



SECTION 2: KEY IDEAS PAGES

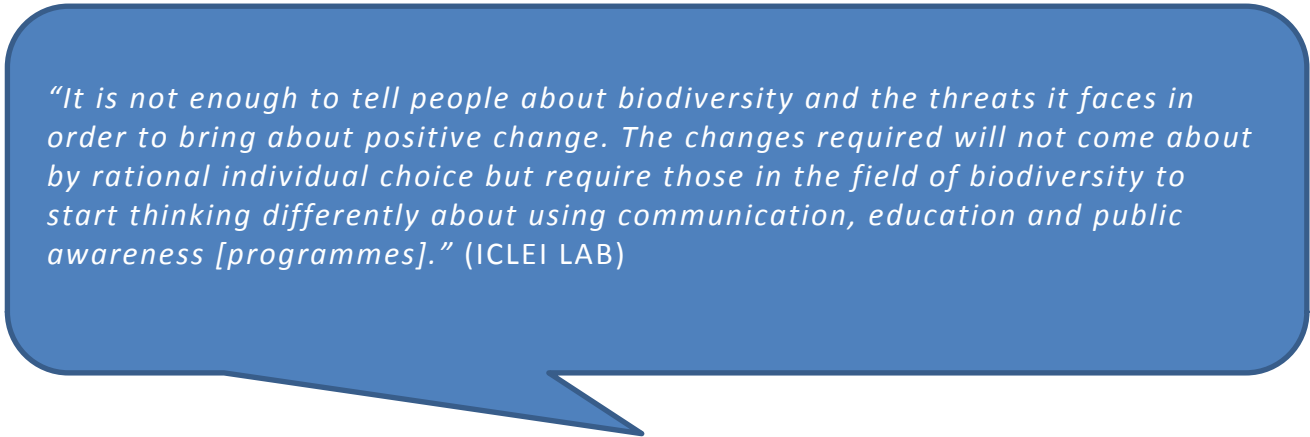


APPROACHES TO CEPA AND CHANGE

CEPA refers to Communication, Education and Public Awareness programmes. These are somewhat different kinds of processes used in a variety of ways towards more or less open-ended results consisting of learning and change among individuals and communities. How we approach and do CEPA activities depends to some extent on our context. But our approach is also influenced by:

- our understanding of *the causes of the problem* we are trying to tackle
- our beliefs about *whom or what needs to change*, and
- our views on *how* such change will come about, and the role of CEPA activities in the process.

CEPA managers and other stakeholders have a range of assumptions or mental models about these fundamental things. To design a CEPA evaluation that fully meets the stakeholders' needs, CEPA managers need to recognize the mental models of CEPA and change that they hold. Biodiversity managers, for example, need to reflect on the exact role that they want CEPA programmes to play in biodiversity programmes. A comprehensive evaluation should encourage managers and CEPA practitioners to reflect, from time to time, on their CEPA models, to consider if those should change.



"It is not enough to tell people about biodiversity and the threats it faces in order to bring about positive change. The changes required will not come about by rational individual choice but require those in the field of biodiversity to start thinking differently about using communication, education and public awareness [programmes]." (ICLEI LAB)

Below is a sketch of three common mental models or approaches for CEPA processes. Most practitioners would regard one or more of these as valid, and use one or more of them, depending on the context. Most practitioners tend to favour one, while some do not even consider that there are alternatives!

A. Advocacy for Change within Powerful Structures

In this approach to CEPA processes, the problem of biodiversity loss is understood to be the result of powerful agencies and structures (such as industry and governments) who have a negative impact on biodiversity, or fail to act in the interest of nature but also in the interest of people who are often negatively affected. Education and communication is used to conscientise citizens to put pressure on these powerful agencies to change their ways. A proponent of this approach was the renowned Brazilian educator Paulo Freire (1921-1997). The model for change is conscientisation, i.e. giving people tools to understand oppressive *systems* and information about problematic actions of powerful agencies. In the 1960s, following in the wake of unregulated development, Japanese teachers and other citizens campaigned in the media and marched against mercury in the sea and other forms of pollution in what was called 'education against the disruption of the public space'. There is strong emphasis on taking oppositional action for system wide change. Today this is still a popular approach among some NGOs and activists but most local governments, who can be regarded as a powerful agency themselves, find this approach to CEPA too disruptive for normal operations.

B. Behaviour Change in Individuals

In this approach to CEPA processes, the problem is seen to be the behaviors of individuals, e.g. local residents. CEPA programmes aim to provide these individuals with powerful experiences and information to cause a change in their behaviour, or (in the case of children) to shape their future behaviour. The need for change, and the nature of the change, is pre-defined by the CEPA manager. For example, a local authority may have introduced a recycling programme, but residents do not yet have the habit of sorting their waste, so a radio campaign is used to get residents to change their waste sorting behavior (develop a new habit or behaviour) to support the new waste management system. Or, CEPA programmes in the forest might be aimed at influencing citizens to support the local authorities' decision to set aside land for conservation purposes, rather than to lobby for a new housing development.

The model for change is in its basic form linear: *experience + information* \Rightarrow *attitude change* \Rightarrow *behavior change*.

While this is perhaps the most widely held understanding of the kind of change that is needed and the kinds of CEPA that will achieve the change, there are also many questions about the assumed relationships between the elements. For this model to work well, the expected behavior needs to be pre-defined and the intended outcomes must be easy to control. For example, if a river is polluted, children can be educated not to swim in it. It may be more complex to educate citizens around behavior in forests, which hold different values for diverse citizen populations who have had different experiences of forests in the past; forests are beautiful and can be enjoyed and treasured, but they can also be dangerous as sites of crime, so 'messaging' becomes more complex or even impossible.

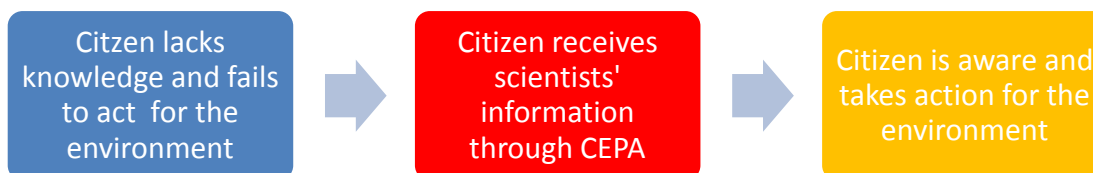
C. Co-Constructing Collective Change

In this approach to CEPA processes, the view is that problems and solutions are complex and context dependent; that CEPA practitioners and stakeholders must learn *together* what the different dimensions of a problem like biodiversity loss are, and that the responses to environmental problems may need to be open ended, because they are complex, and may differ from context to context. It is therefore seldom possible to simply give a target group a message or information, and assume that the situation will change in a predetermined way. The aim of CEPA in this approach is to strengthen collective *capacity* to act on issues. The responsibility for identifying problems and for finding the solutions is shared by individual citizens and by agencies like government, industry and education systems. This model for change may be termed collective or *social learning* and it is reflexive. It may involve various parties coming together to form communities of practice that work together to better understand and formulate solutions to problems of common concern, in the process, questioning the values that may underpin the problem. CEPA practitioners in Canada, South Africa and Holland are among those exploring this approach.

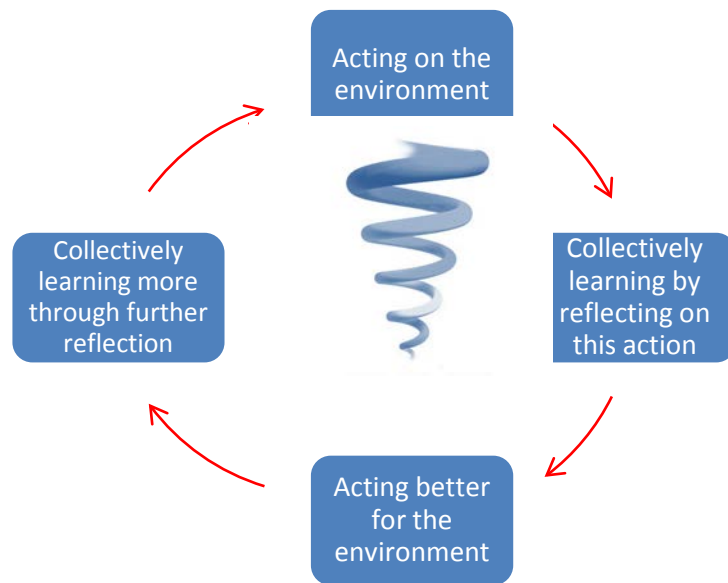
Action may drive change, in a new, non-linear, model of change: *Action* + collective *reflection* ⇒ More action + reflection + *collective* change ⇒

Another way in which to differentiate between different CEPA models is illustrated below:

Linear *Behaviour Change* Model of CEPA:

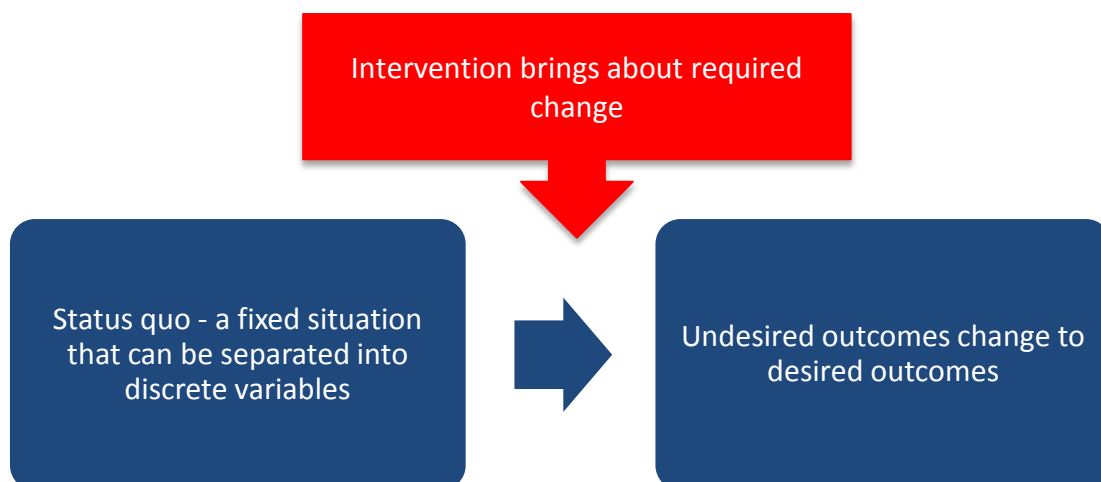


Non-Linear Collective *Learning from Doing* Model of CEPA:

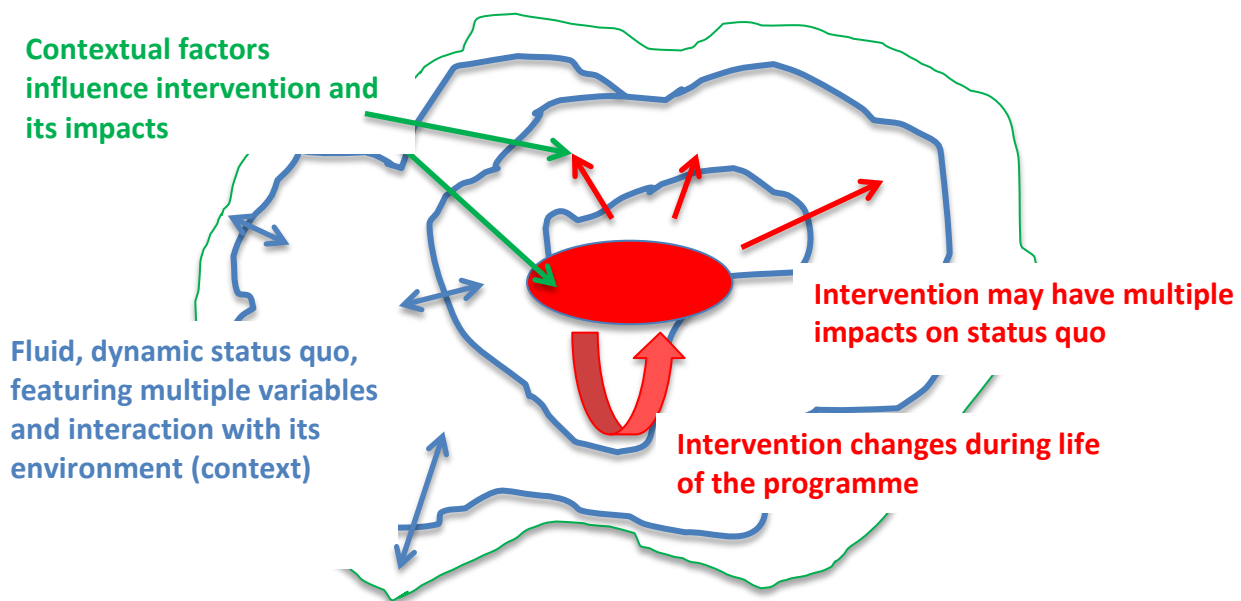


Similarly, we can view change generally as linear or non-linear processes:

A simple, linear model of change:



A non-linear 'complex systems' model of change:



How are our assumptions about CEPA relevant to evaluation?

- Our model of CEPA and change will determine 'what matters most', and what we wish to evaluate
- Evaluating our model of CEPA and change may help us to understand *why* our CEPA programme is successful, or not (see also Reid et al¹).

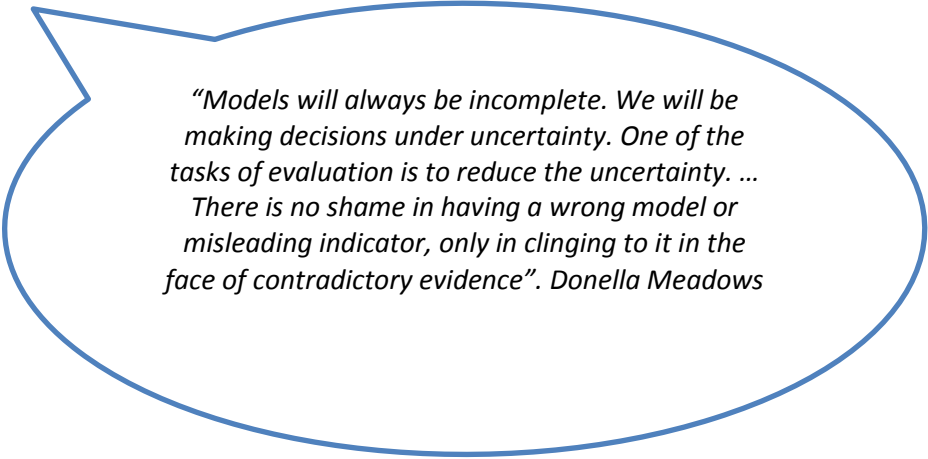
If one city's CEPA model is about getting citizens to change their behavior in a pre-defined way, its CEPA evaluation will use indicators for that specific behavior: Are citizens now sorting their waste? Have children stopped from swimming in the river?

If another city's CEPA model is about building the entire city's capacity to respond appropriately, but in a *variety* of ways, to a *variety* of issues and situations, they would rather test whether they are building that *capacity*, and how such capacity is evident among both staff and citizens, in a variety of ways. These are two quite different approaches to evaluation. For example, the first is more prescriptive, and the second more open-ended.

Understanding that the city's approach to CEPA is one of a number of alternatives, allows the city to evaluate its underlying approach to CEPA, and not just the activities. Therefore, if an evaluation results show that CEPA activities are not reaching the desired results, the city

¹ Alan Reid, Alan, Nikel, Jutta, & Scott, William, *Indicators for Education for Sustainable Development: A report on perspectives, challenges and progress*, Centre for Research in Education and the Environment, University of Bath, 2006

would be able to examine whether it is perhaps the approach to CEPA and model of change which are inappropriate to the situation. The following quote from Donella Meadows² highlights this other consideration:



"Models will always be incomplete. We will be making decisions under uncertainty. One of the tasks of evaluation is to reduce the uncertainty. ... There is no shame in having a wrong model or misleading indicator, only in clinging to it in the face of contradictory evidence". Donella Meadows

How to Use This

We find it useful to articulate our understanding of what we believe CEPA processes are about, and how they are likely to bring about change, and then to map these theories or assumptions as part of our programme plan. This then becomes part of the basis of a comprehensive evaluation that examines both activities and starting assumptions. The process is outlined in detail in *Folder 4: Evaluation Design Steps*.

The big challenge is how to evaluate what matters most, the really worthwhile outcomes of CEPA processes. Often we settle for indicators that reflect what we can practically measure, rather than that which is actually worth focusing on. In longer term CEPA programmes, indicators determine where CEPA managers end up putting most of their attention³.

There is no doubt that the 'really worthwhile' impact and outcomes of CEPA programmes are hard to evaluate.

Discuss the following questions with CEPA colleagues:

How do we measure learning?

Because we have all been tested for our knowledge at school, we may think this is easy. But in many CEPA situations, we want to achieve more than just increase the participants' knowledge. Why?

² Meadows, Donella, *Indicators and Information Systems for Sustainable Development*, A report to the Balaton Group, published by The Sustainability Institute, Vermont 1998

³ See Step 6 in *Folder 4: Evaluation Design Steps*

What is learning? Is it only about gaining more knowledge?

In many CEPA situations there is a desire for participants to develop a deeper understanding, different ways of thinking about biodiversity, different attitudes and values, even to un-learn some of their deep-seated understandings. For example, citizens may have learnt that an area of un-developed land is unsightly, a ‘waste’ (of development opportunity), or a security threat. For them to start valuing it differently, requires more than just factual information about species loss. And often, we don’t have the scientific information to ‘prove’ that a particular area of land plays a critical role in citizens’ well-being. Hence, information is not always enough!

How do we observe values and attitude change? How do we interpret behaviour?

If we are interested in values and attitude change, our evaluation may ask respondents directly: Did you change your mind about this forest? But this is a crude measure, as many of us answer politely to please the other person, or we might not even know for sure whether there has been a shift in our attitude. A change in behaviour can be an indication of a value shift. For example, if villagers are starting to bring injured howler monkeys to the rehabilitation centre for treatment, we could judge that they have changed their attitude and now value biodiversity. But, for some of them it could simply mean that they are hoping for a small reward, or a chance to talk to the staff.

Can we link attitude and behaviour change to eventual outcomes? What about the other variables that could be involved?

When we do observe positive changes in values, attitudes and behaviour, can we confidently attribute them to our CEPA programme? When residents seem more positive about the forest, how do we know this has been influenced by our CEPA activities and not (also) by a television series on climate change, completely unrelated to our programme, or by a new school curriculum? Or could it be that residents who are more affluent and mobile, able to pay for security, and also value nature, are choosing to move into areas closer the forest – regardless of our CEPA programmes? Then again, perhaps these residents value nature now because of CEPA programmes they participated in when they were children?

The outcomes of CEPA programmes may only be observed in the middle to longer term – which also makes it more complex to evaluate if we want to know right now whether these efforts are worthwhile, or not.

How do we link CEPA outcomes to biodiversity benefits?

For some, the most perplexing question about the changes resulting from CEPA is whether we can link them to biodiversity benefits. If the participants in the City of Edmonton's Master Naturalist Programme⁴ volunteer 35 hours of their time after training, does that mean that Edmonton's natural environments are being better protected? To ascertain this, one would probably have to explore the nature and the quality of their volunteer actions. If they clear out invasive alien plants, without destroying any native vegetation, we can probably be confident that they are having a positive effect – provided this was a conservation-worthy site to start with, and that some quirk of nature (such a big storm or an insect plague) does not unexpectedly destroy their work. But what if the Master Naturalists' volunteer work is an awareness raising activity? Then it becomes doubly difficult to evaluate the eventual impact of their work, on the status of Edmonton's biodiversity.

Yet some would probably say that newly aware citizens who support biodiversity conservation and who share their enthusiasm and knowledge with other citizens, are surely a good outcome. Do we still need to prove that it is worthwhile?

An alternative approach: using what we know about good education and communication

Many CEPA practitioners choose to assume that CEPA is inherently worthwhile, provided it follows best practice guidelines. Following this approach, an evaluation would test for evidence that best practice guidelines are being followed. The best practice guidelines – being only theories - can in turn be tested and refined over time as they are informed by our observations of their outcomes, over the shorter and longer term.

How to Use This

What is good CEPA educational or communications practice? Is this being followed? What are some of the results we observe? What changes to practice can we make? What are some of the new results? Asking these questions from time to time leads to a process of ongoing learning, in a process that one could call adaptive management of CEPA activities⁵.

This approach acknowledges that some of the benefits and outcomes of CEPA activities are either truly intangible, or simply so difficult to measure that they are impractical. An approach may then be to simply describe what good environmental education is, and to assess our CEPA processes against these criteria or principles.

What constitutes an excellent CEPA programme? In Appendix 3 we suggest 14 principles which you can examine to see if they match your understanding of what constitutes good CEPA processes.

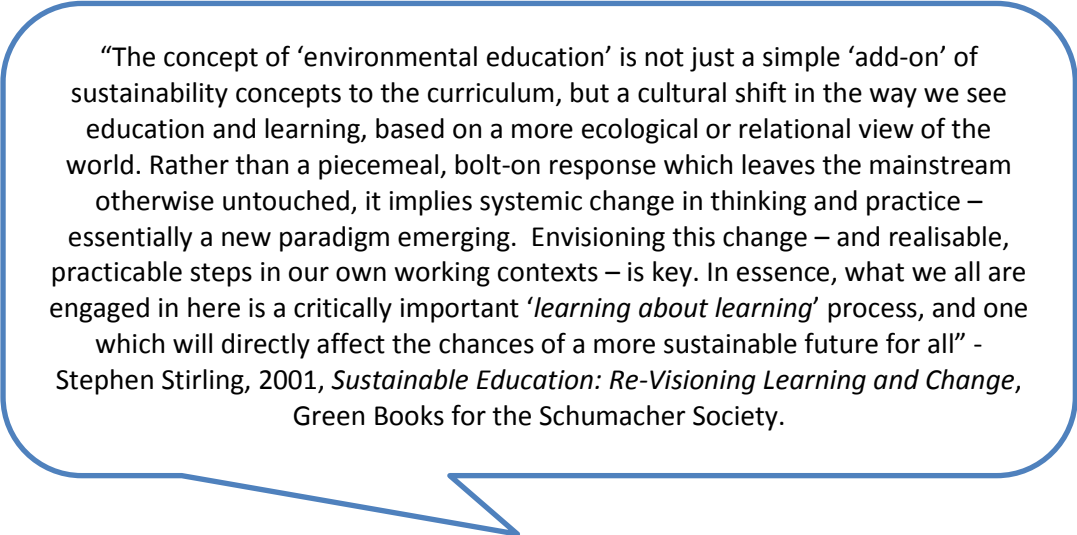
⁴ See *Folder 3: Case Studies*.

⁵ For guidelines on education and communication, refer to the Appendices Folder on the CD.

Summary

To summarise the key ideas in this section, understanding our mental models for CEPA and change is useful in the design of evaluations. What we regard as important milestones and destinations, is determined by what we view as the route to change. These in turn, determine what we choose to evaluate. Our important milestones and destinations are turned into indicators, which often form the backbone of evaluations.

If we conclude that CEPA situations are quite complex and that we can seldom measure anything important or worthwhile directly, a developmental approach to evaluation becomes useful. In this approach, evaluation is used more for learning and ongoing adaptation of activities, as opposed to proving that they are worthwhile. Evaluation becomes integrated with CEPA activities. CEPA is approached as ongoing, collective learning through doing and evaluation. The next set of *Key Ideas* explains this further.



“The concept of ‘environmental education’ is not just a simple ‘add-on’ of sustainability concepts to the curriculum, but a cultural shift in the way we see education and learning, based on a more ecological or relational view of the world. Rather than a piecemeal, bolt-on response which leaves the mainstream otherwise untouched, it implies systemic change in thinking and practice – essentially a new paradigm emerging. Envisioning this change – and realisable, practicable steps in our own working contexts – is key. In essence, what we all are engaged in here is a critically important ‘*learning about learning*’ process, and one which will directly affect the chances of a more sustainable future for all” - Stephen Stirling, 2001, *Sustainable Education: Re-Visioning Learning and Change*, Green Books for the Schumacher Society.

APPROACHES TO EVALUATION

This set of *Key Ideas* explores factors that influence the design of an evaluation. We argue that there are different approaches to evaluation, based on:

- The research framework underpinning the evaluators' approach
- The particular role the evaluation is to play.

The role of the evaluation is in turn influenced by:

- The stakeholders in the evaluation, their needs and interests, and
- The stage in the CEPA programme at which the evaluation takes place.

This section shares ideas and tools for planning different evaluation strategies, and using different indicators, to meet needs of different audiences, and needs that are more or less prominent at different times in the life of a programme. In particular, we highlight a more developmental approach to evaluation, which is non-traditional and demanding, but particularly suitable for complex contexts such as those in which we undertake CEPA programmes.

Research Frameworks for Evaluation

Evaluation is essentially a research process, and as such our approach to evaluation is influenced by our understanding of how one gathers evidence and come to valid conclusions. After all, evaluation reports have to differ from mere opinion on how good a CEPA programme is. How do we gather evidence, what is regarded as suitable evidence, and what count as rigorous research processes that allows us to state with some confidence: "This evaluation found that ..."?

Depending on how we answer these questions, we will adopt one of a number of recognized research frameworks for an evaluation. One such a typology, summarised in Table 1, is described in the forerunner to this toolkit, called *Into Evaluation* (www.capetown.gov.za). Readers interested in this aspect are referred to this document, or one of the other excellent resources detailing different approaches to research (paradigms and methodological frameworks).

Table 1 Research Frameworks for Evaluation⁶

Research Frameworks for Evaluation	Key Features
Experimental and Empiricist	Empiricism is the assumption that objectivity can be obtained by using only measurable indicators and quantifiable data. Based on the traditional scientific method used in the natural sciences, with allowances where necessary for the idiosyncrasies of the social world (e.g. difficult to control variables), often resulting in quasi-experimental design. Pre-test post-test designs and the use of control groups are popular designs in this framework. Research ‘subjects’ opinions are not valued.
Naturalistic and Constructivist (e.g. Illuminative Evaluation, an approach developed by Parlett and Hamilton in the early 1970s)	Intentionally departs from the above approach by using more ‘natural’ methods (like conversations rather than questionnaires); this approach assumes that the ‘objectivity’ of scientific measures is, like much of our reality, socially constructed. Detailed case studies are popular, and stakeholders’ opinions and insights are valued and quoted.
Participatory and Critical (see e.g. the work of Patti Lather on <i>Feminist Educational Research</i> in the critical tradition)	Promotes the learning role of evaluation, and the value of all stakeholders actively participating in setting the evaluation questions, generating data and coming to conclusions through dialogue and reflection. Often uses action research cycles (iterative processes). Where a critical element is present, this assumes that power structures must be interrogated in case they play an oppressive role (e.g. some powerful participants may prevent CEPA programmes from challenging the status quo).
Realist and Pragmatic (see e.g. Ray Pawson and Nick Tilly’s <i>Realistic Evaluation</i> , published by Sage in 1997)	Claims that while much of our reality is socially constructive, there is also a material reality and not all understandings of this reality are equally valid or valuable. Uses a combination of qualitative and quantitative data, detailed case studies as well as programmatic overviews, to interrogate the validity of our theories about our CEPA programmes.

⁶ *Into Evaluation: A Start-Up Resource For Evaluating Environmental Education and Training Projects, Programmes, Resources*, 2004, City of Cape Town, www.capetown.gov.za

Roles of Evaluation

CEPA practitioners and managers use evaluations for a variety of reasons, which will in turn influence the design of these evaluations. These purposes include:

1. Accountability and feedback to funders and other implementation partners
2. Accountability and feedback to intended beneficiaries
3. Keeping track of progress
4. Identifying problems as they arise
5. Improving the programme being evaluated, during its life span
6. Communicating about our CEPA programmes in a credible manner
7. Motivating and inspiring CEPA participants and others with our efforts & results
8. Providing information for decision making about the future of a programme
9. Learning how better to conduct CEPA programmes
10. Learning how to work in an evaluative manner.

Evaluations have different audiences, who often require and expect different things from an evaluation: perhaps different indicators of success, or a different reporting format. For example ...



Over the lifespan of a CEPA programme, evaluation will have different purposes, and different evaluation strategies are appropriate at these different stages of the programme.

Evaluation Strategies

Traditional Evaluation Strategies - Summative & Formative Evaluations

Traditional evaluations are often described as either formative or summative:

- Formative evaluations are conducted during programme development and implementation, to provide direction on how to best to improve the programme and achieve its goals.
- Summative evaluations are completed once a programme is well established and will indicate to what extent the programme has been achieving its goals.

Formative evaluations help you to *improve* your programme and **summative** evaluations help you *prove* whether your programme worked the way you planned. Summative evaluations build on data from the earlier stages.

Within the categories of formative and summative, one can also distinguish different types of evaluation linked to purpose. Table 2 describes these.

How to Use This

Use Table 2 to reflect on what type of evaluation you need at this stage of your CEPA programme's life span, and what questions you could usefully ask.

TABLE 2: Types of Evaluation (adapted from MEERA⁷)

Type of Evaluation	CEPA programme stage	Purpose of the Evaluation	Examples of Question to ask
Formative (Improve)			
Needs Assessment	Before programme begins	Determines if there is a need for programme, how great the need is, and how to meet it. A needs assessment can help determine what groups are not currently served by CEPA programmes in a city and provide insight into what new programme would meet the needs of these groups.	Is there a need for education, communications? What would best meet the need?
Process / Implementation Evaluation	New programme	Examines the implementation process and whether the programme is operating as planned. Focuses mostly on activities, outputs, and short-term outcomes for the purpose of monitoring progress and making mid-course corrections if needed. Can be done continuously or as a once-off assessment. Results are used to improve the programme. The	Is the programme operating as planned? How many participants are being reached with CEPA programmes? Which groups attend the courses?

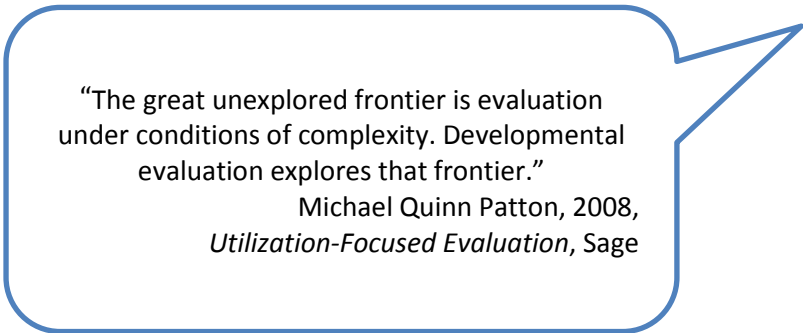
⁷ My Environmental Education Resource Assistant, MEERA website, <http://meera.snre.umich.edu/>, by Jason Duvall, Amy Higgs & Kim Wolske, last modified 2007-12-18 16:33, contributors: Brian Barch, Nick Montgomery, Michaela Zint.

		Edmonton and Nagoya case studies in Folder 3 on the CD are examples of process evaluations.	How satisfied are participants with the courses?
Summative (Prove)			
Outcome Evaluation	Established programme	Investigates the extent to which the programme is achieving its outcomes. These outcomes are the short-term and medium-term changes that result directly from the programme. Although data may be collected throughout the programme, the purpose here is to determine the value and worth of a programme based on results. For example, the Cape Town Green Schools Audit (see Folder 3 on the CD) looked for improvements in students' knowledge, attitudes and actions.	Has the programme been achieving its objectives?
Impact Evaluation	Mature or historic programme	Determines any broader, longer-term changes that have occurred as a result of a CEPA programme. These impacts are the net effects, typically on an entire school, community, organisation, city or environment. Impact evaluations may focus on the educational or environmental quality, biodiversity or human well-being benefits of CEPA programmes.	What predicted and unpredicted impacts has the programme had?

An evaluation is likely to be more useful (and easier to conduct) if the evaluation process is provided for from the start, and built into other programme activities. Making evaluation an integral part of a CEPA programme means designing the CEPA programme with evaluation in mind, collecting data on an on-going basis, and using this data at regular intervals to reflect on and improve your programme.

Developmental Evaluation

When evaluation is integrated into your programme for continuous improvement, the approach is called developmental. Developmental evaluation is in a way a combination of formative and summative evaluation.



“The great unexplored frontier is evaluation under conditions of complexity. Developmental evaluation explores that frontier.”

Michael Quinn Patton, 2008,
Utilization-Focused Evaluation, Sage

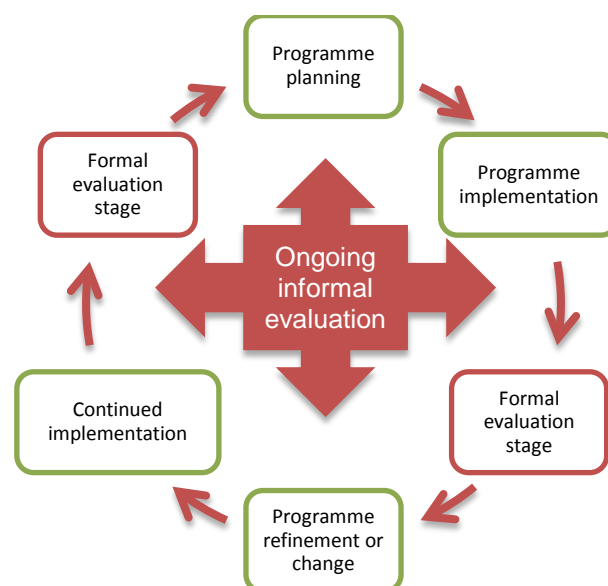
In developmental evaluation, programme planning, implementation and evaluation are integrated processes. Evaluative questions are asked and evaluation logic is applied to support programme (or staff or organizational) development in a long-term, on-going process of continuous improvement, adaptation and intentional change.⁸ Programmes are seen as evolving and adaptive, and evaluation processes are used to regularly examine the programme, and alert programme staff to possible unintended results and side effects. Even assumptions behind the programme and its design are from time to time questioned, all with the intent of improving the likelihood of success.

Developmental evaluation allows CEPA practitioners to adapt their programmes to emergent and dynamic realities in the particular, complex contexts in which they operate. It encourages innovations which may take the form of re-designing aspects of the programme, developing new teaching or communication methods, adapting old resources, and making organisational changes or other systems interventions.

Figure 1 illustrates the *continual loop learning* for developmental evaluation. This cycle can be started up at any stage of a CEPA programme, and it is also described in Folder 4 *Evaluation Design Steps*, where it is used as the basis for designing an evaluation process.

⁸ Patton, Michael Quinn, *Utilization-Focused Evaluation*, Sage, 2008

Figure 1 Developmental Evaluation is a Continual Loop for Learning



Developing and implementing such an integrated evaluation process has several benefits. It helps CEPA managers to:

- better understand target audiences' needs and how to meet these needs
- design objectives that are more achievable and measurable
- monitor progress toward objectives more effectively and efficiently
- increase a CEPA programme's productivity and effectiveness
- Learn more from evaluation.

Table 3 compares developmental evaluation to traditional evaluation. A key difference is one of continuous learning (developmental) compared to definitive judgement based on a single evaluation of the process or result. The evaluator or evaluators also take on a different role; in developmental evaluations, the evaluator plays an active role in supporting the learning of participants through the evaluation process. CEPA programme staff are expected to be centrally involved in these evaluation processes.

Table 3: Developmental evaluation compared to traditional approaches⁹

Traditional Evaluation (formative or summative - for testing results)	Developmental Evaluation (formative and summative combined for continuous improvement)
Testing models: renders definitive judgments of success or failure	Complexity-based, supports innovation and adaptation. Provides feedback, generates learning, supports direction or affirm changes in direction in real time
Uses mostly an external evaluator who is deemed to be independent, objective	Evaluator part of a team, a facilitator and a learning coach bringing evaluative thinking to the table, supportive of the organisation's goals
Measures success against predetermined goals using predetermined indicators	Develops new measures, monitoring mechanisms and indicators as goals emerge and evolve
Evaluators determine the design based on their perspective about what is important; evaluators control the evaluation process.	Evaluators collaborate with those engaged in the change effort to design an evaluation process that matches philosophically and organizationally.
Design the evaluation based on linear cause-effect logic models	Design the evaluation to capture the assumptions, models of change, system dynamics, interdependencies, and emergent interconnections in complex environments.
Aims to produce generalised findings across time and space.	Aims to produce context-specific understandings that inform ongoing innovation.
Accountability focused on and directed to external authorities and funders.	Accountability centered on the innovators' deep sense of fundamental values and commitments and desire for continuous learning, adapting the CEPA programme to a continually changing complex environment.
Accountability to control and locate blame for failures.	Learning to respond to lack of control and staying in touch with what's unfolding, thereby responding <i>strategically</i>
Evaluation often a compliance function delegated down in the organisation.	Evaluation a leadership function for reality-testing, results-focused, learning-oriented leadership
Evaluation engenders <i>fear of failure</i>	Evaluation supports <i>hunger for learning</i>

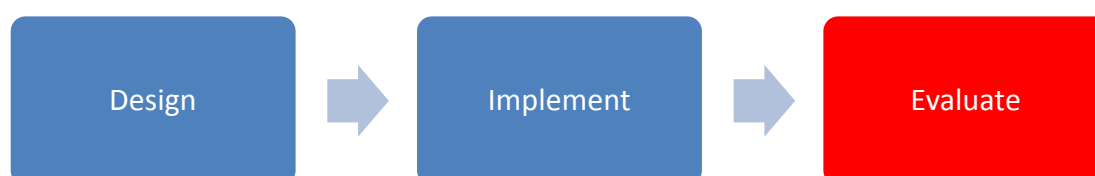
⁹ Patton, Michael Quinn, *Developmental Evaluation, Applying Complexity Concepts to Enhance Innovation and Use*, 2011

Although there are clear benefits to a developmental evaluation as an overarching approach, each evaluation strategy - formative, summative or developmental - fulfills a specific purpose and adds a particular kind of value, when it is appropriate for the situation.

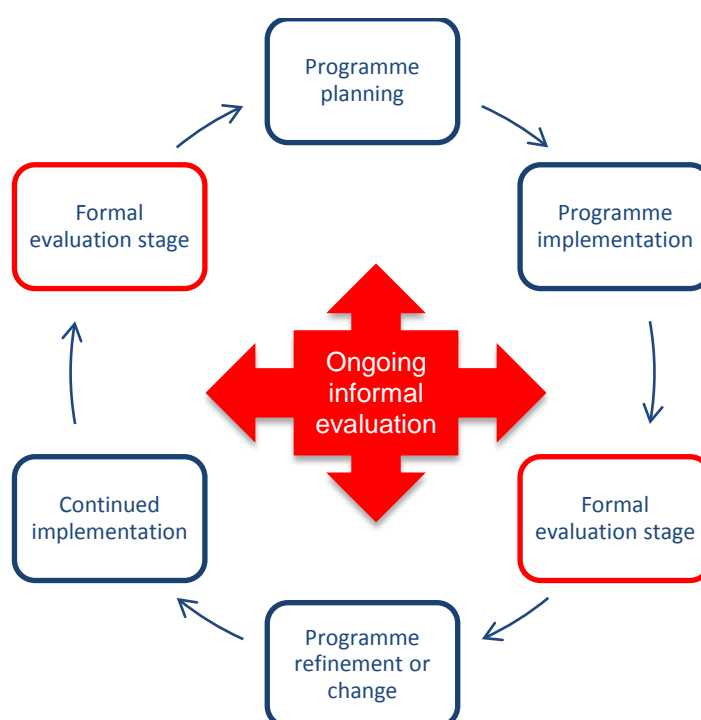
We choose our evaluation strategies according to the circumstances, resources, time lines, data demand, intended users, political features and purposes of a particular situation. A developmental approach may not always be feasible or appropriate.

However, a developmental approach to evaluation is perhaps the only way in which we can adapt our enquiries to the nonlinear dynamics that characterise CEPA programmes, when we start looking them as complex systems. Traditional approaches to programme planning tend to impose order on this complexity, passing over many dimensions in the process. They also assume a certainty which is perhaps impossible to achieve. When situations present themselves as disorderly and highly uncertain, yet we need to evaluate and improve them, it is useful to explore them as complex systems. This is what evaluations based on complex systems theory seeks to do.

Model of Simple Linear Programme Evaluation:



Model of Developmental Evaluation:



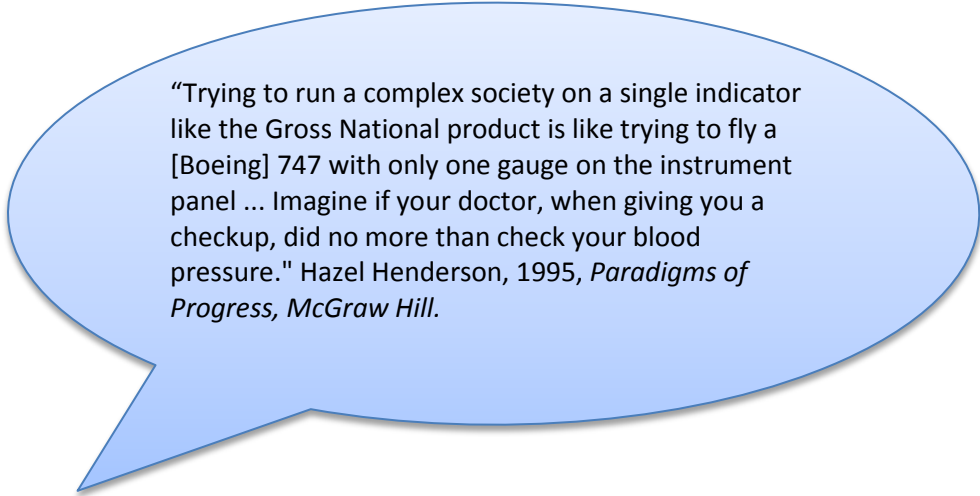
UNDERSTANDING COMPLEX SYSTEMS

This final section of the *Key Ideas Pages* provides us with tools for understanding CEPA programmes and the contexts in which we introduce them, as complex systems.

Do we really need to look for complexity? Is it not better to try and simplify things?

Evaluations that focus only on pre-determined and measurable outcomes tend to ignore the complex nature of CEPA processes and contexts. The danger is that they then fail to capture the rich nuances and full impacts of a programme. Evaluations based on simplicity may also fail to observe features and factors that can undermine the success of a programme. And, such evaluations are seldom able to provide useful explanations for their findings, i.e. the reasons why a programme is succeeding, or not succeeding.

An exploration of the complexity of a CEPA programme and its context provides us with an opportunity to improve our learning and insights and thereby, to more adequately support and steer CEPA programmes.



"Trying to run a complex society on a single indicator like the Gross National product is like trying to fly a [Boeing] 747 with only one gauge on the instrument panel ... Imagine if your doctor, when giving you a checkup, did no more than check your blood pressure." Hazel Henderson, 1995, *Paradigms of Progress*, McGraw Hill.

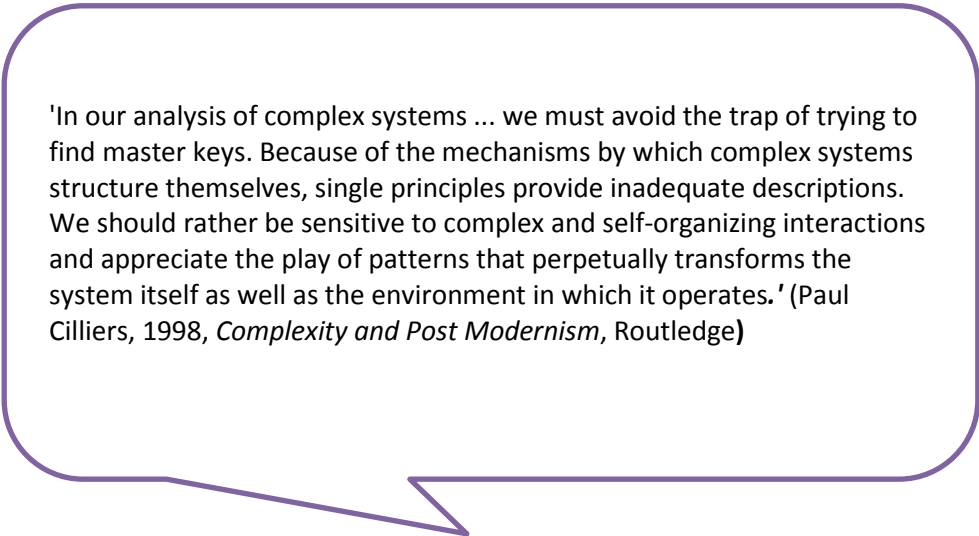
CEPA indicators designed to measure behaviour change and awareness do not pick up the finer dynamics of multiple variables which interact locally at multiple levels – and which affect the desired progress of the programme in a variety of ways. There is a growing realization that a complex systems approach can be a useful tool in facilitating and strengthening the evaluation of educational and social change processes. For CEPA managers to use this approach, a few key ideas should be explored.

What is a Systems Approach?

Wikipedia¹⁰ describes a complex systems approach as “*a new science that studies how relationships between parts give rise to the collective behaviors of a [system](#) and how the system interacts and forms relationships with its environment*”.

The interconnectedness of multiple variables and the significant contribution that even the smallest variable can make to a larger system, are among the major breakthroughs that a complex systems approach has contributed to our understanding of educational and social change processes.

This means that we no longer need to ‘write-off’ or ignore observations we cannot easily explain or events that do not make sense within the linear logic of cause and effect in which most of us have been trained. In a systems approach we can attempt to account for the previously hidden, ‘missing’ and ‘invisible’ variables in order to paint an overall ‘big picture’, even if the conclusions we draw will always remain ‘subject to further changes’. In a systems approach there are no final conclusions. All decisions, including evaluation outcomes, are *contingent*, conditional and provisional, and relevant to a particular phase of our enquiry. Thus *flexibility* becomes the norm, along with multiple reasons to explain observations.



'In our analysis of complex systems ... we must avoid the trap of trying to find master keys. Because of the mechanisms by which complex systems structure themselves, single principles provide inadequate descriptions. We should rather be sensitive to complex and self-organizing interactions and appreciate the play of patterns that perpetually transforms the system itself as well as the environment in which it operates.' (Paul Cilliers, 1998, *Complexity and Post Modernism*, Routledge)

Every new science develops its own ‘jargon’ and the complex systems approach is no exception. Concepts such as *emergent*, *critical junctures*, *flexibility*, *resilience*, *adaptive* and *self-organising* are among those commonly used. While it is not necessary to use these terms, it is well worth understanding the concepts they refer to, in the context of LAB CEPA. References and reading materials listed in this toolkit will assist those who want to explore them further. Here we aim where possible to use simple language that will be self-explanatory to non-specialists.

¹⁰ http://en.wikipedia.org/wiki/Complex_system

What is meant by Complex?

Is complex the same as complicated? Not at all. Think of a piece of machinery with many parts, say an aircraft engine. It looks and it is complicated, but it is not complex. A technician can take the engine apart to see how each part is connected to another to make it work, and put it back together again in exactly the same way. If something goes wrong, a fixed procedure will help us to find the faulty part, replace it, and have the engine working again. In short, there is replicability - the patterns can be reproduced. Predictability is a key factor in a system – such as an aircraft engine - that is complicated but not complex.

For an example of a complex system, think of a family. There may be only two parents and one child, but the dynamics between them, and their interactions with their environment, are complex. There may be some replicability and predictability, but there are invariably also unexpected variations and surprises. One morning the child wakes up and is not eager to go to school. This may be due to a developmental phase, a flu virus, or something else that is hard to determine. Replace one factor – say the father – with a different man, and a whole new dynamic arises. A family of three may appear simpler than an aircraft engine, but understanding it, and working with it, is a more complex process. And so it is with many social as well as institutional structures and situations. They are complex and they cannot be taken apart to study in the same way as a machine or other complicated system.

Another key idea about complex systems is the presence of multiple *variables* that *interact* in multiple and sometimes unpredictable ways with each other in a particular environment, while also influencing that environment in the process. Take for example a carrot seed. At first glance it appears to be a simple system, in fact not even a system at all. We can say if we plant carrot seeds they will, predictably, give carrots. Yes, the seed will give us a carrot. But there is also a complex system at work here. Variations in the water quality (high pH, low pH, brackish, sweet, hard, soft, fresh, chlorinated) are among the variables that will affect germination. Then look at the soil. Soil texture, quality, microorganisms and organic materials present or not present in the soil, are also variables that will impact the germination of the carrot seed. Now let us look at the temperature differentials. This will be determined by the sun - direct sun, heat, shade will be affecting the seed. The amount of rainfall is another factor - whether there is too much rain, whether there is adequate drainage, etc. There is a whole climatic effect on the seed – cycling through autumn, winter, spring and summer, depending on when you plant the seed and whether you plant it inside a glass house, outside, in a pot or directly in the soil.

So these are some of the features of what appears to be actually a complex system that will determine the nature of the carrot. In a laboratory the conditions can be fine-tuned and made to reproduce in a replicable manner. But out in the ‘real world’ all the above variables will impact on the carrot, producing sometimes nice, juicy sweet tasting carrots, and sometime stringy, woody and crookedly shaped carrots. The combination and permutations of these variables can be endless. In a complex system the interaction between the variables not only impacts the carrot itself, but they also impact on the nature of soil structure. Scientists now know that fine hairs on the roots of plants are able to change the micro-environment around them, to facilitate the uptake of water and nutrients from the soil. The

environment in which the carrot is growing can itself be affected by the system. And so it is with CEPA programmes!

A CEPA Programme to Illustrate a Complex System

Cape Town's first evaluation case study (see *Folder 3: Case Studies* on the CD) is an example of a systems approach to CEPA programme evaluation. But to illustrate how CEPA contexts can be seen as complex systems, refer to Cape Town's Case Study 2: The Green Audit and Retrofit programme for schools, in the same folder.

This CEPA programme introduced a process of auditing biodiversity, water and energy consumption and waste production, at a range of schools in the city. What are some of the variables that affected this introduction, and the outcomes of the programme?

Experience has shown that the enthusiasm of the teacher is an important factor in the adoption of these initiatives, even when the focus is on the students, and the city provides external facilitators to introduce programmes to them. Where teachers changed midway through the life of the Green Audit programme, the course of the project in these schools was significantly affected.

Some students mentioned that their interactions with students from other schools were significant learning experiences – even though this was not necessarily planned as a key feature of the programme.

History proved to play a role, too. Historically, water and electricity meters or gages were placed – or came to be obstructed - in inaccessible parts of grounds and buildings, because in the past, children and staff were not expected to monitor the school's water and energy consumption. This factor actually reduced the success of the programme in some schools, as it was just too difficult for the students to obtain the readings – a fundamental part of the auditing. Given the difficulty of gaining access to meters and records, the janitors and finance managers became unexpectedly important variables in the programme, and one finance officer pointed out that if she had been informed about the programme at the start, she could have provided the figures, but since she had not been informed, she couldn't! Could the Green Audit team have foreseen the role of this particular variable? Systems are full of surprises!

It also proved significant that schools are systems with their own rhythm and pattern over the course of the academic year, which differed somewhat from school to school, even though all schools were linked to the provincial and national education systems. The CEPA team needed to understand this rhythm, to know when best to introduce their programme, how much time schools would need to complete the programme, and when to schedule an evaluation that could get the views of the teachers as well as students in different grades, some of whom had a shorter school year than others.

To add to the complexity, variables seemed to have differing impacts in different schools. The nature of the schools' management is an example of such a variable. Some

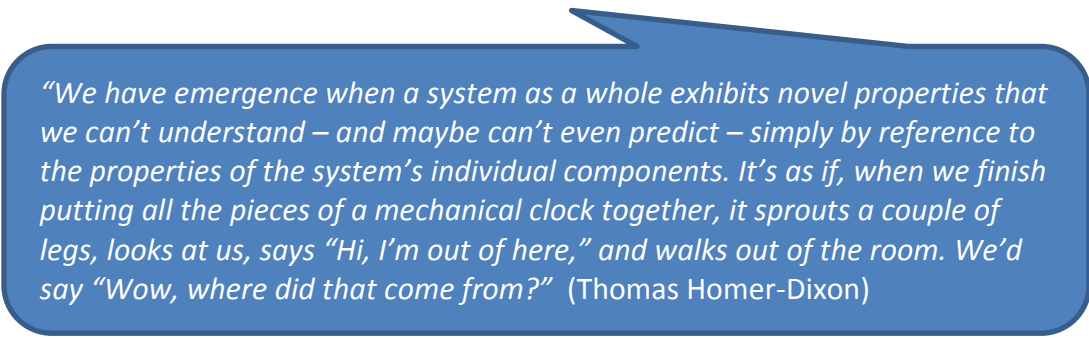
administrators manage their schools with a firm hand, with strict systems and high requirements from their staff and students. The students in these schools are generally better prepared academically, and able to participate well in CEPA projects, but time is often a great constraint for them, given that they have much else to do. In other schools management is rather less attentive with fewer rules and regulations, and fewer activities in the school calendar. Here CEPA teams have more space and freedom to introduce their initiative ... but because academic standards are generally lower, the students at these schools struggle more with some environmental concepts. The interplay between school management, teaching and CEPA initiatives, is an example of interactions between variables in what is undoubtedly a complex system.

More Features of Complex Systems

Complexity does not arise as a result of a chaotic free-play with infinite possibilities. Complex systems have structure. It is structure which enables the system to behave in complex ways. If there is too little structure, the system can behave more freely, but this freedom leads to activities which are meaningless, random or chaotic. The mere *capacity* of the system (i.e. the total amount of freedom available if the system was not restricted in any way) is not a useful indication of its complexity. Complex behavior is only possible when the behavior of the system is constrained. On the other hand, a fully constrained system has no capacity for complex behavior either.

Complex systems do not operate under conditions of equilibrium, that is, they do not necessarily strive to reach some balance. Complex systems are open systems, meaning that the environment in which they operate influences them to the point that they expand beyond their operational boundaries.

Complex systems also consist of many components. At least some functions display behaviour that results from the *interaction* between these components and not from characteristics inherent to the components themselves. This is sometimes called *emergence*, or internal dynamic processes.



"We have emergence when a system as a whole exhibits novel properties that we can't understand – and maybe can't even predict – simply by reference to the properties of the system's individual components. It's as if, when we finish putting all the pieces of a mechanical clock together, it sprouts a couple of legs, looks at us, says "Hi, I'm out of here," and walks out of the room. We'd say "Wow, where did that come from?" (Thomas Homer-Dixon)

Another example of emergence is the appearance of unintended results. We zone a city into industrial, commercial, residential and recreational areas, and then we observe the unintended result of a huge amount of energy being spent to move people between these areas, because they live far from the areas where they want to work, shop and play.

How is a Complex Systems Approach useful in CEPA Evaluation?

Many CEPA managers believe that in order to develop, implement and evaluate a programme effectively, we need to understand the programme's environment or context. As the example above of the Green Audit and Retrofit programme for schools illustrates, the context in which CEPA programmes function is complex. When we evaluate a programme, we tend to *reduce* the complexity of the system and its environment, in that we choose only a few aspects on which to focus.

In the case of the Green Audit programme, the evaluation (briefly described in *Folder 3: Case Studies*) focused on students' and teachers' experience of the programme, and evidence of learning among the students who completed the programme. Broader contextual factors were not included, for example the reasons why some schools dropped out of the programme, were not explored. An evaluation indeed *has* to focus, not everything can be included. What the systems approach does, however, is to make us more aware of the contextual factors that we are leaving out, of how incomplete our selection process is, and that our findings will therefore also be incomplete, as we may be ignoring some crucial variables.

In the process, we become more mindful of the basis or assumptions on which we make our selection, of the fact that there is more than one way to approach an evaluation, and that some selection criteria may be more appropriate than others.

A systems approach can make evaluation design choices more conscious and refined.

In the complex systems approach, there is no search for a meta-framework which explains everything, or supersedes all previous ways of doing things. We realize that we *choose* rather than receive our frameworks for collecting and analyzing evaluation data, but also that this choice

need not be arbitrary, or based on unexamined traditions. As a result, we realize that we need to review the status of our chosen evaluation framework (and the framework itself) from time to time.

Our efforts to find evidence of change in CEPA participants and situations, through indicators, are approached as 'snapshots' through which we can possibly map out the territory as best as we can, in the full knowledge that this is not the territory itself. The process is understood as a matter of reducing the complexity of the programme so it can be communicated and discussed.

A systems approach makes use aware of the bigger picture and what we may be missing.

The indicator based picture, while a reduction of complexity, can be filled out through the use of metaphors and imagery (see e.g. the case example of the evaluation of the City of Cape Town's education and training programme, which compared the programme with a tree), and the use of qualitative data, case studies and stories.

This fuller picture is a more comprehensive understanding of the current status and effects of a programme, as a guide for CEPA managers and stakeholders and a learning tool, rather than final 'proof'.

The realization that evaluation findings are only provisional, does not relegate evaluation to being a useless exercise. Rather, it means that we are more motivated to build *ongoing* and longer term evaluation processes into CEPA programmes, so that we can continue to build a fuller picture of them, by changing our scope and focus from time to time. Un-intended outcomes, unexpected results or even negative scenarios are also more likely to find a valid place in the big picture.

A new approach to indicators as guidelines in continuous improvement.

An understanding of complex systems brings with it a new understanding of the role and use of indicators in evaluation. It encourages us to see indicators as guides rather than end goals in themselves. As the systems theorist Paul Cilliers¹¹ put it: *Our indicators serve only as feedback loops*

for us to reflect on the territory and the direction we're heading. Just like a compass and map, they guide us through unknown places.

The choice and use of indicators is critical, if we consider how they can actually determine changes in systems. Another systems thinking pioneer, Donella Meadows¹², explained that indicators arise from values (we measure what we care about) but they also *create* values (we care about what we measure). When indicators are poorly chosen, they can cause problems, as the pursuit of indicators may then steer CEPA processes in the wrong direction.

Say the City of Cape Town's indicator for success of the Green Audit programme was the number of schools who participated in it. If this became the driving force for the implementers, they would be tempted to change the programme so that it does not require students to measure their schools' water and energy consumption and take action to reduce it. They could simply produce and distribute a book on water and energy consumption, and

¹¹ Cilliers. Paul, 1998, *Complexity and Post Modernism*, Routledge, London.

¹² Meadows, Donella, 1998, *Indicators and Information Systems for Sustainable Development*, Report to the Balaton Group, Sustainability Institute, Vermont.

teach a once-off lesson at each school. In the process they could reach more schools, and their indicator would look good. However, they would alter the quality of the learning process, as educational guidelines (see Appendix 3) suggest that meaningful actions are a better opportunity for deeper learning and capacity building, than simply receiving messages.

In a systems approach indicators are not treated as end results, but rather as reflexive points to guide programme implementers. In this instance, if the indicator showed that only few schools participated successfully in the Green Audit programme, the reasons could be explored: Is the programme introduced at the right time of the year? Should it be of longer duration? Does it clash with what schools are already doing? The reason for this clash might be problems in the existing school system that might need to change – for example, the school community's access to information about their actual resource consumption.

Thus the Green Audit programme may *evolve over time*, in response to reflection on indicators, to focus on access to water and energy consumption figures, and focus on systems changes which can give large numbers of residents this access, as the basis for learning and action. The indicator could then be: the number of residents (or school communities) who have access to their consumption figures, and their resources and capacity to utilize these figures for learning and action.

It should be clear from this example that it would be difficult if not impossible to develop generic indicators that can adequately account for all CEPA situations, given their nature as open complex systems. The attention therefore shifts rather to system specific indicator development processes (see Step 6 in Folder 4), as they keep responding to evaluation findings, and are being refined to better attune the CEPA programme to its goals and its context. The more in-depth an evaluation enquiry, the more nuanced these indicators will become.

An *iterative* approach to programme development, implementation and evaluation becomes necessary. Evaluation should be a way of work, the way in which all CEPA initiatives are approached, as a matter of course. Individual initiatives need to be evaluated and refined at regular intervals. Across all the initiatives in a programme, evaluation results should be combined and compared, and their lessons used to refine programmes on an ongoing basis.

A systems approach encourages and allows for continuous improvement.

Complex systems theory encourages the practice of *micro-reflection*. CEPA managers and evaluators can design-in *embedded reflective processes* to provide evaluation insights within a given time-frame. These insights can be applied to

the CEPA programme straight away, for example, re-assessing the conceptual design that was used at the start of the project, checking whether it still holds or whether it needs tweaking. The advantage of such an approach is that it provides opportunity for self-correction in a self-organised 'emergent' process, before a programme strays too far off

course and resources are wasted. These in-built reflection processes can thus save resources. They also create spaces for ‘safe-fail’, small scale experimentation and innovation during the project cycle, without costing too much in terms of resources upfront.

In the adaptive view promoted by complex systems theory, the complexity of context means that social and educational change is typically a journey across shifting ground during which goals become redefined. *In the realm of practice, processes of change often begin by being conceived as linear, and then are subsequently reconceived as non-linear and adaptive, as events unfold. The evaluation design process outlined in Folder 4 is based on this idea.*

A systems approach helps to identify effective intervention points.

Indicators are leverage points in a system (see Appendix 1). Their presence or absence, accuracy or inaccuracy, use or non-use, can change the behaviour of a system, for better or worse. In fact, changing indicators can be one of the most

powerful and at the same time one of the easiest ways of making system changes. It only requires delivering new information to new places¹³.

Systems theory teaches that short, simple feedback loops can significantly affect behaviour change, compared to longer, complicated feedback loops. A long, complicated feedback loop is involved when a student has to make a special effort to take an electricity reading from an inaccessible meter in the basement of the school building, and get a monthly account from the finance officer. An example of a short, simple feedback loop is an electricity usage panel on a cell phone with usage per appliance measured in physical impact or monetary value. Systems theory suggests that the shorter feedback loop of the latter is more likely to influence the system, change behavior and reduce electricity use.

¹³ Ibid