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Presenting author: Karen Shippey

E-mail address: Karen.Shippey@westerncape.gov.za

Company:

Western Cape Government

Department of Environmental Affairs & Development Planning

Chief Directorate: Environmental Sustainability

Country: South Africa

Co-author: Francini van Staden

E-mail address: Francini.VanStaden@westerncape.gov.za

Company:

Western Cape Government

Department of Environmental Affairs & Development Planning

Directorate: Sustainability

Country: South Africa

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ABSTRACT

The past decade has brought unprecedented change to our ecological and natural systems globally. This is experienced differently across the world, but what has become clear is that our urban settlements are ill prepared for the nature and scale of climate change being experienced and the associated severe weather events. In the context of areas which have high Gini coefficients and a low Human Development Index, the transition required comes starkly into focus. This paper explores the socio-economic and socio-ecological shifts needed to embrace resilience in such an urban context. In doing so, it considers the concept of “sufficiency” in the developing world setting and the development targets and goals in the context of ecological overshoot of global resource use.

Transition requires fundamental shifts in approach to citizen expectations, informality and long term urban planning. The current extreme drought being experienced since 2015 in the Western Cape Province of South Africa provides a catalyst for a significant step-change in the urban fabric and social attitudes. The paper explores the premise of how decision making during times of crisis, influences the urban dynamics relating to vulnerability and resilience, opening opportunities for fundamental shifts in approach. This transition is especially relevant as the targets of the Sustainable Development Goals struggle to find a foothold and relevance with local authorities and communities.

INTRODUCTION

The need for humanity to live sustainably was defined most notably in the 1987 World Commission on Environment and Development's "Our Common Future" report, followed by decades of international debates and agreements that expanded on the common goal of sustainability. As with the goal of humanity being ecologically sustainable, the goal of achieving equity in human rights, was once merely vision. This vision has however transformed the world over time, and today, human rights are tangible and visible, defining contemporary society (Lauren 2011). Harvard Psychologist, Prof Stephen Pinker, points out that we are in a time in history of less war, more human rights, less hunger and poverty and more humanism than ever before (Pinker 2018).

This trajectory aiming for sustainable development and human wellbeing culminated in the international adoption of the seventeen Sustainable Development Goals in September 2015. Whilst the Sustainable Development Goals provide a suite of targets it is accepted that these create a desired end state. Actually attaining all of these goals simultaneously in any single community would be the sustainability utopia. The SDGs should shape our desired end point and influence our development approach. Central to the end-goal of humanity living sustainably, is meeting of human needs through the concept developed by Clifton (2010) aptly named "consumptive sufficiency".

Despite significant progress towards social-wellbeing or 'social sustainability', the gap in resource consumption is worsening and causing our natural systems to be falling into deficit since resources used in one year take more than one year to replace[1] (Kresge 2015; WEF 2018). The social-ecological systems view accepts that humanity and the natural environment are fundamentally interlinked (Berkes, Colding & Folke 2008). It is a postulation of this paper that combined management and simultaneous solutions to both social and ecological challenges are not only possible but probable when they are managed as a coherent system.

Interestingly Pinker points out that a quirk of human nature is that our assessment of risk and danger is driven by available episodes from memory and not representative data which he refers to as called "the availability bias" (Harvard Gazette 2018). Considering our human propensity for comparing our situation to what is readily available in our personal experiences and reference points, it not surprising that the scientifically and statistically based siren calls for more ecological sustainability are only heeded by the minority. Our human scale experience is that nature will provide if we can only harness its bounty. It can take the experience of the utter failure of an ecological system or experiencing an extreme weather event for any particular community to internalise the inherent risk of our consumptive behaviours and to value resilience. The most comprehensive experience of scarcity in living memory is the experience in World War II which as Theien (2009) comments is arguably the only experience within living memory of a regime resembling sustainable consumption with most goods being placed under rationing to ensure fairness in distribution and this system being widely socially supported. Cohen (2004) points out how the war-time consumer was above all a citizen, putting social responsibilities first. The adopted thrift was a survival response for the household but also a social value and for many survivors of this period of scarcity, the internalisation of a "waste not-want not" approach was a lifelong value.

During a resource crisis, the need to strengthen the resilience of social, economic and ecological systems becomes self-evident to most communities and individuals. Resilience can be thought of as the ability to “bounce-back” from a setback although recently it is being thought of as the ability to “bounce-forward” (Kresge Foundation 2015) i.e. to a new state which will be more robust than the previous state or condition. Whilst sustainability and resilience are sometimes viewed as synonymous, Barnes and Nel (2017) argue that resilience is a means to achieving sustainability, as well as being a core characteristic of a sustainable system. Since the need for resilience becomes self-evident during times of crisis it presents a unique opportunity for change. The psychology of loss and change plays an important role in the response of communities, households and individuals to a state of disaster or scarcity. The response can be compared to the psychology of loss or grief which was developed into the Kubler-Ross model in the late 1960s (Kubler-Ross 1973).

This paper argues for stepwise advances towards social and environmental justice goals through understanding different stages or curves of change management. It is proposed that these stages can be applied as leverage points transforming a city or community within the framework of our current agreed international vision – namely the Sustainable Development Goals. This paper presents a model of possible pathways towards this end goal, including using large crises for making big societal shifts, but also a cyclical approach to change, with gradual steps towards a changed society. It explores the possibility of this psychologically supported model reducing the time it will take to move people to a societal fabric change.

Pathways to Sustainability or Sufficiency

Huber (2004) highlights that the 1990s conceptualisation of Sustainability included the principles of income distribution, equitable access to resources as well as equitable sharing of environmental burdens and that ‘efficiency’ and ‘sufficiency’ were seen as strategies to achieve this. The concept of sufficiency accepts that there is self-limitation to consumerism in order to better adapt to the natural resource limitations. Whilst much of the sufficiency literature focuses on self-sufficiency as a response to the impact of our modern lives, this raises interesting challenges in an urban environment which is space poor for most citizens. The opportunities for considering economies and efficiencies of scale for certain urban infrastructure, and services, must be balanced with the benefits of decentralisation and self-sufficiency of services to a neighbourhood or household level.

A useful way to consider the ecological impact of lifestyle choices was developed by Ehrlich and Holdren (1971) when they developed the IPAT formula which is as follows:

Ecological Impact =f(Population, Affluence, Technology)

Assuming that population isn’t the core focus of an intervention, it leaves the considerations of affluence and technology as key leverage factors in reducing impact on our environment to a “regenerative state”. Daly (1996), and more recently by Princen (1997, 2003, 2005) expound the principle that if sufficiency is achieved for all critical resources and the associated level is regenerative, then you have reached a state of sustainability. This simple formulation does not however address the important social and intra- or inter- generational injustice considerations of historic overconsumption by those in higher income categories. This is argued by Kenner (2015) to be a critical point in the quest of sustainable

consumption. The IPAT model also doesn't factor in the existence or potential for development of social capital. Social capital is defined by social networks in which reciprocity, trust, and cooperation are core and choices are made for the common good not only individual benefit (Woolcock and Narayan 2000; Häuberer 2011). There has been much debate about this in South Africa with the terms social contract and social compact being used to define collective agreements between social partners in society about how to address major issues that require their collective contribution (NPC 2015). The NPC's Diagnostic Overview Report (2011) explores the aims of a new social compact, and how it can be constructed. Trust, respect, shared responsibility and commitment are central to an effective social compact as it fosters a collaborative approach to problem solving and problem management. The value in creating a new social compact for justice and sustainability is that it satisfies many of the underlying values of justice and sustainability, including stakeholder collaboration around shared goals and visions that inspires responsible yet pioneering leadership.

It is however widely agreed in the social science community that the existence or development of social capital fundamentally changes the potential outcomes of a transaction or interaction and it is therefore postulated that it has a fundamental impact on the possible ecological impact as well. As such, one can reconfigure the IPAT equation explicitly including equity of access to resources and the presence of social capital. Contemplating the nuances of reducing our impact does open a pathway to re-imagining a more equitable resource sharing moving towards the SDGs i.e. – we will have reached an appropriate level of current sustainability and human wellbeing when all people are in a state of sufficiency. The nature of the sustainability or sufficiency may well differ in nature in various places in the world and between communities. As with culture and communities there is no one stable steady state but multiple states which may all exist but may for each community represent sufficiency in that place and at that time. There are multiple pathways to the end-goal of sustainable living and sufficiency as illustrated in Figure 1 below.

Pathways to Sufficiency Model

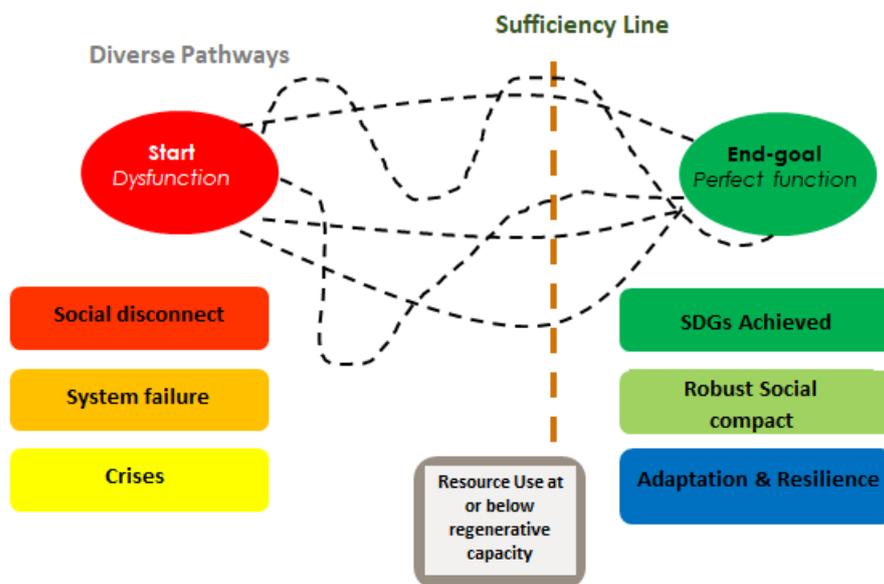


Figure 1: Pathways to Sufficiency

Psychology of crisis and change

Having ascertained the importance of social dynamics in the “state” and impact behaviour of a community it is important to understand the aspects which cause change in behaviour and allow for leverage in moving towards the SDG targets. Social systems, as with most physical systems, require a degree of discomfort or push factors to prompt change. Alternatively, the new state needs to offer significant benefits to the individual or the group. As such there is a degree of “activation energy” required either through discomfort or promise of improvement needed to stimulate change. It is postulated that a negative stimulus in a social or community such as that caused by resource scarcity, triggers a sense of loss or de facto grief and that the individual or the group undertakes a journey to reach a new internalised “way of being” with the reduced resource availability. The group may also re-evaluate personal risk and vulnerability because of such an experience and determine new life long values such as was the case with those who lived through a World War.

In projecting societal shifts, cues can be taken from the ‘Kubler-Ross Change Curve’ (Kubler-Ross 1973) originally developed as the stages of grief. This work was later adapted by authors such as Kotter (1995), Hiatt and Creasy (2018) for the theory of organisational change management. Creasy (2007) defines change as a reaction to an opportunity, challenge or an event that sets in motion the path for change. This strongly resembles the discussion earlier of resilience and the ability to “bounce forward” to a stronger position after a challenge or crisis. Figure 2 illustrates the linkage between ‘Kubler-Ross Change Curve’ and the change management theory which is currently pervasive in business management.

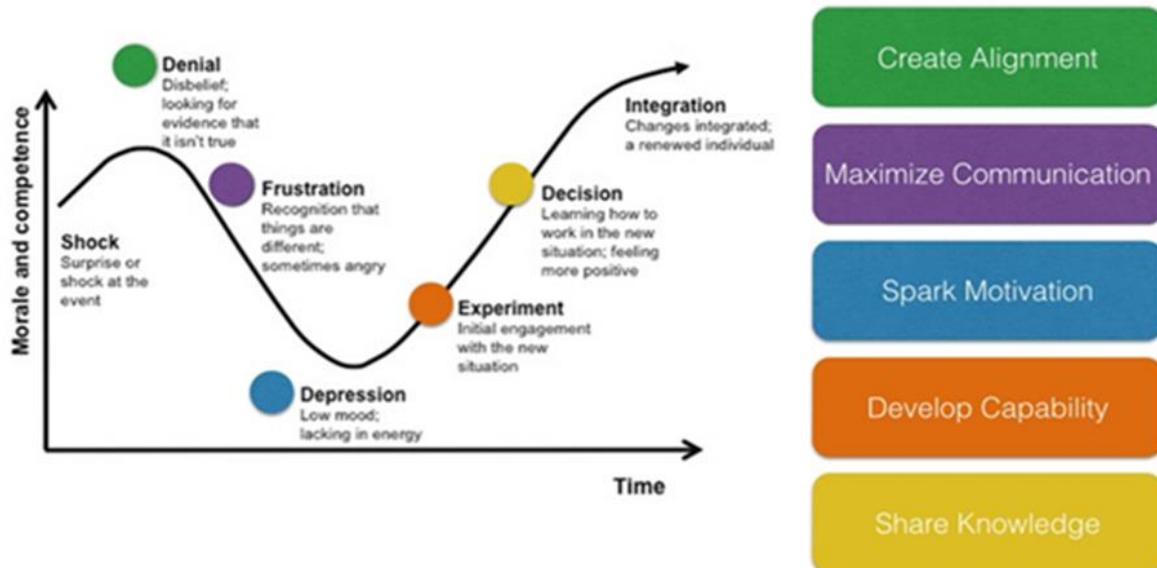


Figure 2: Kubler-Ross Change Curve adapted for change management adapted by Little (2014)

Leading from knowledge on sufficiency and the barriers to societal change, it is our supposition that this “curve” or stages to change can effectively be applied to understand leverage points which can ensure movement of a community or city towards the desired SDG targeted end state. We further suggest that resource crises intensify the change possibilities experienced and should be utilised to increase progress towards sufficiency and equity. It is further recognised that each path of change will be contextual, and should

therefore be approached with flexibility for adapting to the local socio-ecological contexts. The authors termed this approach the Socio-ecological Sufficiency Model.

With context multiplicity and flexibility to needs, there are however eight key change management stages (adapted from Kotter, 1995) that are central to the model and the five stages shown in the adaptation on Figure 2:

Table 1: Steps of the Change Management Process

Kotter 8 Steps of Change Management (1995)	Adapted from Little (2014) and Potier (2016)
<ol style="list-style-type: none"> 1. Create a sense of urgency 2. Create a guiding coalition. 	<p>Create Awareness/ alignment</p> <ol style="list-style-type: none"> 1. Ensure awareness by all of the resource challenge/shortage
<ol style="list-style-type: none"> 3. Create a vision for change. 4. Communicate the vision. 	<p>Maximise communication</p> <ol style="list-style-type: none"> 2. Communicate the resource challenge/shortage and timeframes and related actions.
<ol style="list-style-type: none"> 5. Remove obstacles. 6. Create short-term wins. 	<p>Spark Motivation & Understanding</p> <ol style="list-style-type: none"> 3. Build understanding of the potential benefits of changing use patterns, technologies —<i>why</i> the new technology or process <i>needed</i>.
<ol style="list-style-type: none"> 7. Consolidate improvements 	<p>Develop Capability & Ownership:</p> <ol style="list-style-type: none"> 4. Create ownership of the change, so citizens feel included and are eager for adoption of the new or updated processes and technologies.
<ol style="list-style-type: none"> 8. Anchor the changes 	<p>Share Knowledge & Commitment:</p> <ol style="list-style-type: none"> 5. Generate higher morale and increased commitment from all groups in consistently using a new technology, system and/or process.

It is emphasised in change management theory that the human process of obtaining support, endorsement and acceptance is critical for any long term adjustment. The Consulta Paragon website says that otherwise, the moment conditions become more favorable old patterns will re-emerge. To illustrate the Socio-ecological Sufficiency Model we consider two recent examples within the Western Cape Province of South Africa.

Case study 1: Cape Town 2015-2018 Water Crisis Response

In South Africa, municipal service systems struggle to service the population equally and to a reasonable level. The demand on the existing system has in general overtaken the systems design capacity and difficult fiscal environments mean that maintenance and replacement schedules suffer and there is an overall deterioration in service provision over time. The

South African National Planning Commission's Diagnostic Overview (2015) identified the country's socio-economic obstacles as barriers to South Africa's development path. These included the following key issues

- infrastructure is poorly located,
- inadequate and under-maintained,
- spatial divides hobble inclusive development,
- the economy is unsustainably resource intensive and
- public services are uneven and often of poor quality.

These factors remain core challenges to social justice and urban resilience as the low income and marginalised communities face a higher proportion of the societal and economic burden of this inequity (Chan 2012). Similarly, the current drought experienced by the City of Cape Town, the worst in the city's recorded history and currently in the fourth consecutive year of poor rainfall on which its municipal water supply depends, has shown to create patterns of 'water poverty' where high income groups buy in alternatives where low income groups are not able to. Crisis is therefore closely linked to social justice which makes social justice a critical factor to decision-making in times of crisis.

The City is globally recognised for its progressive efforts in the fields of energy efficiency, climate change, green bonds and water loss prevention in the reticulation system. The municipal financial sustainability is directly linked to the ability to sell water and electricity to citizens at a marked up price and cross-subsidise both indigent users of municipal services and non-revenue activities such as parks and recreation. This finance model has dominated the debate around water and energy efficiency for the past decade making it extremely difficult to change policy or practice to encourage or even require decentralised systems which would allow for increased resilience in the city's services.

It took an energy crisis in 2005- 2007 and the current 2015-2018 drought to shift the stance of the municipality to embrace more diversified approaches to these services. An example that illustrates that when disaster strikes and systems fail, it presents very specific opportunities that must be recognised beyond the immediate disaster management. The city's water bylaw is not only recovering from the current disaster but moving society and the city's structural management model forward towards long-term change and urban resilience.

Prior to the current drought, the Water Bylaw was driven by legal risk, public health, technical functionality and revenue protection. The 2010 Water Bylaw focussed on ensuring connections for water services and waste water utilised only the municipal services and making any other approach to on-site treatment, stormwater harvesting, use of greywater or dual reticulation extremely onerous to undertake legally.

As the drought become more intense in 2017, the need to drive down daily demand for the City's municipal water supply overcame other considerations such as revenue protection. The drought restrictions introduced started to recommend new behaviours which technically were not allowable under the water bylaw. This included such practices as utilising rainwater and greywater for flushing of toilets. This fundamental dilemma of resource limitation caused a rapid review and update of the bylaw to be undertaken in a matter of months.

The proposed new bylaw¹ included features such as increased required on-site storage, mandatory rainwater and stormwater harvesting, dual reticulation and colour coding for on-site greywater reuse and compulsory sub-metering for complexes and sub-units of buildings. These provisions had been mooted by environmentalists for years but it was only when the severe shortage of the resource was experienced that these adaptation approaches were internalised as standard for upgrades and new buildings which will move the city as a whole to a higher level of practical resilience overall which was not achieved prior to this crisis.

A key learning point in this case, was that due to the nature of the engagement and the need to rewrite policy quickly, once the drought had reached a critical stage, the proponents of sustainability had to have documented evidence for their policy proposals. Despite the urgency of the drought, the autocrats would not affect changes which were unproven and hence all new approaches or inclusions needed to have documented success elsewhere in the world or through previous local research before being incorporated into the bylaw update.

So whilst the water scarcity experienced in the drought triggered the appropriate lever for change for increased resilience and towards lower resource utilisation, practitioners needed to be ready and prepared for these changes with evidence-based policy suggestions and ensure the approaches and technologies proposed were “adoption ready”.

This can be seen as a direct stimulation of a change process and the relevant adaptation of the population to new situation of less water availability and changed rules around usage. As such it shows the features of the proposed Socio-ecological Model and this is illustrated in Figure 3 below.

¹ [At the time of presenting this paper \(May 2018\) this bylaw has not yet been adopted by the Cape Town City Council](#)

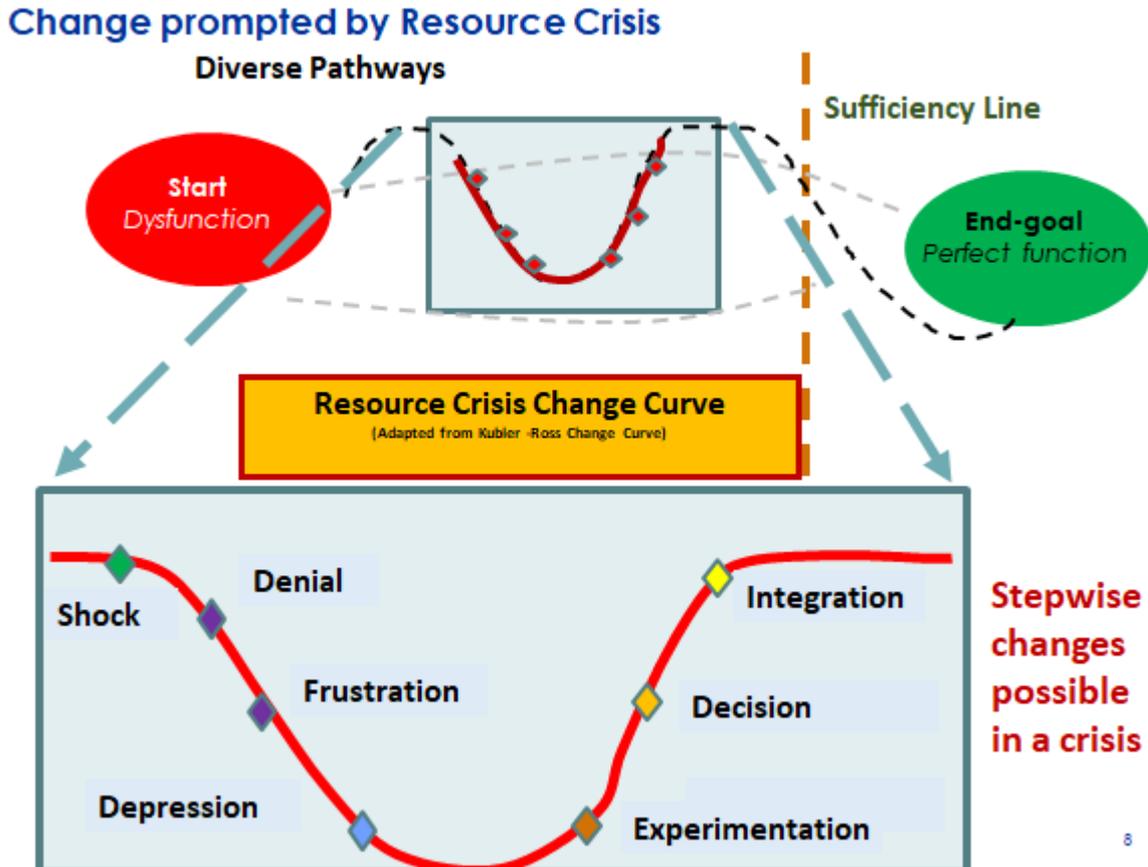


Figure 3: Behaviour and Resource utilisation change prompted by resource crisis

Case 2: Feasibility Study for Alternative and Sustainable Infrastructure and Services for Settlements

The *Feasibility Study for Alternative and Sustainable Infrastructure and Services for Settlements* (WC DEA&DP, 2017) which we will refer to as the “Feasibility Study” was undertaken to provide an evidence base for benefits and risks of the use of “alternative, resource-efficient and decentralised services solutions in social housing. Key aspects analysed included resource efficient technologies, design for non-motorised transport, high-density and multi-use buildings, settlements with employment opportunities and high community safety, and settlements that are supported by urban agriculture.

As summarised in Shippey et al (2018), the Feasibility Study developed two development concepts for each site - the Business as Usual (‘BAU’) and Sustainable Infrastructure interventions concept. This allowed each site to be compared from an efficiency, functionality and, financial perspective. The BAU scenario used the most recent affordable housing development approach and costing in the Municipality to mimic the unaltered application of previous designs, layout and infrastructure provisioning. The Sustainable Infrastructure development concepts were developed through a design-led thinking process attempting to envision what a future could look like from a sustainable and resilient spatial and infrastructure response point of view. It was intended that the Sustainable Infrastructure would ‘challenge’ the BAU in application to the two development sites.

A systematic approach to understanding the various opportunities and constraints associated with each technology alternative were adopted. The criteria used included the following:

- Technical Feasibility
- Sufficient densities for scalability (design envelopes)
- Operation and maintenance requirements, including low, medium or high skill
- Environmental and human health risk associated with failure
- Utility demand reduction
- Existing evidence and implementation
- Local Product certification/quality standard
- Cost (CAPEX and OPEX)
- Site specific conditions (e.g. solar exposure, average wind exposure etc.)

Seven areas were selected to be reviewed for reliable and cost-effective alternatives based on the 2015 market and availability. These service areas included water supply, sanitation, stormwater, energy, transport and roads, waste and top structures (buildings). Based on these interventions, the most direct resource savings are therefore anticipated in water and energy specifically. Water utilisation achieved an 88% reduction of anticipated requirement and electricity 60% reduction of requirement. Not only does this have direct impacts on the household expenditure for these services but also the required scale of service provisions which need to be made within the centralised systems of the Municipalities. Whilst the study was a success in showing that sustainable infrastructure in the long terms is cost effective and technically feasible it highlighted two critical areas for future work namely funding for the upfront capital expenditure and the options for funding models and the need for a more developed and stable social compact with households in order to ensure that the required regular maintenance and refurbishment of renewable and decentralised systems occurs and is funded by the households as required to maintain services.

In the developing country context, upfront expenditure is typically not available. This can however be overcome through innovative financing models such as introducing an element of private sector funding either through impact investment schemes or fulfilling the social and environmental obligations for retirement funds². Establishing the social compact is perhaps the more contentious barrier that has to be overcome. The new social compact as described by the National Planning Commission and the outcome of the Sustainable Settlements study critically links ownership culture to the general disconnect between state, society and environment.

At the time of publishing the two concept designs in Mossel Bay and Malmesbury have not yet been implemented although elements of the feasibility have been incorporated into the social housing planning in both municipalities. The policy evidence and cost benefit analysis has been provided but it was acknowledged by officials involved in the study that the social acceptance of decentralised and alternative infrastructure is low due to the fact that middle and upper class households have not widely adopted such technologies in the area. “Activation energy” is lacking to break the comfort of the BAU model.

What may be required is a more stepwise approach to achieving a shift towards sustainable and greener infrastructure without a catastrophic disaster to prompt the disruptive scarcity

noted in the first case. It is proposed therefore that a series of smaller nudges could produce the same long term outcome although it would require concerted effort to ensure stakeholder acceptance and recognition that stakeholders would be moving through the psychological change process continuously which is likely to require considerable commitment by local authorities and politicians. This incremental change is illustrated as Figure 4 below.

Incremental change possible in non – crisis situation

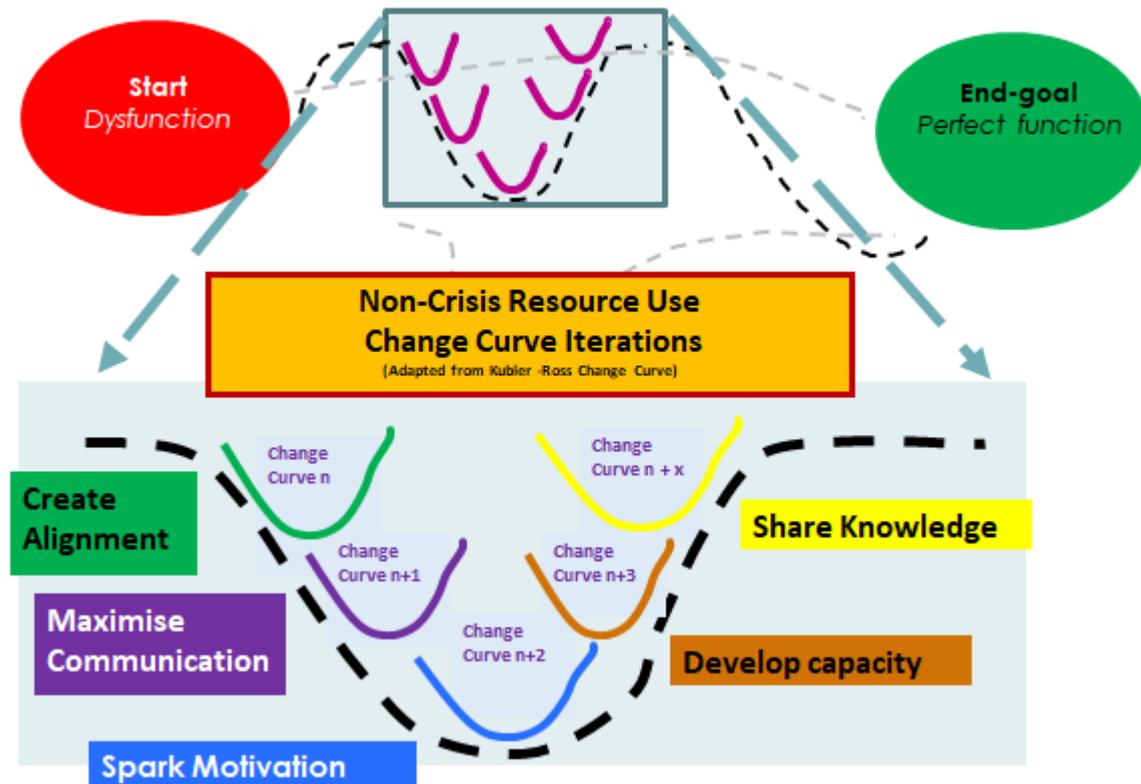


Figure 4: Behaviour and Resource utilisation change prompted by multiple interventions in a non-crisis scenario

DISCUSSION

Each case study illustrates entirely different change leverage contexts, albeit towards the same end-goal of sustainable livelihoods. Different challenges have set in motion paths for sustainability change. Barriers to change were different in each case, and so were the responses and reactions to change opportunities. This clearly illustrates that the model's curves are contextual to the spatio-temporal circumstances.

Although both case studies effectively illustrate movement towards the desired SDG targeted end-state, a critical resource scarcity intensified the positive progress towards the desired end-goal. A resource crisis can be harnessed as activation energy, but in other cases such as the Feasibility Study, activation energy may not be as pronounced. It implies that activation energy must be harnessed differently to ensure that triggering of change motivation carries the societal shift through the change pathway.

In integrating the two cases studies with the Socio-ecological Sufficiency Model, it confirms that societal change requires a driver to shift the status quo. The Feasibility Study was

initiated in 2014, research was delivered by 2016 and shared with authority stakeholders in 2017. Although sustainability recommendations are well-received, there is currently still a lack of 'buy in' to the feasible sustainability solutions. However, in the CCT water by-law case, commitment to adopting and implementing change was achieved in less than a year. This is perhaps not surprising as disasters trigger awareness and understanding for change at all levels of society – from neighbourhoods to political decision-makers. People become more open to design, system, technology and behaviour changes that can lead to system changes - the very changes that are explored in this Socio-ecological Sufficiency Model. This returns to the question - what happens after the 'awareness stage' to bounce change motivation forward to change adoption and commitment, especially where there is no crisis to drive such this process?

Waiting for a crisis to drive change is not a solution. However, we can use the same thinking and psychology of crisis-driven change to bounce forward cases such as the Feasibility Study. The 'people' element is proposed as being crucial; as a crisis can be harnessed, so can society be harnessed in a much more focused way. The shortcomings of the awareness phase to drive change forward must however be recognised. Following awareness and understanding stages, which the Feasibility Study has clearly passed, change must be internalised to adoption and commitment. It is also a very likely reason why sustainability programmes fail - awareness and understanding are generated, but there is a lack of financial buy-in or the urgency of a crisis is lacking. When there is no 'change at all cost', the change motivation quickly disappears.

Analysing the case studies positioned us to make the argument: future-plotting that is underpinned by research is critical and needed when the opportunity comes to shift society. It also illustrates that activation energy is not all encompassing; societal shift is a change process with cycles, barriers and time implications. It does however clearly demonstrate that to achieve sustainable livelihoods, digging deeper than activation and awareness are key to success. Triggers are needed, but shifting society cannot be dependent on legislation, policies or even crises. But society can be guided when opportunities become aligned. Shifting society is complex; there is no linear or straight pathway. Shifting society can be expected to go through vertical and horizontal cycles, each uniquely influenced by socio-ecological contexts. Ignoring these contexts, and specifically, the deeply ingrained social element, is surely to delay the transition process significantly.

The aforementioned cases indicate two key points for transitioning society towards sufficiency: the social compact must be strengthened and specific opportunities must be harnessed beyond immediate recovery from disasters. Although activation energy is found in times of crisis, "changing at all cost" is not necessarily considered successful in changing the fabric of the system if it does not strengthen the social compact. This is also seen in other world regions, such as the Australian 'Millennium Drought'. Authorities implemented community-dictated water restrictions, as opposed to the typical economic intervention which would have resulted in water price increases. Community opinion indicated that equitable sharing of the responsibility or 'burden' of the drought was more appropriate, and this is a change implemented that strengthened the social compact.

Change that moves community forward towards the desired end-goal as well as simultaneously strengthen the social compact come together at the 'sufficiency line' of the

Socio-ecological Sufficiency Model. Here it is recognised that social justice does not mean abundance for those in society who can afford it, but sufficient resources for all. It illustrates that the 'cost sensible' option to change is no longer always the preferred or ideal solution if the goal is to change the fabric of society and to change the way resources are considered and consumed.

RELEVANCY TO IMPACT ASSESSMENT

If learning and commitment to societal change are to continue in post-crisis times, adapting our language will be evident of taking such learnings forward. There are many examples of this, where terminology and language become accepted and standard-practice post-crisis times. It is only in recent times with the effects of climate change and planetary boundaries coming urgently to our attention, that terminology such as 'security', 'sufficiency' and 'resilience' are becoming common language. This links to economic growth and development – in the coming post-crisis time, our understanding should not merely remain with new terminology that has now taken a deep hold in our understanding of post-crisis or 'new normal', which again, will not bring authentic change to the societal fabric. It is therefore important that new terminology and the concepts that it embraces, be evident in socio-economic development and projects. It is here that the environmental impact assessment (EIA) fraternity has a key role to play. Through best-practice, stakeholder collaboration and EIA decision-making, these new understandings must flow over to practice. Every single project must have a tangible link to shifting society towards the end-goal of a sustainable livelihood for humanity.

CONCLUSION & RECOMMENDATIONS

Within the framework of the Socio-ecological Sufficiency Model, it has been demonstrated that there are multiple pathways to sufficiency, including normal and slower incremental cycles, as well as faster crisis cycles. Whichever pathway, understanding and committing to social fabric change remain critical. This can only be achieved by understanding the dynamics of societal change, and how it plays out at the level of the individual.

Combining the psychology of crisis and change learnings with the two case studies, it appears that there is a strong emotional component linked to change. Sudden scarcity equates to loss for the individual, and therefore for society as a whole. Although scarcity may be equally experienced, sufficiency may look and feel different for different spatio-temporal and cultural contexts. Working with these elements combined, are crucial for creating capability and knowledge to forward the change pathway, beyond the change activation energy.

It is concluded that sufficiency can be brought about by crisis. Society can reach sufficiency either through stepwise change when crisis strikes, but this must be underpinned by awareness and understanding of the emotional process that accompanies crisis-driven change. It responds to the age-old adage of never wasting a good crisis and it becomes particularly meaningful when the activation energy of a crisis is understood. It is not an easy pathway to change and although it has the potential to build new lifelong value systems (essentially societal shifts) it remains a painful process for society. A better way to transition is through gradual acceptance of common socio-ecological good. This can be supported by

research-induced readiness for change as per the Feasibility Study details, before or entirely independent of crisis events.

What has also been found is that in times of scarcity, inequality is several exacerbated. A key part of sufficiency is balancing the 'access books'. This extends to the social compact; a sense of responsibility and ownership is key to achieving sufficiency across society. Where there is a lack of taking up this ownership and responsibility, pockets of communities or even individuals will become a liability to the sufficiency state.

Transition to sustainable livelihoods have long passed the awareness and understanding stages of the Socio-ecological Sufficiency Model of change presented in this paper. What is required now is the support society through the change pathway: through the loss, reimagining of a new state and acceptance. It requires the industry and practitioners to adopt change management strategies that are deeply embedded in the social element. A critical recommendation from this study is to recognise the common thread of environmental impact, social inequality, behaviour science and disaster management as collectively and in a trans-disciplinary sense; it provides knowledge, insight and tools to guide society in the change process towards sufficiency. As a Nigerian proverb summarises - "in the moment of crisis the wise build bridges and the foolish build walls."

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[1] In 2017, the global Earth Overshoot Day –was the earliest date yet. In 1987, the annual Earth Overshoot Day was recorded for 19 December but in 2017, overshoot was reached by 2 August.

[2] In South Africa, Regulation 28 of the Pension Fund Act requires the consideration of environmental, social and governance (ESG) aspects as part of the investment process.

* Corresponding author. Tel.: +27 21 483 0776; fax: +27 21 483 3093.
E-mail address: Karen.shippey@westerncape.gov.za.