequent are quite simplistic ToCs that really do not say much how the intervention is expected to work and are also of limited use.

Part of the problem is thinking or assuming that there has to be a single ToC model for an intervention. I have argued previously ([Mayne 2015](#_ENREF_13)) that what is needed in most cases are several different depictions of a ToC, to meet different purposes. Further, ToCs can quickly become overly complicated and less useful if too much detail is included in one representation.

The article presents and discusses several different levels of detail for representing a ToC, including a new pathway-level ToC model. Each has different strengths and weaknesses, and serves different purposes. For the ToC models that are more detailed, the article then discusses the characteristics of and criteria for robust ToCs. This is followed by a discussion of Theory of Change Analysis, a new analysis tool that can be used to strengthen ToCs as well as the intervention designs they represent.

First a review of the terms being used:

* *Results* is used to include outputs, outcomes and impacts, where impacts are the final outcomes affecting wellbeing. A *result statement* is the exact text used to describe the result. The term *intervention* is used here to describe specific activities undertaken to make a positive difference in outcomes and impacts of interest. It covers policies, programs and projects
* *Impact* *pathways* describe causal pathways showing the linkages between a sequence of steps in getting from activities to impact. An intervention may have several pathways to impact.
* A *theory of change* (ToC) adds to an impact pathway by describing the causal assumptions behind the links in the pathway—what has to happen for the causal linkages to be realized. Theories of change are models of how change is expected to happen (*ex ante* case) or how change has happened (*ex post* case).
* *Rationale assumptions* identify the underlying hypotheses or premise(s) on which the intervention is founded.
* *Causal link assumptions* are the salient events or conditions necessary (or likely necessary) for a particular casual link in a ToC to be realized; if the assumption doesn’t hold, then the expected effect from that link will not occur. This can be a quite demanding requirement, if interpreted literally. We can rather think in probabilistic terms, whereby causal link assumptions can be thought of as *likely necessary* assumptions, events and conditions that almost always have to occur for the causal link to work.

Further discussion of these terms can be found in ([Mayne 2015](#_ENREF_13)).

**The COM-B theory of change model**

The ToCs being discussed here are built around behaviour-based ToCs, introduced in [Mayne (2015](#_ENREF_13)) and also used by [Morton (2015](#_ENREF_22)). Here, a brief introduction and update is needed.

Most interventions seek to change the behaviour of individuals and/or organizations. Yet surprisingly evaluation of interventions has not made much use of the quite large literature on behaviour change theories and models. One review of this literature is by [Darnton (2008](#_ENREF_4)).

There are exceptions. Bennett’s hierarchy has been used in the evaluation of education programs ([Bennett 1975](#_ENREF_1); [Bennett and Rockwell 1995](#_ENREF_2)). The hierarchy includes an imbedded behaviour change model whereby changes in capacity of knowledge, aspirations, skills and attitudes (KASA) are seen as leading to practice changes. Steve Montague has used the Bennett hierarchy in a variety of evaluation settings ([Montague 2000](#_ENREF_18); [Montague and Valentim 2010](#_ENREF_21); [Montague and Lamers-Bellio 2012](#_ENREF_20)).

In a recent article ([Mayne 2015](#_ENREF_13)), I used the NOA (Needs, Opportunities and Abilities) model of [Gatersleben and Vlek (1998](#_ENREF_9)) discussed by [Darnton (2008](#_ENREF_4)) as a key part of a useful ToC model. Darnton’s review of behaviour change models notes a key aspect, namely that *all* of the capacity change elements in the models are necessary to bring about behaviour change. How the capacity change elements are organized and grouped differ among different models, but are essentially referring to the same set of capacities. The NAO model argues that needs and opportunities lead to motivation which when combined with abilities leads to behaviour change.

More recently, in working with the Palladium group (<http://thepalladiumgroup.com>), a newer behaviour change model was identified that seems even more intuitive and is specifically aimed at interventions designed to change behaviour. The Better Evaluation site also discusses this model (<http://betterevaluation.org/comment/68681#comment-68681>). [Michie, Stralen and West (2011](#_ENREF_17)) set out the COM-B model of behaviour change: behaviour (B) occurs as the result of interaction between three *necessary* conditions, capabilities (C), opportunities (O) and motivation (M).

*Capability* is defined as the individual’s psychological and physical capacity to engage in the activity concerned. It includes having the necessary knowledge and skills. *Motivation* is defined as all those brain processes that energize and direct behaviour, not just goals and conscious decision-making. It includes habitual processes, emotional responding, as well as analytical decision-making. *Opportunity* is defined as all the factors that lie outside the individual that make the behaviour possible or prompt it. ([Michie et al. 2011: 4](#_ENREF_17)) [italics added]

Their COM-B systems model is shown in Figure 1. Note that both capabilities and opportunities can influence motivation and all three not only bring about behaviour change but can also be influenced by the resulting behaviour change, i.e., there is often a feedback loop from behaviour change to capacity change. If practice change is seen as limited, then there may be a need for more capacity change work.

Reflecting on Bennett’s KASA model:

Capabilities

Behaviour change

Opportunities

Motivation

**Figure 1: The COM-B System Model**

* *Capability* relates to knowledge and skills, and is similar to abilities.
* *Opportunity* is not in the KASA model (but is in the NAO model).
* *Motivation* relates to attitudes and aspirations.

Interventions typically address one or more of capabilities, opportunities and motivation, indeed often just capabilities such as when knowledge and skills are enhanced through education and training. In such a case, the behaviour change assumptions would have to include an assumption about adequate opportunities and motivation being in place, since a key behaviour change requirement is that capabilities, opportunities and motivation are all present and adequate.

In a ToC context, we would have Figure 2. Further discussion on behaviour-based ToC models can be found in [Mayne (2015](#_ENREF_13)), and on the COM-B ToC model and the kinds of assumptions it uses in [Mayne (2016a](#_ENREF_14)).

Behaviour Change

Capacity Change

**Figure 2: The COM-B Based Theory of Change**

Reach & Reaction

Outputs/

Activities

Direct Benefits

Improved Wellbeing

*Reach*

*Assumptions*

*Capacity Change*

*Assumptions*

*Behaviour Change*

*Assumptions*

*Direct Benefits*

*Assumptions*

*Wellbeing*

*Assumptions*

***External Influences***

Capability

Opportunity

Motivation

Timeline

**Enabling Environment**

**(**to help bring about the assumptions)

**Risks vs assumptions**

Assumptions are (likely) necessary events and conditions need for a causal link to work. As such they also represent risks to the causal link working and hence to the intervention: risks are the inverse of assumptions, and vice versa. Sometimes it is more convenient to work with risks rather than assumptions, identifying what could go wrong that would undermine the intervention. When doing so, it needs to be kept in mind that the risks should still meet the (likely) necessary criterion—if the risk materializes then the causal link (likely) will not work—and the sufficiency criterion—the need to identify all salient risks for the link to work.

**Implementation theory**

Discussions of ToCs sometimes distinguish between implementation or action theory and program or change theory ([Funnell and Rogers 2011](#_ENREF_8); [Chen 2015](#_ENREF_3)). Program theory is seen as the mechanisms at work to bring about desired change in outcomes while implementation theory as what it takes to trigger such changes. Implementation theory in particular is seen by many as a critical and often neglected aspect of understanding how interventions work ([Montague 2014](#_ENREF_19)). Implementation failure is often behind why interventions do not work as expected.

The behaviour-based ToCs models discussed by [Mayne (2015](#_ENREF_13)), such as the COM-B ToC model shown in Figure 2, although often not explicitly discussed, embed both program and implementation theory. Here I would like to more explicitly link implementation theory with behaviour-based ToC models. Let me define *implementation theory* as all those actions that need to be taken by the intervention and intermediaries (partners and delivery agents) to realize the ToC, i.e., to implement an intervention. That is, implementation theory covers the activities undertaken by the direct delivery agents of the intervention components, as well as actions taken by partners and other delivery agents (intermediaries) to bring about an enabling environment.

Thus implementation theory would include:

* actions taken to delivery goods ands services (outputs) to the beneficiaries
* the extent to which the intended beneficiaries were reached
* actions taken intended to bring about capacity and behaviour change by intermediaries
* the extent to which the ‘right’ intermediaries were reached
* the resulting behaviour change in intermediaries, namely, the actions they actual undertake
* the extent to which the ‘right’ beneficiaries were reached
* the intervention managing and governing arrangements between the intervention and the intermediaries[[1]](#footnote-1)

The program or change theory would be the rest of the ToC model, with an overlap with the beneficiary reach, namely:

* the extent to which the ‘right’ beneficiaries were reached
* the capacity and behaviour changes expected with the beneficiaries
* the resulting direct benefits and wellbeing improvements.

In the generic models used, such as Figure 2, a distinction between beneficiaries and intermediaries is not evident. This distinction is made explicit in Figure 3 which is adapted from Figure 2 in [Mayne and Johnson (2015](#_ENREF_16)).

*Outputs*

& Activities

Intermediaries Behavioural Change

**Enabling**

**Environment**

(Changes dueto intermediaries’ actions)

**Direct Benefits**

(for beneficiaries)

*Wellbeing Changes*

Intermediaries Capacity Change

Beneficiary Capacity Change

Beneficiary Behavioural Change

Intermediaries Reach

Beneficiary Reach

**Figure 3: Illustrating Implementation Theory**

Implementation Theory

The implementation theory is explicitly identified in Figure 3, where external influences are not shown. Figure 3 shows that in addition to delivering outputs to beneficiaries, there is also frequently the need to ensure that an enabling environment is in place (se also Figure 2). An *enabling environment* can include needed policies and regulations, research support, relevant markets and actions by the private sector, and actions to ensure that other key stakeholders or participants support the interventions aims and efforts. The involvement of intermediaries (partners and delivery agents) raises issues of how all these stakeholders interact among themselves and with beneficiaries, and hence, how the intervention is managed and governed.

In terms of behaviour-based ToCs then, implementation theory would addresses issues of:

* Whether the ‘right’ intermediaries (i.e., partners) were reached and their initial reactions.
	+ Where the intermediaries intended to be reached actually reached and was their reaction positive?
	+ With hindsight, are the intermediaries reached the ones that need to be involved?
* Are the management and governance arrangements in place for the intervention adequate and appropriate?
* How partners/delivery agents then interact with the ‘intervention’:
	+ Is their motivation and agenda for participating consistent with and supportive of the aims of the intervention?
	+ What opportunities do they have for interacting?
	+ What capabilities do they need to have to interact effectively
* To what extent have the resulting actions of intermediaries established the needed enabling environment?

Implementation is often the reason why interventions do not deliver as expected. A focus on implementation theory can provide the way to assess implementation design and actual delivery.

**Different representations of the same theory of change**

Previously I have discussed three types of ToCs with different levels of detail ([Mayne 2015](#_ENREF_13)). Here the discussion is expanded.

To illustrate I will use an example of an intervention aimed at significantly improving girls’ education outcomes in a setting where girls education is not seen as that important by parents, teachers and the community. A more detailed discussion of the example can be found in [Mayne (2016b](#_ENREF_15)).

**A Narrative ToC***.*  This the elevator ride version, set out in text which describes very generally how the intervention is intended to work. It might typically set out in a few words the key pathways of the intervention and then describe the intended key results. It should only be a sentence or two—and would usually not set out any of the assumptions involved (so technically isn’t a ‘real’ ToC!).

*Uses*:

* To communicate quickly what the intervention is all about.
* To get agreement on the big picture, including the key pathways to impact.

In the girls’ education example, the Narrative ToC would be something like:

*With gender-sensitive teaching, support from parents and the community, and improved accommodation for girls, girls’ education outcomes will improve significantly.*

**The Overview ToC***.*  This ToC gives a similar picture as the Narrative ToC but in diagram form, with a little more detail, illustrating the various pathways to impact that comprise the intervention. Typically it would show a key step in each pathway along the way to impact. It could also set out the rationale assumptions behind the intervention.

*Uses*:

* To communicate with some detail how the intervention is seen as working.
* To act as a framework showing how the various pathways (nested ToCs), that would be developed separately, fit in.
* To get agreement on the big picture.

**Figure 4: Overview ToC for Enhancing Education Outcomes for Girls**

Improved education outcomes for girls

**Pathway 1**: Engagement with parents and communities

**Pathway 2**: Improved school accommodation

**Pathway 3**: Training for teachers

Greater support for girls’ education & time for study at home

Girls feel more comfortable attending school

Girls receive gender sensitive supportive teaching

Girls more actively engaged in learning

**External Influences**

Internet availability

Text books become available

*Girls Behaviour Change*

*Direct Benefits*

*Community and Parents Behaviour Change*

*Girls Capacity Change*

*Girls Capacity Change*

**Rationale Assumptions**

* With the appropriate environment and support, girls are quite capable to achieve good education outcomes.
* Social norms on education for girls can be changed in a reasonable time frame.

Figure 4 illustrates an Overview ToC for the girls’ education example.

**Nested (Operational) ToCs**. These are the more detailed ToCs—what might be called *operational* ToCs—with explicit causal link assumptions. There could be a nested ToC, for example, for each pathway, for each pathway in a different geographical area and/or for different targeted reach groups. These more detailed ToCs can usefully be developed based on the generic behaviour-based ToC model, shown in Figure 2.

*Uses*:

* Detailed nested ToCs can be a very useful way of unpacking a more complex ToC associated with a complicated/complex intervention where there are a number of impact pathways at work, and/or a number of intervention components ([Mayne 2015](#_ENREF_13)).
* This level of detail, accompanied by a ToC analysis discussed below, is very useful at the planning stage (i.e., ex ante) for an intervention, identifying what actions and conditions are needed to implement the intervention. Developing detailed nested ToCs should not be that complicated nor time consuming.
* This level of detail also allows for the identification of the key causal assumptions needed for the intervention to work. Thus detailed nested ToCs can be quite useful to revise and firm up an Overview ToC, as well as Pathway ToCs, discussed below.
* As discussed below, to be useful, a ToC needs to be adequately robust. A Nested ToC provides a basis for assessing how robust is the ToC.
* Detailed Nested ToC can be used to help design a monitoring system for the intervention.
* Detailed nested ToCs can also be used ex post in contribution analysis ([Mayne 2012](#_ENREF_12)). An intervention with a number of pathways needs to be unpacked in order to apply contribution analysis to the parts.

Figure 5 illustrates a detailed nested ToC for the teacher-training component (PW3)—a Nested ToC of the example intervention.

**A Pathway-level theory of change**

A number of authors who have used contribution analysis in complex settings have noted that contribution analysis can be quite data and analysis demanding, when having to work with a large number of pathways. With that in mind, intermediate level ToCs would be useful—more than the Overview ToC but less detailed than an operational nested ToC. Such an intermediate level ToC could also be useful when the detailed ToC is too complex to be helpful.

This is where a **Pathway ToC** could be useful. The idea of a Pathway ToC is to develop a not too complicated ToC for using with, in particular, contribution analysis, i.e., ex post, especially when there may be quite a few pathways to analyse. But to do so without loosing the essential features of the ToC. So, for example, rather than the more detailed generic Behaviour-Based ToC with the activities, outputs, reach, capacity change, behaviour change, direct benefits, impact chain of results (Figure 2), we might have more simply, activities/outputs, behaviour change, direct benefits, impact (Figure 6) as the pathway ToC.

*Outputs*

Awareness and skills training provided to teachers on girls’ education needs

*Teachers’ Capacity Change*

*Capabilities*-gender sensitive teaching skills acquired

*Motivation*-positive attitude towards girls’ education acquired

*Opportunity*-changed social attitudes, penalties for bad performance

*Teacher Behaviour Change Assumptions*

A1 Teachers see improved learning by girls

A2 Teachers are assessed in part on their application of the training

*Teacher Capacity Change Assumptions*

A3 Training addresses teachers’ attitudes towards girls’ education

A4 School administrations stress the importance of better teaching for girls

A5 Parents & communities support the training initiative (**PW1**)

**Figure 5: Theory of Change for Teacher Engagement (PW3)**

*Teachers’ Behaviour Change*

Teachers provide girls with more empathetic and supportive teaching in schools

1-6 months

2-6 months

*Reach and Reaction*

All teachers participate and react positively

*Reach Assumptions*

A6 All teachers get the training

A7 Training relates to the local conditions

Figure 6 shows the essence of the pathway getting from activities/outputs to impact explicitly identifying results that are usually straightforward to measure. In this case, to not loose key aspects of the ToC, the associated causal link assumptions should normally include assumptions that:

* The intended target groups were reached.
* Adequate improvements in capabilities, opportunities and motivation were achieved.

In setting out the causal link assumptions, a detailed nested ToC for the pathway greatly helps in their identification. The aim would be to have a minimum number of higher-level more aggregate assumptions.

Behaviour changes

Outputs

***External Influences***

Direct

Benefits

*Direct Benefits Assumptions*

*Behaviour Change Assumptions*

Including,

* Assumptions about reaching target groups
* Assumptions about bring about capacity change

Wellbeing changes

*Wellbeing Change Assumptions*

**Figure 6 A Pathway Theory of Change**

Activities

Time line

Figure 6 shows one model for a pathway ToC. Even simpler pathways could be developed, such as dropping the behaviour change box, or the direct benefit box. Then the pathway assumptions would have to include assumptions about behaviour change and direct benefits respectively. This not a slight-of-hand! When you move a results box to an assumption, you may be dropping some of the underlying causal link assumptions associated with the box, but then focusing on higher-level assumptions for analysis.

Figure 7 shows a **Pathway ToC** for the teacher-training component of the example, a condensed version of Figure 5.

Experience to date does suggest the need to first develop the detailed ToC, and then the Pathway ToC. In this way it becomes clear what is being supressed in the Pathway ToC and needs to be included in some fashion in the assumptions. Trying to directly develop a pathway ToC likely will lead to an incomplete ToC.

Some have resorted to something like a pathway ToC in order to be able handle a large number of pathways in a complicated/complex intervention. [Freeman, Mayhew, Matsinhe and Nazza (2014](#_ENREF_7)) report on their use of pathway ToCs. Here I am trying to formalize the idea of a Pathway ToC.

*Outputs*

Awareness and skills training provided to teachers on girls’ education needs

*Teacher Behaviour Change Assumptions*

A1 Teachers see improved learning by girls

A2 Teachers are assessed in part on their application of the training

*Teacher Capacity Change Assumptions*

A3 Training addresses teachers’ attitudes towards girls’ education

A5 Parents & communities support the training initiative (**PW1**)

*Reach Assumptions*

A6 All teachers get the training

A7 Training relates to the local conditions

**Figure 7: Pathway Theory of Change for Teacher Engagement (PW3)**

*Teachers’ Behaviour Change*

Teachers provide girls with more empathetic and supportive teaching in schools

2-6 months

*The advantages of a pathway theory of change*

Pathway level ToCs would reduce the amount of data required to carry out a contribution analysis to determine if the intervention had made a contribution or not. However, in an ex post mode to then understand why the intervention worked or not, one would need to have the analysis and discussion at the capacity-behaviour change level. But digging into, for example, why the expected behaviour changes did not come about, can be done retrospectively, asking those involved about reach and capacity change (capabilities, opportunities and motivation).

The use of pathway ToCs should also reduce the monitoring needs which can be supplemented when needed by mini case studies. Thus, in Figure 6 you would want to monitor the activities undertaken and the outputs delivered, as well as the behaviour changes, direct benefits and impact observed. These would tell you if the pathway is being realized. If the results expected are not happening, you could investigate through a mini case study why not. In an evaluation you could explore in a similar fashion why the pathway is working or not.

It would be the Pathway ToC that would best help design a monitoring system and be used in Contribution Analysis.

**Theory of Change Analysis and Robust Theories of Change**

As noted at the outset of this article, ToCs constitute a wide range of models and concepts and can serve different purposes. However, what constitutes a good or solid ToC is not that clear, and the characteristics or criteria of a robust ToC have not been widely discussed.

*Some terms*

Let me first define and discuss a few terms (new terms in bold). As noted earlier, since they are necessary or likely necessary, causal link assumptions also represent risks to the causal link occurring. Consequently, rather than listing assumptions and risks, one can just identify assumptions, recognizing that sometimes it is easier to write an assumption as a risk.

Nevertheless, some assumptions are riskier than others. For example, if an assumption is that some party, perhaps a local government, takes some action that has not been taken before, and nothing is being done to encourage the government to do so, then that assumption is quite likely at risk—and indeed may not be plausible. If an assumption is that a market emerges for a new product and again nothing is being done to encourage such a market, then the assumption is at risk. In addition, an assumption may be at risk because of pressures trying to make sure the assumption is not realized. An assumption that monitoring will be done by a third party may be at risk if there are other powerful parties who do not want the monitoring to be effective.

For theory of change analysis I will call these **at-risk assumptions** and the associated specific risks, **critical risks**. In an ex ante situation, at-risk assumptions represent potential gaps in the design of the intervention and likely serious threats to the intervention working. As a result, one may want to identify possible **confirming actions** that could be taken early on to give assurances that the assumption is likely to be realize, or **corrective actions** that might be taken to mitigate critical risks. In an ex post situation, they are areas that need special attention to see if in fact anything was done to address the risk.

In ex ante situations, it is important to keep the time line in mind. At-risk assumptions for causal links well in the future may be less of a problem—realizing the risk, actions could be taken later to address the issue. Many assumptions would not be expected to be at risk, such as when the assumption can be expected to be realized based on past experience and/or research, the intervention design is solid, or even if it is agreed that it is likely to occur.

In a theory of change model, at-risk assumptions could be identified by bolding the assumption, and the specific critical risks discussed in the accompanying text.

*Issues in analysing a theory of change*

In addition to their use in evaluations, ToCs have also been found useful in designing interventions or assessing the designs of interventions ([Leeuw 2012](#_ENREF_11); [Rey and Brousselle 2012](#_ENREF_24); [Tremblay, Brousselle, Richard and Beaudet 2013](#_ENREF_25)). [Mayne (2015](#_ENREF_13)) and [Mayne and Johnson (2015](#_ENREF_16)) discuss a variety uses of theories of change, and discuss some forms of analysis of ToCs. However, no structured approach for such analysis has been proposed.

Those developing theories of change use forms of analysis both during development and after. However, given the numerous elements of a ToC and the various possible purposes, it is useful to undertake a structured analysis with specific aims in sight. The **theory of change analysis** (ToC Analysis) discussed here aims at addressing two questions:

1. Does the intervention ToC appear robust? That is, is the ToC structurally sound and plausible?
2. What are the implications for monitoring and evaluation of the intervention?

ToC Analysis is done on a proposed ToC, one that has been developed to reflect how an intervention is working or was expected to work; hence the ‘appear’ term in the question. Reality might suggest that the intervention and its ToC were not in fact that robust! But *a priori* we would want to identify any evident shortcomings in the ToC and hence the intervention design. And *ex post*, if we find that a ToC that has been used to model an intervention is not very robust, this might help explain a less than successful intervention and/or identify issues that an evaluation should explore.

*1. Criteria for robust theories of change*

When a ToC is being developed, the expectation is that it is not just a bunch of ideas, but that it is well articulated, credible, plausible, and logical—that it is robust. A robust ToC is defensible, would support a well-designed plausible intervention design and provide a solid basis for both monitoring and for theory-based evaluations.

A related idea is that of a ToC being evaluable, for which Rick Davies ([2012](#_ENREF_5)) has set out a list of criteria. Davies’ set of criteria are quite broad in their coverage, meant to include anything that is called a ToC. And indeed, as noted above, a wide range of models and representations have been used to depict theories of change, and several of Davies’ criteria challenge what has been set out as to whether it is a ToC at all.

Our starting point is a little different. In defining above what a ToC is, it is assumed that what is being examined sets out:

* the pathways of change as a causal sequence of results, and
* assumptions behind the pathways.

Thus, several of Davies’s criteria are ‘assumed’, namely testable, explained, complete and inclusive. How well those criteria are addressed in a ToC are part of the robust criteria discussed below. The other Davies’ criteria are mostly covered in the robust criteria. In addition, several other criteria are needed to assess the robustness of a ToC.

A robust ToC is one that is structurally sound and plausible. A robust ToC supports a sold and plausible intervention design: with this deign, it is reasonable to expect that the intervention will be able to contribute to the intended results. Criteria for **a robust theory of change** for an intervention would address the following questions:

For a **structurally sound** ToC:

1. Is the ToC **understandable**? Are there pathways of results, and causal link assumptions set out? Is there a reasonable number of results?
2. Are the ToC results and assumptions **well defined?**
3. Is the **timing** sequence of results and assumptions plausible?
4. Is the ToC **logically coherent**? Do the results follow a logical sequence? Are the causal link assumptions *pre*-events and conditions for the subsequent effect? Is the sequence plausible or at least possible?
5. Are the causal link assumptions **necessary** or **likely necessary**?
6. Are the assumptions **independent** of each other (recognizing that some assumptions may apply for more than one causal link)?

For a structurally sound ToC that is **plausible**:

1. Is the ToC generally **agreed**?
2. Are the results and assumptions **measureable**, or at least key results and assumptions? What is the likely strength or status of evidence?
3. Are the causal link assumptions likely to be **realized**?
4. Are the sets of assumptions for each causal link along with the prior causal factor plausibly **sufficient** to bring about the effect?
5. Are **at-risk assumptions** mitigated through confirming or corrective actions?
6. Is the **level of effort** (activities and outputs) commensurate with the expected results?
7. To what extent are the assumptions **sustainable**?

A ToC that is reasonably robust would provide a solid basis for using the ToC ([Mayne and Johnson 2015](#_ENREF_16)) in (1) designing and planning an intervention, (2) in managing an intervention, (3) in assessing and evaluating an intervention and (4) in scaling up an intervention. Robustness, as imagined here, is not a zero-one variable. Meeting all the criteria could be quite demanding. Rather, in most cases, one would be improving a ToC over time, moving towards a more robust version.

There is evident need for an intervention to be plausible. At the outset, clear gaps or flaws in the design will most probably lead to a less successful intervention. Evaluability assessments are now seen as exploring the plausibility of intervention design with a view to improving the designing and/or to identifying if it makes sense to undertake an evaluation ([Davies 2013](#_ENREF_6); [Trevisan and Walser 2014](#_ENREF_26); [Peersman, Guijt and Pasanen 2015](#_ENREF_23)). The criteria here for a robust ToC include those used in evaluability assessments.

*2. M&E implications*

One purpose of ToC is to provide a framework for setting out monitoring and evaluation plans. In carry out ToC Analysis, it becomes clear just what needs to be monitored and paid attention to in evaluations. Questions here would be:

1. What **data** on results and assumptions should be monitored?
2. What **issues** need attention in an evaluation?
3. What is the likely **strength or current status of evidence** for the various results and assumptions, and in particular for each causal link?

Table 1 pulls these criteria together for ToC Analysis. Each criterion is then discussed.

*Ex Ante and Ex Post Perspectives*

In carrying out ToC Analysis it is important to keep in mind the perspective being used, namely if the situation is ex ante or ex post. The analysis is similar in both cases, but the implication of the findings will differ.

The context for the *ex ante* perspective is where a ToC is being developed for an intervention that has yet to be implemented or in the early stages of implementation. The intent would be to develop a robust ToC to match a plausible intervention design, so that at the outset it seems reasonable that the intervention would bring about the expected results. In this setting, ToC Analysis can be used to:

* Facilitate agreement on a ToC
* Identify possible gaps in the intervention design and what can be done
* Identify results and assumptions that need monitoring
* Identify issues that a future evaluation needs to address

|  |
| --- |
| **Table 1 Criteria for Theory of Change Analysis** |
| **Overall Criteria**  |
| *Understandable* | Is the logic and structure of the ToC clear? |
| *Agreed* | To what extent is the ToC agreed or contestable? |
| *Level of effort* | Are the activities and outputs of the intervention commensurate with the expected results? |
| **Criteria for Each Result** |
|  |  |
| *Well-defined* | Is the results statement unambiguous? |
| *Plausible timing* | Is the time frame for the result reasonable? |
| *Logical coherence* | Does the result follow logically from the previous result? Is the sequence plausible or at least possible?  |
| *Measureable* | Is there a need to measure the result? How can the results be measured? What is the likely strength or status of evidence for the result being realized? |
| *M&E Implications* | What are the implications for monitoring and evaluation? |
| **Criteria for Each Assumption** |
| *Well-defined* | Is the assumption unambiguous? |
| *Logical coherence* | Is the assumption a pre-condition or event for the effect sought? |
| *Justified* | What is the justification for the assumption as being necessary or likely necessary? |
| *Realized*  | Is it plausible that the assumption will be realized? Are there at-risk assumptions that should be addressed? |
| *Sustainable* | Is the assumption sustainable? |
| *Measureable* | Is there a need to measure the assumption? How can the assumption be measured? What is the likely strength or status of evidence for the assumption being realized? |
| *M&E Implications* | What are the implications for monitoring and evaluation? |
|  |  |
| **Criteria for each causal link** |
| *Independence* | Are the assumptions for the link independent from each other? |
| *A sufficient set* | Are the set of causal link assumptions along with the prior causal factor sufficient to bring about the effect? Is the link plausible? |
| *Strength/Status of evidence* | What is the strength or current status of evidence for the causal link being realized? |
| **Source:** Author |  |

In an *ex post* setting, the intervention has been in operation for some time and an evaluation is to be undertaken to see the extent to which the intervention has actually worked. Some monitoring data may have been gathered and some changes in the intervention may have been made over time. There is a need to either build (reconstruct) a ToC or to revise an earlier ToC to reflect how the intervention is now seen as working. Ex post ToC Analysis can be used to:

* Facilitate agreement on a robust ToC, often a reconstructed ToC.
* Identify current intervention design weaknesses that may explain limited expected results being achieved.
* Identify results and assumptions data that an evaluation needs to collect or get from monitoring data.
* Identify evaluation questions that need addressing in an evaluation.

Note that in this ex post scenario, ToC Analysis itself would not be assessing if the ToC was in fact realized. That would be done as part of the evaluation, using something like contribution analysis.

In either case then, ToC Analysis would seek to:

**1. Strengthen the ToC**. Identify and correct any structural weaknesses in proposed theories of change.

**2. Strengthen the Intervention Design.**  Identify weakness in intervention design and what could be, or should have been, done to strengthen the design

**3. Identify data needs**. Identify monitoring and evaluation data that needs to be collected for assessing performance of the intervention.

**Discussion of the theory of change analysis criteria**

The criteria in Table 1 can be used to assess the robustness of the ToC, and the underlying intervention. However, as noted earlier, robustness is not a 0-1 rating. That is, since, as discussed earlier, there can be different models for the ToC of an intervention with different levels of detail, the criteria need to be applied in a sensible manner. They might best be thought of as guidelines for assessing the strength of a ToC and the intervention it represents.

***Overall Criteria***

*Understandable.*  The ToC and especially its pathways should be clearly evident so that readers understand the intervention in the same way. I have argued elsewhere that a complex ToC needs to be unpacked into several nested ToC models ([Mayne 2015](#_ENREF_13)). Further, in any one ToC, there should be a reasonable number of results statements, so that the ToC model is ‘readable’ to others beyond those who developed it. A possible rule of thumb could be that if you have more than 13 result ‘boxes’, you may have a mess instead of a ToC.

*Agreed.*  If the ToC, despite how well constructed, is the product of just one person or a small group, it may not have much support or buy-in, and not be sustainable in the sense of not being used or not lasting long. Broad agreement among stakeholders would usually suggest a more robust ToC. And there may be different views on how the intervention is supposed to work. In this case, one may need to build more than one robust ToC and check it against reality in due course, See, for example, [Hansen and Vedung (2010](#_ENREF_10)).

*Level of effort*. This is a rough check on the plausibility of the intervention. Does is seem reasonable that given the activities of the intervention and their outputs will be enough for the intervention to make a difference in the ways expected? Interventions are sometimes seen with quite ambitious intentions expected to be realized from a quite modest level of effort.

***Criteria for the results***

*Well defined*. The results need to be as *well defined* as practicalas to their meaning and content, and their measurability.They should not be subject to different interpretations by different readers.

*Plausible timing*. There should be an indication of when the results are expected to come about, and the *time frame* set out should be realistic, *plausible*. Setting out realistic timing for when results can be expected is frequently neglected in developing ToCs, indeed often completely absent. Unrealistic expectations about timing can point to quite unrealistic interventions. Even less attention is paid to the trajectory of the expected results, as [Woolcock (2009](#_ENREF_29)) discusses.

*Logical coherence*. That is, the step-by-step model from activities/outputs to impact makes sense, based on plausible or at least possible logic and perhaps prior evidence. The distinction here between plausible and possible logic reflects the fact that different ToC models provide different levels of detail. A ‘possible’ logic sequence implies that the causal step is possible but represents a large leap in logic, which may be due to the level of detail in the ToC or to a causal link at-risk. Remember, the ToC is a model of expectations, which may of course turn out otherwise. If the ToC is behaviour based such as discussed by [Mayne (2015](#_ENREF_13)) or [Morton (2015](#_ENREF_22)) and illustrated in Figure 2, this significantly strengthens the logical coherence of the model.

*Measurable*. The results, or at least key results, should bemeasureable—there are reliable and valid measures of the results and the needed data can be (readily) collected. Depending on the use being made of the ToC, there may not be a need to measure all the results set out in a pathway. For example, in a behaviour -based theory of change model, measuring capacity change can sometimes be a challenge. On the other hand, measuring behaviour changes is usually much simpler, and may be all that is needed if the expected behaviour changes have occurred and other aspects of the model are verified. The ToC analysis should indicate if the result (a) needs to be measured, (b) might be useful to measure or (c) not really needed to be measured. It is useful here to note the likely *strength of evidence* based on the measures.

*Implications for monitoring and evaluation*. One can also assess as part of the analysis, what the implications of each component of the ToC are for monitoring and evaluation.[[2]](#footnote-2) Implications could be:

* Evaluation questions to be addressed.
* Issues that need to be carefully watched or explored.
* Issues, results and/or assumptions that should be monitored.
* Identifying data that should be collected.

The analysis would identify specific ***M&E actions*** that should be taken to strengthen monitoring and evaluation.

***Criteria for the assumptions***

*Well defined*. The events and conditions set out in the assumptions need to be aswell definedas practicalas to their meaning, content, and their measurability.They should not be subject to different interpretations by different readers.

*Logical coherence*: Since the assumption should be needed for the effect to occur, it should be a logical pre-condition or event.

*Justified*. The assumptions are justified by a solid argument as necessary or likely necessary events or condition for the causal link to work.

*Realized*. One should expect that the assumptions would be realized. That is, there is general agreement, logic, actions being taken or prior evidence that make the assumption plausible.

* *At-risk assumptions*. The analysis could identify the at-risk assumptions, the *critical risks* that exist to the intervention and *corrective or confirming actions* that could or need to be taken to mitigate the risk. Ex ante this would identify weaknesses in the intervention design and what might be done to strengthen the design. Ex post it would identify assumptions that need careful examination.
* In essence here one is assessing the degree of control the intervention has over the assumption.

*Sustainable*: An assumption may be realized during the period of the intervention, but one normally would hope that the assumption is sustainable after the intervention is over. If not, then the assumption is at future risk, as would be the causal link, the result in question and indeed, the intervention. Where sustainability is an issue, the intervention might want to undertake some form of corrective action.

*Measureable*. The assumptions, or at least key ones, are measurable: there are reliable and valid indicators and the relevant data canbe (readily) collected, and/or there is adequate prior evidence. The analysis should indicate if the assumption (a) needs to be measured, (b) might be useful to measure or (c) not really needed to be measured. Again, it is useful here to note the likely *strength of evidence* based on the measures.

The *M&E Implications* criteria are discussed above.

***Criteria for each causal link*:**

*Independence*. For each causal link, the assumptions should be independent of each other, that is, be separate events/conditions, and hence be a minimum set of assumptions, recognizing that the same assumption may be needed for more than one causal link.

*A sufficient set*. The set of the initial result plus assumptions for the causal link should be seen as sufficient for that link to work, that is, for the cause plus assumptions to contribute to the effect. The link should be plausible—the link causal package appears to be enough to bring about the effect.

*Strength/Status of Evidence*: This final criterion is about the likely strength of the evidence on the causal link occurring (ex ante), or the current status of evidence about the link having been realized (ex post), classified as strong, medium or weak. Again the analysis would be seeking to identify intervention design weaknesses or issues that need exploring in an evaluation. Where evidence appears weak, this might suggest the need for additional monitoring, research and/or evaluation.

**Carrying Out ToC Analysis**

The actual ToC Analysis needs to carried out in a step-by-step manner. Too often, a theory of change is developed on the basis of the ideas and beliefs of those involved without much challenge and analysis. Without structured analysis and challenge, it is unlikely that a robust theory of change and the implications for intervention design would emerge.

ToC Analysis entails a careful examination of:

* each element in the theory of change,
* how the elements fit together, and
* an assessment of the ToC weaknesses, data needs and their implications.

ToC Analysis would use the criteria in Table 1 as the basis for analysis and roughly in the order set out. There would likely be some interplay among results, assumptions and the pathway. The findings could then be summarized in terms of implications around the two questions.

***Step 1 - Overall Criteria***

The initial analysis is to determine if there is indeed an actual ToC model to work with, and if the intervention seems at all plausible.

*Understandable*: If the ToC is hard to understand such as if pathways are unclear or there is a proliferation of results, then there is need for rethinking and redrafting so that there is something resembling a ToC with impact pathways.

*Agreed*: If there are different views as to how the intervention is expected to work, more discussion on the ToC is probably warranted. If differences persist, then it may be necessary to build more than one ToC and analyze each of them.

*Level of effort*: If the expectations for results are quite out of line with the level and nature of the activities being undertaken, there may be a need to rethink the design of the intervention or to reduce expectations to a more realistic level.

***Step 2 - Detailed ToC Analysis***

The detailed ToC Analysis is best done result level-by-result level in sequence. That is, using the behaviour-based ToC model, in order:

* *Getting to Reach*: Will the outputs delivered reach the intended targets groups with the right reaction?
* *Getting from Reach to Getting from*: Will the outputs delivered and their reach lead to the intended capacity changes?
* *Getting from Getting from to Behaviour Change*: Will the capacity change lead to the intended Behaviour Changes?
* *Getting from Behaviour Change to Direct Benefits*: Will the behaviour changes lead to the intended Direct Benefits?
* *Getting from Direct Benefits to Wellbeing Changes*: Will the direct benefits lead to the intended Wellbeing Changes?

For each level, an analysis of results and an analysis of assumptions would be done and a summary of findings set out:

***Analysis of results***

*Definition*: If not well defined, need to further define terms.

*Timing*: If not sensible, suggests a structural change to the ToC.

*Logical coherence*: If not OK, suggests a structural change to the ToC.

*Measurement*: Indicate if *needed*, *might be needed*, *not needed,* andthrough what means. If strength of evidence is weak and the measurement important, suggests an issue to be addressed in the M&E Implications.

*M&E Implications*: Brings together the M&E issues. Need to remember that not all results may need to be measured.

***Analysis of assumptions***

*Definition:* If not well defined, need to redefine terms

*Logical Coherence:* If not OK, suggests the need for structural changes in the ToC*.*

*Justification*: If not necessary or likely necessary, then the assumption should be dropped.

*Realization*: If realization is in doubt, then need to identify assumption as at at-riskand set outconfirming or corrective actions*.*

*Sustainability:* Similarly, if the assumption is found not to be sustainable, a corrective action may be needed, or, in an ex post case, the issue noted as a lesson learned for future similar or follow-up interventions.

*Measureable*: indicate how measures would be taken and if *needed*, *might be needed*, *not needed.* If strength of evidence is weak and measurement important, suggest an issue to be addressed in the M&E Implications.

*M&E Implications*: Need to remember that not everything need be measured.

***Assessing the causal link***

*Independence*: If assumptions not independent, consider merging assumptions.

*A sufficient set*: If not a sufficient set, additional assumption(s) or more of the prior result are needed.

*Strength/Status of Evidence*: Indicate level of evidence for the link being realized.

***Summary of findings for Getting to a Result***

The summary of the analysis can depend on the specific purpose and context, but in general can highlight (1) the changes needed to enhance the robustness—structural soundness and plausibility—of the ToC, (2) the level of evidence there is on result and assumptions, (3) the actions that needed to enhance the robustness of the intervention design and (4) the M&E implications.

*Structural changes needed*

Where the structural criteria for a robust theory of change are not met, structural changes are needed to the ToC to enhance its robustness, i.e., changes in descriptions used, result statements, coherence, assumptions and/or causal links. After any structural changes, we would want to conclude that the ToC is reasonably sound.

*Strength/Status of evidence*

Summary analysis can indicate the strength of evidence for (1) the result in question, (2) the assumptions associated with the link and for (3) the link being realized.

*Additional intervention effort needed to enhance plausibility*

If plausibility or sustainability of the ToC/intervention design is questionable due to at-risk assumptions identified and/or sustainability is questioned, then confirming or corrective actions are likely needed. The analysis would want to conclude that with the confirming/corrective actions, the intervention design is (or ex post would be) robust. Where the ToC is seriously contested more than one ToC may needed to be developed and analysed.

*M&E Actions*

In order to monitor how well implementation is going or to verify the ToC in an evaluation, it is important to identify what data needs collecting and the likely strength of the resulting evidence.

**Conclusion**: Overall conclusions for the specific link (component) in the ToC on robustness, level of evidence and sustainability.

Theories of change are best developed in a participatory manner involving those designing/implementing the intervention and the evaluator ([Mayne 2015: 137-138](#_ENREF_13)). During this development, of course, the criteria for a robust theory of change can be kept in mind. In other cases, the ToC Analysis is done on a completed theory of change, probably by the evaluator (although not necessarily). The findings of the analysis should then be discussed with intervention implementers. This discussion may bring to light issues that were not but need to be included in the ToC, identify issues about the intervention design that need addressing, and/or identify data that needs to be monitored or that needs to be addressed in a planned evaluation.

**An Example**

To illustrate issues and concepts in analysing useful ToC models, I used an example of a previously used case of an intervention aimed at improving the nutritional diets of children through providing training and information to mothers ([Mayne 2015](#_ENREF_13)). The ToC used there is shown in Figure 8, with one small change to be consistent with the COM-B model: the motivation assumption has been shown as a capacity change assumption rather than a behaviour change assumption.

The ToC in Figure 8 was used to carry out the TOC Analysis. All the details are not provided here—but can be found in [Mayne (2016b](#_ENREF_15))—as the analysis is quite lengthy. And that is worth a note. TOC Analysis is not a quick and dirty approach: it takes time, but not a lot, and patience to go through each criterion for each result and each assumption. But it can be worthwhile. Having developed the original example, I was not expecting many new insights, but I was wrong!

*Behaviour Changes*

Mother adopt new feeding practices

***External Influences***

* Lower prices for food
* Other staples become more nutritious

*Capacity Changes*

Mother acquire new capabilities about nutrition benefits and feeding practices

*Reach and Reaction*

Mothers with young children

*Direct Benefits*

Children consume a more nutritious diet

*Capacity Change Assumptions*

1. Capabilities - Nutrition benefits and feeding practices understood and relevant

2. Opportunities – Nutritious food available and affordable

3. Motivation – Mothers want to improve the health of their children

*Reach Assumptions*

1. Targeted mothers with young children reached

2. Approach & material seems appropriate

*Wellbeing Changes*

Children’s nutrition status & health improves

**Figure 8: A Nutrition Intervention Theory of Change**

*Activities/Outputs*

Training & Informing on Nutrition Benefits & Feeding Practices

Time line

*Behavioural Change Assumptions*

1. Mothers make decisions about children’s food

2. New practices supported by husbands and mother-in-law

3. Parents see improvements in children’s health

*Direct Benefits Assumptions*

1. Practices prove practical

2. No reduction in other nutritious food intake

*Wellbeing Change Assumptions*

1. Children have access to health care

The findings from the TOC Analysis are summarized for each results level:

***Getting to Reach and Reaction***

Several needed *structural changes* were identified:

* The result statement was not well-defined. What did ‘mothers with young children reached’ mean? It could mean several things, such as mothers heard about the training, mothers were asked to participate, or mothers participated in at least the first session. I assumed it was the later case: reach and reaction was asking if mothers at least started the training and if they had a positive initial reaction. So the result statement needed to be changed.
* The first reach assumption was the same as the reach statement! Clearly a logical coherence problem. A new assumption, in fact two, were needed:
	+ Targeted mothers are well identified
	+ Targeted mothers can be communicated with

In order to get participation, the intervention needed to know who and where the targeted mothers were, and needed to be able to get the message to them about the nutrition training sessions.

If *sustainability* in the target area was an issue, then would need to be a plan of how new mothers beyond the initial reach were to be reached, such as perhaps building in the training the need to spread the word within their communities.

There are two M&E implications:

* Track % of targeted population that initially participated
* Monitor initial reaction of participants

 ***Getting from Reach to Capacity change***

Several small structural changes were needed in the wording of the result and assumptions (see Figure 9).

Assumption 2 about the availability and affordability of nutritious food (opportunities), without more information, is possibly *at-risk*. A useful *corrective action* would be to:

* Make local markets aware of the intervention and the expected increased demand for certain food products.

And a *confirming M&E action* is needed:

* The availability and affordability of nutritious food should be monitored during the life of the project.

***Getting from Capacity Change to Behaviour change***

Behaviour change assumptions 1 and 2 overlap somewhat and may be *at risk*. The intervention may need:

* a better understanding about how decisions on food are made in households.
* the intervention to be offered to households rather than only mothers.

*M&E implications:*

* Household surveys could track adoption of the new practices, general household support and identify problems. Perhaps a survey after 2 months and a follow-up 1 year later.

***Getting from Behaviour Change to Direct benefits***

Assumption 2 about substituting other foods is *at risk*. A *confirming action* could be:

* to include this substitution issue in the nutrition training.

*M&E implications:*

* Follow-up household surveys could track children’s dietary intake.

Overall, although implied by the timeline, Figure 8 did not set out a clear time frame for the intervention to have an impact. The level of evidence on realizing the ToC would be good, using the measures suggested.

Based on this TOC Analysis, the revised and more robust ToC is shown in Figure 9. At-risk assumptions are shown in bold.

**Concluding Remarks**

Behaviour-based ToCs are proving very useful in a variety of contexts ([Mayne 2015](#_ENREF_13)), and in particular the COM-B theory of change model ([Mayne 2016a](#_ENREF_14)). A number of points have been made in using these ToC models:

* The need for more than a single ToC representation of an intervention.
* The usefulness of an intermediate level pathway ToC, especially as the basis for contribution analysis.
* Seeing risks as assumptions and vice-versa.
* Implementation theory is a part the ToC models.
* Distinguishing between ex ante and ex post perspectives in working with ToCs.
* The usefulness of assessing the robustness of theories of change and of interventions.
* The need for structured theory of change analysis (ToCA) for firming up a theory of change model, ex ante intervention design analysis and/or ex post contribution analysis.

ToC Analysis takes some time and discipline to carry out. But it is mainly a desk review, and overall entails hours rather than days of work. The results are usually quite informative, leading to

* more robust ToCs,
* better intervention designs, and
* useful M&E actions to help manage the intervention and support future evaluation.

*Behaviour Changes*

Mother adopt new feeding practices

***External Influences***

* Lower prices for food
* Other staples become more nutritious

*Capacity Changes*

Mother acquire new capabilities about nutrition benefits and feeding practices

*Reach and Reaction*

Mothers with young children *participate*

*Direct Benefits*

Children consume a more nutritious diet

*Capacity Change Assumptions*

1. Capabilities - Nutrition benefits and feeding practices understood and relevant

2. Opportunities – **Nutritious food available and affordable**

3. Motivation – Mothers want to improve the health of their children

*Reach Assumptions*

1. Mothers with young children in the target area *are well identified*

 *2. Targeted mothers can be communicated with*

3. Approach & material seems appropriate

*Wellbeing Changes*

Children’s nutrition status & health improves

**Figure 9: A Robust Nutrition Intervention Theory of Change**

*Activities/Outputs*

Training & Informing on Nutrition Benefits & Feeding Practices

Time line

*Behavioural Change Assumptions*

1. **Mothers make decisions about children’s food**

2. **New practices supported by husbands and mother-in-law**

3. Parents see improvements in children’s health

*Direct Benefits Assumptions*

1. Practices prove practical

2. **No reduction in other nutritious food intake**

*Wellbeing Change Assumptions*

1. Children have access to health care

3 months

4 months

6 months

1 year

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1. Thanks to Steve Montague for pointing out the importance of the administrative arrangements in implementing an intervention. See, for example, [Montague (2014](#_ENREF_19)). [↑](#footnote-ref-1)
2. This is a practice that Universalia sometimes uses in its evaluations. [↑](#footnote-ref-2)