

**A brief on
contribution
analysis:
Principles and
concepts**

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A brief on contribution analysis: Principles and concepts

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Contribution analysis (CA) is an approach for determining if an intervention contributed to bring about an observed result and in what way, based on verifying solid theories of change (Mayne, 2011; Mayne, 2012).

Introduction

The contribution claims confirm the causal links between the intervention and the observed results, and the analysis of the intervention theory of change (ToC) leads to understanding on how and why the intervention has made a contribution. Other theory-based evaluation approaches such as Realist Evaluation (Westhorp, 2014), have similar aims.

In this Brief, I would like to set out several key principles in contribution analysis:

1. **Generative causality.** Understand generative causality, multiple causal factors and contributory causes, and their implications
2. **Useful ToCs.** Develop robust ToCs for the intervention, using nested ToCs as needed
3. **Meaningful causal questions.** Ensure the causal questions addressed are meaningful.
4. **Empirical evidence.** Use empirical evidence to verify or update the ToCs, building credible causal narratives for the causal links in the impact pathway
5. **Inferring causality.** Set out credible evidence-based causal claims

First a review of the terms being used:

- **Impact pathways** describe causal pathways showing the linkages between a sequence of steps in getting from activities 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.
- **Rationale assumptions** identify the underlying hypothesis or premise on which the intervention is founded.
- **Causal link assumptions** are the events or conditions necessary or likely necessary² for a particular casual link in a ToC pathway to be realized.
- **Results** are the outputs, outcomes and impacts associated with an intervention.

A discussion of these terms can be found in (Mayne, 2015). It should be noted that these terms are not always defined or used by others as set out above, and indeed there is no universal agreement on them. It is important, therefore, to define carefully how the terms are being used in a particular setting. In particular, the definition above of ToCs excludes many models of interventions that do not articulate the assumptions behind the causal links, yet are labelled “ToCs”, many of which at best impact pathways.

Finally, 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. Many interventions in complex settings have a number of components or



sub- interventions, all working towards the same aims, and possibly with links among the intervention components.

An overview of contribution analysis

The basis of the contribution claim is the empirical evidence confirming a solid ToC of an intervention, i.e., confirming the chain of results, the assumptions behind the causal links in the ToC and the related causal narratives explaining how causality is inferred. The ToC is the outline for the contribution story of the intervention. The steps usually undertaken in contribution analysis are shown in Table 1, and are discussed in Mayne (2011).

Table 1: Steps in Contribution Analysis

Step 1: Set out the specific cause-effect questions to be addressed

Step 2: Develop robust theories of change for the intervention and its pathways

Step 3: Gather the existing evidence on the components of the theory of change model of causality:

- The results achieved
- The causal link assumptions realized

Step 4: Assemble and assess the resulting contribution claim, and the challenges to it

Step 5: Seek out additional evidence to strengthen the contribution claim

Step 6: Revise and strengthen the contribution claim

Step 7: Return to Step 4 if necessary

Contribution claims are based on developing evidence showing the steps between the activities of an intervention and the intended results were sufficient to link cause and effect.

Key concepts in causality and contribution analysis

There are several important concepts in contribution analysis that need to be understood, especially around causality. Causality is always a key element of an evaluation, and hence what perspective to take on causality is important. Contribution analysis – and other theory-based evaluation approaches - uses a generative view of causality, talking of causal packages and contributory causes.

Generative causality

In many situations a counterfactual perspective on causality in an evaluation—which is the traditional evaluation perspective—is unlikely to be useful; experimental or quasi-experimental designs are not feasible or not practical. Rather, a more useful perspective is that of *generative causality*: seeing causality a chain of cause-effect events. This is what we see with interventions, a series or several series of causal steps –impact pathways - between the activities of the intervention and the desired impacts. Taking the generative perspective and setting out an *impact or contribution pathway* is essential in understanding and addressing the contribution made by the intervention. The associated ToC sets out what is needed if the causal links involved and hence the expected results are to be realized.

Causal factors

There could be a variety of types of causal factors at play:

Causal factors along a pathway. The setting here implies that the activities of an intervention on



their own are not likely to contribute to the results. Rather, the outputs of the intervention activity along with other supporting factors – the assumptions along the pathway theory of change – together will make a contribution to bringing about the results. That is, it is this *causal package* of factors that will bring about or influence change, and all the factors in the causal package are necessary to bring about the change—they are all INUS causes¹—and hence in a logical sense all are of equal importance.

External causal factors. These are the perhaps the easiest to imagine: factors outside the intervention that could have played a role in bringing about the results and hence made a contribution.

Causal factors associated with the components of the intervention. There may be several components or sub-interventions of the intervention at work, each aimed at bringing about or supporting the bringing about of the expected results. Each of these components is likely to have its own pathway to impact, setting out just how it is expected that the component activities undertaken will contribute to the observed results. Each component would be associated with one or more causal factors. Component causal factors are typically the direct proximate result of the component activities.

Contributory causes

Contribution analysis aims at arriving at credible claims on the intervention as a *contributory cause*, i.e., that the intervention was one of several necessary or likely necessary² factors in a *causal package* that together brought about or influenced the changes observed (Mackie, 1974; Cartwright and Hardie, 2012; Mayne, 2012). *Theories of change are generative models of an intervention as a contributory cause.*

Contribution analysis uses the generative perspective on causality to assess whether the intervention has ‘made a difference’. Made a difference in this context means that the intervention had a positive impact on peoples’ lives, that is, it made a contribution, it played a causal role. In most settings, *on its own, the intervention would not make a difference.* It is the associated causal package of factors that makes a difference. This interpretation of making a difference needs to be distinguished from the meaning associated with the counterfactual perspective on causality, where made a difference means ‘what would have happened without the intervention’.

Contribution claims

Contribution claims are not just about whether the intervention made a contribution or not. Certainly, a key contribution claim is this yes/no evaluation question: Has the intervention (component) made a difference? Has it played a positive causal role in bringing about change?

But a more interesting and important contribution claim is around the evaluation question:

- How and why has the intervention (component) made a difference, or not?

The contribution claim here is about the intervention (or a component) causal package at work. How and in what manner did the intervention support factors along with the intervention efforts bring about, or contribute to, change? The contribution claim provides the evidence on why change occurred, i.e., the *causal narrative*.

Such a contribution claim might also, of course, be explaining why the expected change did not be realized, why the intervention did not make a difference.

Demonstrating contribution claims

As noted above, the basis for contribution analysis is the intervention ToC, and verifying the ToC—the results, the assumptions and the causal links—with empirical evidence. But a key point needs to be made: the aim of contribution analysis is to get beyond basing a contribution claim



on opinions of stakeholders about the contribution made. Interviews may be conducted as part of the process to gather information on the results achieved and if assumptions were realized. But basing contribution claims on opinions about the claims is not part of the process. Rather, the evidence gathered on the ToC is used in analysis to conclude on contribution claims.

Issues in contribution analysis

Meaningful contribution questions

Step 1 in contribution analysis (Table 1) is setting out the causal questions to be addressed in the analysis. This continues to be a key first step and one not always adequately addressed. The challenge here is that it is relatively easy to set out evaluation questions that sound reasonable and meaningful, but are actually not. In Mayne (forthcoming), I discuss the problem, arguing that many traditional evaluation questions may not be that meaningful or useful, especially in the case of complex interventions. The basic reason is that most interventions *on their own* are not the cause of observed results. As discussed above, the cause of the results is the intervention *plus* a number—often quite a few—of other factors.

I argue that causal questions such as:

- To what extent has the intervention met its objectives and/or expected impacts?
- Has the intervention been effective?
- What has happened as a result of the intervention?
- What would have happened without the intervention?

in the context of most interventions, are usually not that meaningful, certainly not without considerable more explanation, and hence not that useful.

More meaningful causal-related evaluation questions are those such as shown in Table 2, adapted from Mayne (forthcoming). These questions all allow for the reality that causality is complex and interventions only contribute to observed results. And questions 2 through 8 are all issues that CA can address and provide insight on. Question 2 is perhaps the key CA question, leading to—assuming there is the evidence—the *contribution claim*:

The intervention (or a component) contributed to an observed change—it played a positive role in bringing about change—and it did so in the following manner,

Table 2 Meaningful Impact Evaluation Questions

1. Results. What have been the observed results (outputs, outcomes and impacts)?
2. Contribution to results. Did the intervention make a difference, i.e., play a positive causal role in bring about the observed results? In particular, how and why has the intervention made a contribution? What causal (support) factors are needed for the intervention to make a contribution?
3. Other influences. What other influencing causal factors were at play?
4. Relative importance. What is the relative importance of the various causal factors at work?
5. Sustainability. Are the results achieved sustainable?
6. Generalizability. Will the intervention work elsewhere? Can it be scaled up?
7. Lessons. What lessons on bringing about long-term change can be learned for future programming?
8. Likely future impact. Is it likely the intervention will make a contribution to results in the future?



Useful theories of change

The need in CA for robust ToCs

Previous articles (Mayne, 2011; Mayne, 2012) on contribution analysis have not said much about the quality of the theory of change on which the analysis is based, assuming a reasonably detailed and sound ToC. But this assumption about the ToC needs to be set out more clearly. *Using a weak ToC in a contribution analysis can only lead to weak contribution analysis findings.*

I have suggested criteria for robust theories of change, based on the ToC being both structurally sound and plausible. The detailed criteria are discussed in Mayne (2017) for all elements of a ToC: each result, each assumption, each causal link and overall. Table 3 sets out the criteria.

Table 3 Criteria for a Robust ToC

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*:

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



For example, if the ToC is not understandable, or the timing is not sensible, or if the ToC is evidently not logically coherent, the causal links in the model cannot be confirmed, or if seemingly 'confirmed', would not lead to credible causal claims. Similarly if terms are ambiguous, and the specific results cannot be empirically confirmed. If some of the causal link assumptions are evidently not necessary, confirming them adds nothing to making a causal claim. If the set of causal link assumptions for a link is clearly not sufficient, confirming them will not lead to a causal claim since something is missing.

Step 2 in Table 1 showing the steps in contribution analysis now refers to the need for a robust theory of change. The full set of the robust criteria are quite demanding, and the aim is often to ensure a reasonably robust ToC is available for contribution analysis.

Unpacking complex intervention settings: different ToCs for different purposes

There is not a unique representation of a theory of change for a given intervention and deciding on how much detail to include is a challenge for those developing ToCs. I have argued previously that what is needed in most cases are several different depictions of a theory of change—theory of change models—to meet different purposes (Mayne, 2015). Further, ToCs can quickly become overly complicated and less useful if too much detail is used in one representation. A rule of thumb I have used is: If you have more than 13 result boxes, you likely don't have a ToC: rather, you probably have a mess.

In Mayne (2015) several levels of theory of change models are presented and their uses discussed. Here they are briefly outlined:

A Narrative ToC. This the elevator ride version, set out in text which describes very generally how the intervention is intended to work.

The Overview ToC. This ToC indicates the various pathways to impact that comprise the intervention. Typically it would show some of steps in each pathway along the way to impact but not in any detail. It could also set out the rationale assumptions behind the intervention.

Nested/Detailed ToCs. These are the more detailed ToCs with explicit causal link assumptions developed to unpack a more complicated/complex intervention ToC. 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. Nested TCs are needed to unpack a complex intervention setting. CA would normally be done on the different (nested) pathway ToCs.

The key point here is that there can usefully be several depictions of a ToC, and that in most cases, a number of nested ToCs can be usefully developed. Assuming there is only one ToC for an intervention is not helpful for framing contribution analysis. The more detailed nested ToCs are the type used in contribution analysis (Mayne, 2012).

The need for evaluable ToC models

And there usually is the need for the evaluator to develop or guide the development of ToCs that can be used for evaluation purposes, such as in contribution analysis. It is often the case that the evaluator finds an already developed ToC of the intervention being evaluated, but it is not suitable for evaluation purposes. It may have designed by program designers and well suited for moving the proposal forward to get funding, or it may quite well depict the very big picture of the intervention for communication purposes, but such ToCs often need considerable work to be useful for evaluation purposes. Usually, key nested ToCs need to be identified and built to unpack the complexity of the intervention with careful thought given to the causal assumptions at play.

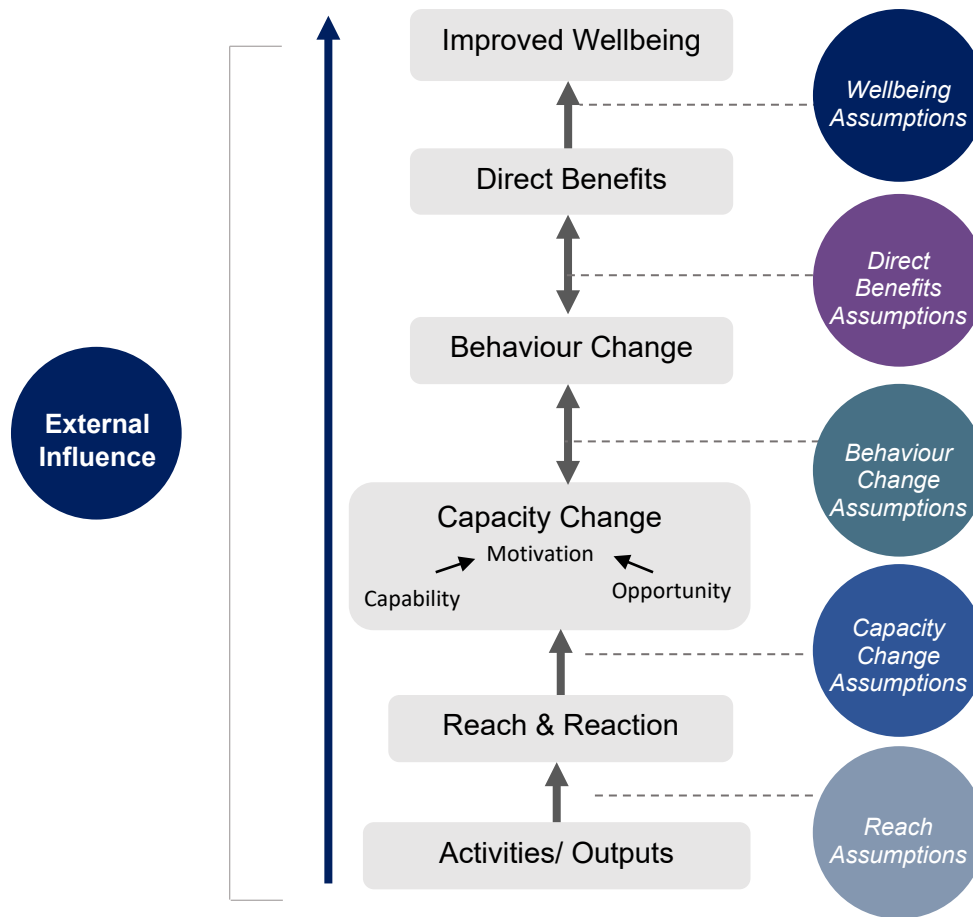


Here, we do not have space to get into developing thoughtfully structured, robust ToCs—see for example Mayne (2018b) and Mayne (2019). Developing ‘good’ ToCs is itself a challenge, but equally, it is often a serious challenge to bring on board those who ‘own’ the existing ToC and may not want to see a new ToC or ToCs brought into play. Koleros and Mayne (forthcoming) discuss handling this situation.

Behaviour change ToC models

Most interventions involve changing the behaviour of one or more actor groups. I have argued (Mayne, 2017; Mayne, 2018a) that the more detailed ToCs needed for CA can usefully be developed based on a generic behaviour change ToC model, shown in Figure 1. The model is based on the work of Michie, Atkins and West (2014) that argues behaviour (B) is changed through the interaction of three necessary elements: capabilities (C), opportunities (O) and motivation (M). Hence the name, the COM-B model.

Figure 1: The COM-B Theory of Change Model



The COM-B ToC model has proven very useful for building robust nested ToCs—it is quite intuitive and is based on a synthesis of empirical evidence on behaviour change—and undertaking contribution analysis. It is especially helpful in explaining how behaviour changes were brought about. That is, the COM-B model is a model of the mechanisms³ at work in bringing about behaviour change; it explains the mechanisms at work and hence the basis for inferring causality about behaviour change.



Inferring Causality: demonstrating contribution claims

CA aims to result in claims about the contribution made by an intervention to observed results. A first question then is, which results?

Which results?

In looking at an intervention and its ToC, it is clear that there could be a number of interesting contribution claims, namely, claims associated with any of the results along the impact pathway. Contribution claims for early results would likely be quite easily established while more distant outcomes and impact likely more of a challenge. But it would be important to identify just which contribution claims were of prime interest.

And of course, claims for more distant results need to be built on credible claims for the earlier pathway results. Hence the need to consider approaches to verifying a single causal link in a ToC, i.e., the causal link between one result (R1) and its subsequent result (R2). The contribution claim would be that:

1. R1 was indeed a contributing factor in bringing about R2, and
2. R1 did so as a result of the interactions between R1 and the contributing factors in the causal package (the causal link assumptions) associated with the causal link between R1 and R2, in the following way:

In a more complex intervention there would be several different pathways to impact, each with their own ToC. And often, it is useful to know the extent to which each of these pathways contributed to the success (or not) of the intervention, the pathway *impact story*. Hence, there are likely to be quite a few useful and interesting contribution claims to focus on. For example, in the case where actor-based ToCs have been developed for the intervention, it is of considerable interest to understand how and why the various actor groups contributed to bring about results. All to note again the importance of identifying which contribution claims are of interest.

Causal inference analysis

Key to a credible contribution claim are credible arguments inferring causality—the logic and evidence used to justify a causal link—which would be used in Step 4 to assess the contribution story to date. As noted earlier, an evidence-based contribution claim has two parts and would look like:

1. The intervention (or a component) contributed to an observed change—it played a positive role in bringing about change, and
2. It did so in the following manner,

Showing the intervention was a contributory cause accomplishes both of these aims: the intervention is part of a causal package that was sufficient to bring about the change—which explains how the change was brought about (2), and that the intervention was a necessary part of the causal package (1), and hence a causal factor in bring about the change.

Contribution claims are demonstrated by verifying the associated theory of change, that is, providing evidence that the results, assumptions and causal links were realized. Basically, one is showing that the causal package(s) worked. Process tracing is a useful alternative way for getting at (1), but does not provide the information needed for (2).



In the traditional CA approach, showing that the intervention was a contributory cause and hence made a difference, i.e., contributed to an observed impact and how it did so, requires demonstrating that:

- the theory of change (the causal package) was sufficient, and
- the intervention activities were an essential part of the causal package, and hence a causal factor in bringing about change.

Sufficiency is demonstrated by showing that each causal link in the theory of change (ToC) with its assumptions was realized. Sufficiency was always a weak point in the argument, and I would now say that data showing the ToC was realized is not enough. One needs in addition to build credible causal narratives for the ToC. What is needed is good causal reasoning (Davidson, 2013). Patton (2012: 374) makes a similar point in stressing that rigorous thinking is more important than methodological rigour.

Let me note that CA is expected to be done on a reasonably robust ToC, and many of the criteria for robustness (Table 3) are indeed criteria for inferring causality, forming the elements of a credible causal narrative.

Table 4 sets out four **tools for inferring causality**, all of which are embedded in a robust ToC.

Table 4 Evidence for Inferring Causality

Tools	References	Comment
Checking that change occurred		
1. Verifying pathway and assumptions	<ul style="list-style-type: none"> • Robust ToC #9 • Contribution Analysis • Weiss (1995) 	Are the pathway and assumptions verified? This forms the evidence base for making the contribution claims.
Hoop tests for confirming plausibility		
2. Logic and plausible time sequence	<ul style="list-style-type: none"> • Robust ToC #3 : timing • Davidson (2009) • Robust ToC #4: Logical coherence 	If intervention is a contributing factor, then must pass these hoop tests. Link: Are assumptions pre-events & conditions for the result? ToC: Is sequence of results plausible? Is the timing of the occurrence of the results plausible?
3. Reasonable effort expended	<ul style="list-style-type: none"> • Robust ToC #11: level of effort • Davidson (2009) 	Is it reasonable that the level of effort expended will deliver the results?
4. Expect-to-see effects realized	<ul style="list-style-type: none"> • Process tracing: hoop test 	If effects not seen, causality very unlikely. But effects might have other causes.
Building the causal narrative		
5. Causal packages are sufficient	<ul style="list-style-type: none"> • Robust ToC #10: A sufficient set; • Robust ToC #5: necessary or likely necessary assumptions 	Is it reasonable that the collection of causal package factors is sufficient to bring about the result? Are the mechanisms at work identified? Have the barriers to change been addressed?
Confirming a causal factor		
6. Some unique effects observed	<ul style="list-style-type: none"> • Process tracing: smoking gun tests 	Result only possible if intervention is the cause.



The evidence tools in Table 4 can be used to build credible causal narratives. Causal narratives provide the argument and evidence—the warrant—how the causal factors at work played a positive role in bringing about change. They explain the how a causal link worked; the causal mechanisms at play.

What CA can do and not do

Contribution analysis is not a quick and dirty approach to addressing causality. Its advantages are that (1) it can be used to make causal inferences when experimental and quasi-experimental designs are not possible, (2) it explores just why and how an intervention has influenced change, (3) it allows for making causal inferences about the intervention without necessarily examining external causal factors, and (4) it addresses cases where there are numerous causal factors at work by assessing contributory causes leading to credible contribution claims.

On the downside, (1) it often does require a substantial amount of data, along with rigorous thinking, (2) it requires reasonably robust theories of change, and (3) it cannot determine how much of an outcome result can be attributed to an intervention.



References

- 1 That is, they are a Insufficient but Necessary part of a condition that is itself Unnecessary but Sufficient for the occurrence of the effect (Mackie, 1974). See (Mayne, 2012: 276) for a discussion of these INUS conditions.
- 2 Likely necessary allows for a probabilistic interpretation of an assumption (Mahoney, 2008: 421). See (Mayne, 2015: 126) for a discussion.
- 3 Realist evaluations use the concept of mechanisms to infer causality (Pawson and Tilley, 1997; Westhorp, 2014).
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