Stop going around in circles: towards a reconceptualisation of disaster risk management phases

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Stop going around in circles: Towards a reconceptualisation of disaster risk management phases

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ABSTRACT

Purpose: The way that disasters are managed, or indeed mis-managed, is often represented diagrammatically as a 'disaster cycle'. The cyclical aspects of the disaster (risk) management concept, comprised of numerous operational phases, have in recent years been criticised for conceptualising and representing disasters in an overly simplistic way that typically starts with a disaster 'event' - and subsequently leads onto yet another disaster. Such cyclical thinking has been proven to not be very useful for the complexities associated with understanding disasters and their risks.

Design/methodology/approach: This is a conceptual paper developed, through a review of the literature and discussions between the authors, as a counterpoint to the pervasive 'disaster cycle'.

Findings: The 'Disaster Risk Management (DRM) Helix' is presented as an alternative way of conceptualising the DRM phases. The helictical conceptualisation of DRM phases presented in this paper is intentionally presented to start a discussion (rather than as an end point) on how best to move away from the constraints of the 'disaster cycle'.

Originality: It is envisaged that the helictical conceptualisation of DRM can be suitably malleable to include important factors such as temporal considerations and the underlying root causes that create differential levels of vulnerability. It is thus the intention that the DRM Helix can provide a catalyst for exciting discussions and future adaptations of the diagram that can better capture the dynamic (non-cyclical) nature of disasters and their root causes.

Keywords: Disaster, risk, management, cycle, phases, helix

Stop going around in circles. Towards a reconceptualisation of disaster risk management phases

INTRODUCTION

Many academic and practitioner focused publications that discuss how disasters can be better managed refer to the concept of the 'disaster cycle', the 'disaster management cycle' or even the 'disaster risk management cycle'. The 'cycle', as the name suggests, implies a cyclical process of activities which invariably involves a disaster 'event',[1] along with efforts to reduce disaster impacts and disaster risks as well as responding to disasters if they occur. The cyclical aspects of the disaster management concept (comprised of numerous operational phases) has in recent years been criticised for conceptualising disasters in an overly simplistic way that typically starts with a disaster 'event' and ends with another disaster (Bosher & Chmutina 2017; Aubrecht *et al.* 2013; Bosher 2005), (see Figure 1). US comedian Jon Stewart, famously highlighted this issue after Hurricane Katrina affected New Orleans in 2005 when he commented on the 'disaster cycle' diagram (similar to that shown in Figure 1) used by FEMA; stating *"This chart clearly depicting the agencies' responsibilities in the event of a disaster.... It begins with a response to a disaster, leads to recovery, mitigation, risk reduction, prevention, preparedness…….. and ends up back in disaster! In truth, FEMA did exactly what they said they were going to do."* (Stewart 2005).

Figure 1: Typical representation of the disaster management cycle (Water Symposium of Florida 2021)

Studies and debates on the various phases[2] of disasters go back as far as the 1920s (Neal 1997; Coetzee & Van Niekerk 2012). Thus, for nearly over a century, both scholars and practitioners within the field of humanitarian response and disaster studies have used categories relating to the various phases of disaster management to understand their field of study as well as to improve their response to disasters more effectively (Neal 1997). However, the keyword of note here is 'response', as the operational approaches to disaster management were at the time primarily focused on response and relief efforts following disasters and less concerned about risk reduction measures (Lewis *et al.* 1976; Twigg 2004; UNISDR 2004; Coetzee & Van Niekerk 2012).

The 1970s, witnessed an increase in disasters that caused deaths and greater economic losses than in previous decades (Wisner *et al.* 2004; Miller *et al.* 2008). This increase in disastrous 'events' fomented a heightened awareness of needing to move away from what had been an overly reactive (response and hazards focused) view of disaster management towards a disaster risk management approach that suitably considers pre-disaster risk reduction activities (Bosher 2008). Studies on disaster sociology have also highlighted nuanced social, political and economic influences on the root causes of disasters. For instance, critical (non-hazardcentric) roles of how hazards become disasters have been highlighted, such as due to the uneven distribution of resources (Adger 2000), the differing strength and breadth of available networks (Blaikie *et al.* 1994; Aldrich 2012), mechanisms of exclusion and inclusion (Cutter *et al.* 2003), mobility (Adger 2000), caste (Bosher *et al.* 2007), gender identity and status (Enarson and Chakrabarti 2009; Fordham 2008; Krishnaraj 1997), plus language and property laws (Berkes, Folke and Colding 2000).

However, despite these changes in thinking, the concept of the 'disaster (risk) management cycle' has persisted and thus has continued to embed an overly simplistic cyclical appreciation of how disasters (and risks) should be managed. This is not the first publication to question the validity of the disaster management cycle (Bosher 2005; Aubrecht *et al.* 2013; Bosher & Chmutina 2017) but in this paper we endeavour to present an alternative way of conceptualising the Disaster Risk Management (DRM) processes in a way that can be suitably malleable to factor in important aspects (such as temporal aspects) and better consider the underlying root causes that create differential levels of vulnerability.

The disaster (risk) management merry-go-round

Many documents and publications referring to how disasters can be managed mention the 'disaster (management) cycle', a version of which is shown in Figure 2 (Bosher & Chmutina 2017). The cycle typically includes a disaster 'event' that is then followed by relief/rehabiliation activies, then reconstruction and hazard mitigation, and emergency preparedness; but then these phases are followed by yet another disaster. This implies a cyclical process of actions which always involves a disaster (and efforts to reduce disaster potential and disaster impacts) but results in yet another disaster. This may actually be a honest reflection of how disasters are often mis-managed and re-created, but of course a new way of thinking about the non-cyclical aspects of disaster risk management would be helpful to policy makers, practitioners, researchers and students alike.

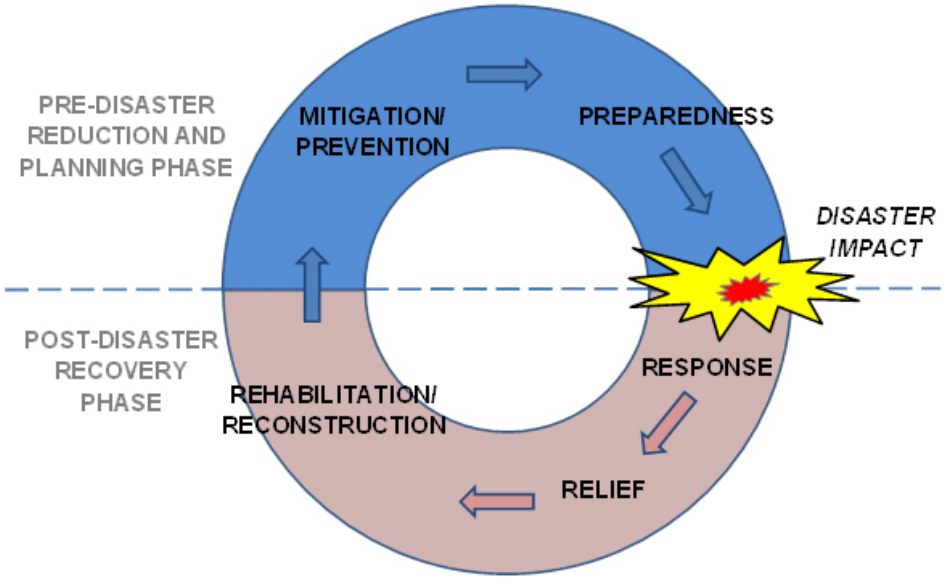

Figure 2: The disaster (risk) management cycle (and typical phases it is composed of) (Bosher & Chmutina 2017)

The cyclical (wheel-shape model) is also considered by Nojavan *et al.* (2018) in their review of 'disaster management models' as a processing operational model because it inclues factors/stages such as prevention, response, and reconstruction. While there have been numerous iterations of the cyclical model of 'disaster (risk) management, Nojavan *et al.* (2018) observe that Cuny (1998) proposed what turned out to be a highly adopted cycle for disaster management that considered the key required management and executive actions that need to be carried out in the course of a disaster. However, it should be noted that there is no real agreement between scholars and practitioners within the field of disaster studies on when the disaster cycle first appeared (Wisner, 2007).[3]

Nonethless, the problem with the disaster cycle from a holistic DRM perspective is that the disasterous 'event' is ever present as it starts/ends the cycle of phases. Ideally, effective DRM (where risk reduciton measures are suitably taken on board) would result in the elimination of a disasterous 'event' as it would address not only the physical manifestation of a disaster 'event' but its systemic root causes; or at least lead to a future disaster that causes significantly less losses/impacts than previous disasters (due to decreasing exposure and increasing capacities brought about by the risk reduction measures).

The phases

According to Alexander (2002) in 'Principles of Emergency Planning and Management', disaster management could be divided into pre- and post- disaster containing of four phases: Mitigation, Preparedness, Response/Relief, and Recovery:

Pre-disaster phases

- *Mitigative (Preventative) Adaptations* - Structural and non-structural measures undertaken to limit the adverse impact of hazards/threats. Ideally this includes the identification of potentially damaging physical processess, phenomenon or human activity (Bosher & Chmutina 2017).
- *Preparedness* - The knowledge and capacities developed by governments, response and recovery organizations, communities and individuals to effectively anticipate, respond to and recover from the impacts of likely, imminent or current disasters (UNDRR 2020).

Post-disaster phases

- *Response*/*Relief* - Actions taken directly before, during or immediately after a disaster in order to save lives, reduce health impacts, ensure public safety and meet the basic subsistence needs of the people affected (UNDRR 2020)
- *Recovery (sometimes called 'recovery and rehabilitation')* - Decisions and actions typically taken after a disaster with a view to restoring or improving the pre-disaster living conditions of the stricken community (Bosher & Chmutina 2017).

In most conceptualisations of the 'disaster cycle', the phases described by Alexander in 2002 (and defined above) have rightly endured (even if the terminology used has not always been consistent) as they align nicely with key operational aspects of DRM. Clearly it has also been noted that these phases are not self-contained phases but in reality are substantially overlapped and interconnected (Neal 1997; Contreras 2016; Aguirre 2018). The South Africa Green Paper on Disaster Management (South Africa 1998) tried to adddress the concurrent activities by proposing an 'Expand-Contract Model' (see Figure 3). In this presentation disaster management is seen as a continuous process, where disasters are managed in a parallel series of acivities. Thus, the situation before or after a disaster will dictate the amount of time and effort needed for effective disaster management aspects. This model therefore acknowledges that certain activities run concurrently and need varied levels of attention and is not contained in individual units.

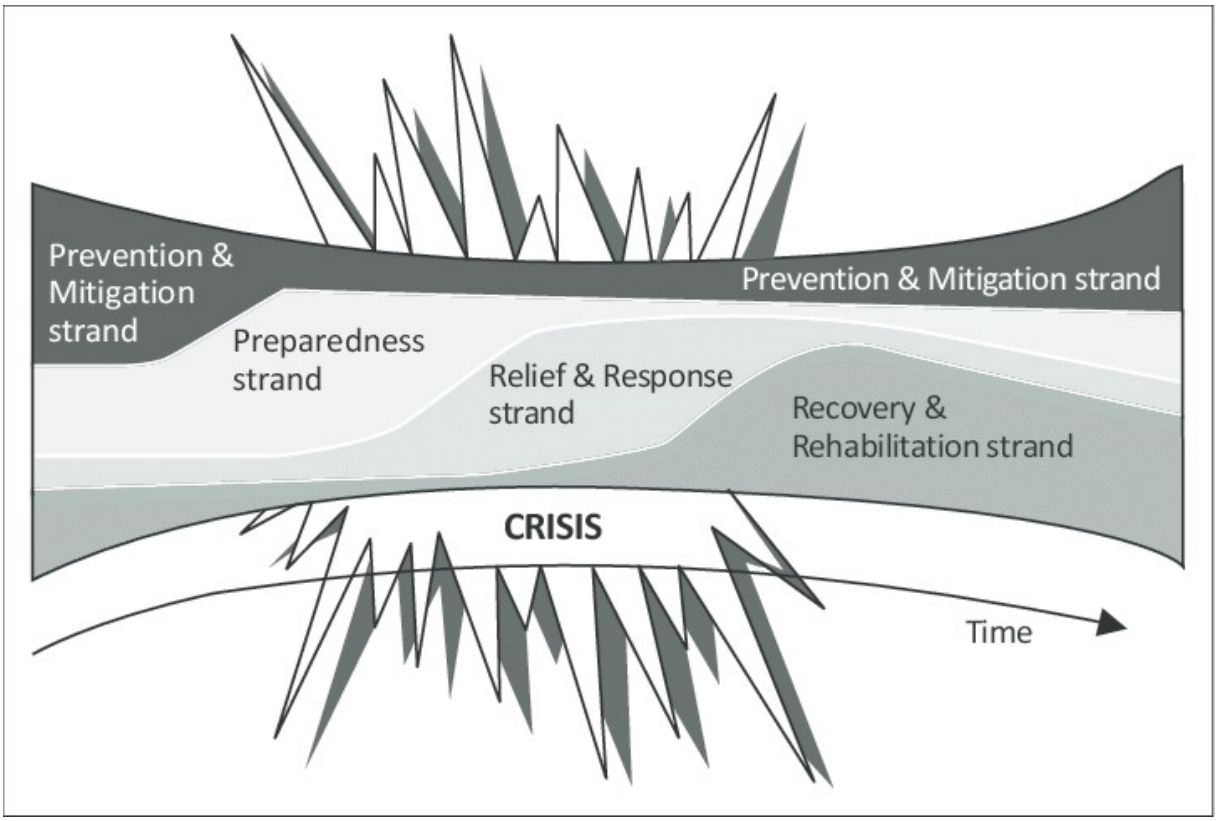

Figure 3: Expand-Contract Model (South Africa 1998)

However, the persistence of the 'disaster cycle' in much of the extant literature has arguably contributed towards a conceptualisation of disasters that undervalues the beneficial impacts of pre-disaster risk reduction activities that are often associated with mitigation (i.e. structural and non-structural risk reduction measures) and preparedness (i.e. emergency planning and capacity building) activities. Moreover, the focus of post-disaster risk reduction activities is also questionable as it often aims to 'build back' – and in recent years, 'build back better' – without addressing the question 'better for whom?' and thus not actually tackling the root causes that turned the hazard into a disaster (Chmutina and Cheek, 2021). The phases therefore tend to frame a disaster as a one-off event and a technocratic problem that can be 'managed' rather than a process that is neither linear nor cyclical but instead multi-dimensional and evolving. Such a linear line of thinking is not surprising considering that in most countries the public sector is responsible for disaster (risk) management.

TOWARDS A NEW CONCEPTUALISATION OF DISASTER RISK MANAGEMENT

It is thus posited that there is a need to move away from the two dimensional and overly simplistic 'disaster cycle', but that this is done in a way where the key phases (which we acknowledge are not always clearly framed and thus invariably overlap with each other) are not only maintained but better represented. A key suggestion is that the management of disasters needs to be conceptualised in a way that takes on board some key principles which can be difficult to represent in the two-dimensional disaster cycle, namely:

a) ***Move away from a closed loop –*** Typically the disaster cycle is presented as a closed loop, which continuously goes around in circles, moving from one disaster phase to another (with little acknowledgement of the overlapping nature of those phases). While the more cynical reader may feel that this cyclical process is an honest reflection on how disasters can often become recurrent 'events', there is a clear need to better factor in other components of DRM that are not merely related to the

phases. For instance, there needs to be scope to include the idea that moving through the phases can include new inputs and activities that may lead to no further disasters. The loop is thus not closed, it is open and moves towards the future.

b) Avoid making the 'disaster event' a key component of the concept (as this is rather defeatist and inaccurate) – The persistence of the 'disaster event' in the 'disaster cycle' is indicative of the enduring legacy of disaster management (rather than disaster risk management), where most activities tended to be biased towards emergency management activities, such as responding to 'events' or at least preparing to respond to 'events'. Surely the key weakness of the 'disaster cycle' as it is often represented, is that the cycle starts/ends in a disaster. This implies that a disaster is required to instigate risk reduction activities (which is not the case) or all the efforts to undertake mitigation and preparedness activities will inevitably end up in another disaster (which should also not be the case).

c) Factor in temporal and resource considerations – The disaster cycle is very two-dimensional conceptualisation that does not factor in temporal aspects or important considerations such as resource needs. There is no way of understanding from the 'disaster cycle' what proportion of resources are being devoted to post-disaster response or rehabilitation (for instance). Indeed, how much time (relatively) is being devoted to these activities and is there scope to integrate hazard mitigation and risk reduction activities into the post-disaster rehabilitation and reconstruction activities, as after all the boundaries between the phases are fuzzy (Contreras 2016).

d) ***Be flexible enough to factor in underlying root causes of vulnerability and drivers of disaster risk –*** In light of the renaissance in debates questioning the use of the highly contested 'natural disasters' term, there has been a burgeoning amount of research published highlighting why the term is such a misnomer (see Smith 2006; Chmutina & Von Meding 2019; Horowitz 2020; Kelman 2020). As Bosher stated (2008:8) "*when disasters are labelled as 'natural disasters' (because of the perception that 'it was nature's fault') it becomes too easy for society, governmental institutions.. to absolve themselves of blame*". Recent discussions, which were significantly influenced by the earlier work of O'Keefe *et al.* (1976), have highlighted that an over focus on disaster 'events' and hazards invariably comes at the cost of properly understanding the deep-rooted causes of vulnerability (Wisner *et al.* 2004) and the socio-economic and political drivers of disaster risk creation (Lewis & Kelman 2012; Wisner & Lavell 2017; Van Riet 2021). The disaster cycle, as typically portrayed, does not provide sufficient scope for important socio-economic and political aspects to be factored into it, thus providing an overly simplistic representation of how disasters are not only managed but how they can be created.

e) ***Acknowledge the role of complex systems –*** Any model which aims to portray the complexity involved in DRM must take cognisance of systems and the complexity in interaction between systems (Coetzee and Van Niekerk 2018). Systems thinking challenges linear cause and effect relationships and aims to better understand different systems' states and system levels. Such an understanding will facilitate adaptive and transformative behaviour which is a hallmark for effective disaster risk management - the ability to change.

THE 'DISASTER RISK MANAGEMENT HELIX'

After years of doodling various diagrams and then reverting back to the drawing board, the idea of the 'helix' emerged in 2005 to provide a basis to develop a conceptual diagram that would better encapsulate more of the important dimensions and factors that the traditional 'disaster cycle' struggles to portray (see *reference removed*). A 'helix' (corkscrew) shaped strand may be a positive way forward as it can be multi-

scalar, uneven, non-repetitive and unstable, while still being a continuous function. In the first instance, the helix would be a single strand helix[4] but there is scope for the helix presented in this paper to ultimately become a double-strand helix, possibly by including the second strand as a representation of sustainable development practices that, for instance, reflect levels of poverty, equity, urban planning, or political freedom. The second strand could thus represent any other processes that create synergies or tensions with the process of DRM.

The idea of representing the phases of disaster (risk) management as a helix is not unique. Aubrecht *et al.* (2013) presented a suitably different helictical vision of disaster management that was primarily focused upon risk and crisis communication through the use of participative stakeholder communication networks. While this was an encouraging move in the right direction for helping to integrate complexities diagrammatically into the concept of DRM and move away from the 'disaster cycle', the idea has not so far gained much traction.[5] This does not however mean we should give up on the idea. Walsh, Adamson and Kelman (2020) investigates the role of disaster memory in Mauritius and how this shapes hazard and risk perceptions. They argue that patterns of memory can be theoretically mapped as a helix. These authors highlight that a three-dimensional helical concept allows for "*partially repetitive patterns…without presenting a false return to an original state*" (Walsh *et al.* 2020:10).

The DRM Helix as illustrated in Figure 4 starts with proactive attempts (blue arrows) to reduce the impact and occurrence of identified threats (a). For illustrative purposes, this may then be followed by a disastrous 'event' (b), the impacts of which have been reduced due to earlier disaster risk reduction activities, which is then followed by post disaster recovery/rehabilitation (red arrows) activities that merge into disaster risk reduction and preparedness activities (blue arrows) with the ultimate result that the impact of the next disaster 'event' is (ideally) significantly reduced (c) and possibly in some cases eliminated (d). An axis for 'Resources/Effort' is included to illustrate that, if DRM is addressed in a sustainable manner, then less resources may be required in the future (as an unspecified period of time) and the period between each 'disaster' occurring will hopefully be significantly extended. The scenario represented in the diagram is not an ideal scenario (where in this case three 'disasters' occur before the threat is significantly reduced); an ideal scenario would require effective DRR that enables us to move from point 'a' on the diagram directly to point 'd' without experiencing (any) more disasters (see Figures 6 and 7 later in this paper for relevant illustrations).

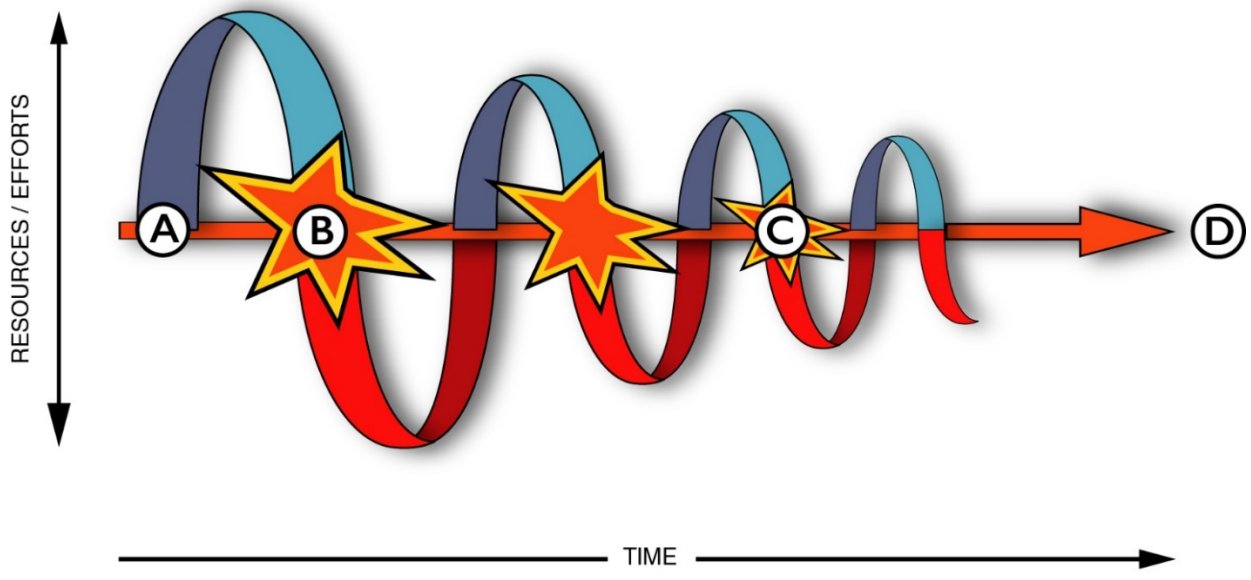

Figure 4: Helix diagram illustrating a reduction of risk over time (due to risk reduction interventions)

Time is factored into the DRM helix along the bottom (x axis) of the diagram but as a 'relative' component and not an absolute measure (i.e. chronometric time of specific intervals or moments measured in days, months, years etc.). The time aspects are relative to the activities being undertaken, so depending on the context, the disasters portrayed in Figure 4 could occur over 1,10 or maybe 100 year timeframes; the key point to reflect upon when using the diagram is whether the disasters reoccur - and if so, do they increase or decrease in impact over time. It would be at the user's discretion if they wished to convert the 'relative' timeline into an 'absolute time scale'. Likewise, for the purposes of this paper, the 'Resources/Efforts' component of Figure 4 (on the y axis) is indicative and used to merely illustrate the extent of resource use over time for specific pre-disaster and post-disaster activities. As with the temporal component, the user would be able to include resources as more defined/quantifiable measures if they found that useful.

Scenarios to illustrate the flexibility of the DRM Helix concept

In an attempt to illustrate the flexibility of the 'DRM helix' concept, this section will use some hypothetical case scenarios to demonstrate how the helix can represent different types of DRM and development contexts and how different scenarios can lead to either a reduction or elimination of disasters or indeed the contrary case where disasters are not eliminated (or maybe even disasters are increased).

Worst case scenario (Figure 5): in this scenario, a disaster leads to resources[6] being devoted to response and recovery – often focusing on a certain (usually more affluent) area affected by a disaster - but not much into risk or vulnerability reduction. This is well illustrated by the situation in Haiti, a country mired in poverty rooted in the heritage of colonial and economic exploitation: the devastating impact of 2010 earthquake is well known, and issues related to land grabbing and market-oriented reconstruction (Petter *et al.* 2020) that may have led to further devastating impacts of the Hurricane Matthew in 2016. This leads to a larger impact 'event' that may be followed by less resources (due to economic constraints) being put into response, recovery and risk reduction activities, thus potentially leading to an even larger 'event' in the future. This scenario is exacerbated by poor building/planning practices leading to risk (re)creation and inadequate support for marginalised sections of society. In essence, this is an overly reactive approach that does not deal with underlying root causes of vulnerability and does not reduce risk creation, leading to frequent high impact disasters.

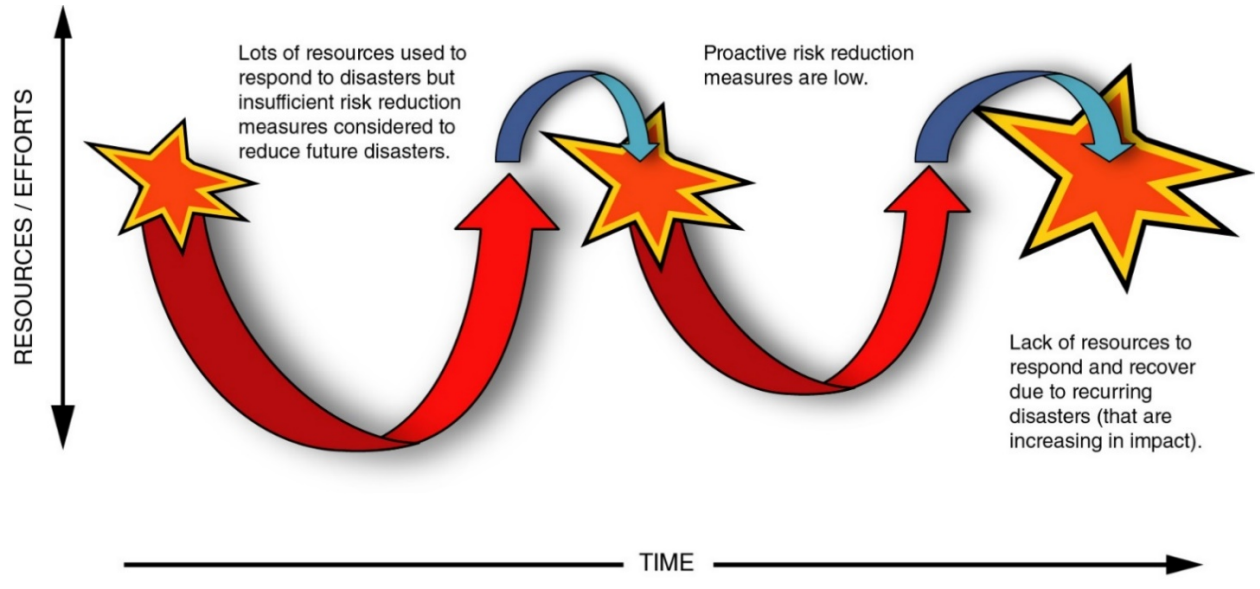

Figure 5: Helix diagram representing a worst case scenario

Note: Red arrows indicate post-disaster phases (relief, response, recovery). Blue arrows indicate pre-disaster (or proactive if no disasters have been experienced) risk reduction activities (i.e. mitigation and preparedness).

Ideal case scenario (Figure 6): in this scenario, there is no disaster. It is the case that sound multi-hazard/threat risk assessments that have been proactively undertaken when developing a location (for example); the risk assessments suggest that risk reduction measures should be taken on board or development in a hazard prone area is not permitted and thus future disasters are avoided or at least minimised. This is an ideal scenario that for the purpose of illustration does not require a disastrous 'event' to initiate any disaster risk management measures and due to suitably informed and well-designed risk reduction measures, disasters are avoided. The main emphasis of this scenario is suitably informed decision making that results in desirable[7] social, physical, economic and environmental development pathways that avoid disaster risk creation.

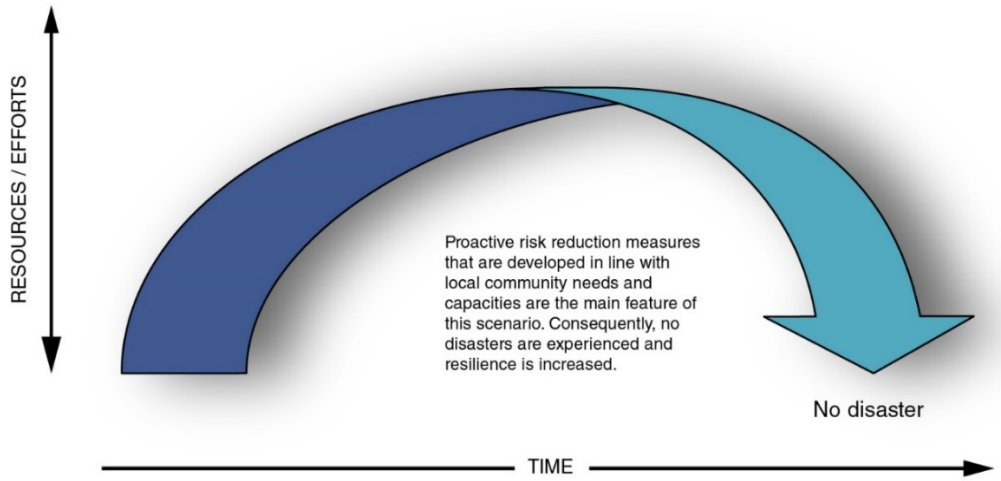

Figure 6: Helix diagram representing an ideal case scenario

Note: Blue arrows indicate pre-disaster (or proactive if no disasters have been experienced) risk reduction activities (i.e. mitigation and preparedness).

Realistic DRM case scenario (Figure 7): This scenario is arguably more realistic because it acknowledges that in most cases disaster risk reduction is not really considered until a disastrous 'event' has already occurred. In this illustration, the disaster does not have a major impact, leading to a relatively small response and recovery activities but also initiating suitably informed (by multi-hazard/threat risk assessments) risk reduction activities (preparedness and mitigation) that have potential to lead to a future of no further disasters.

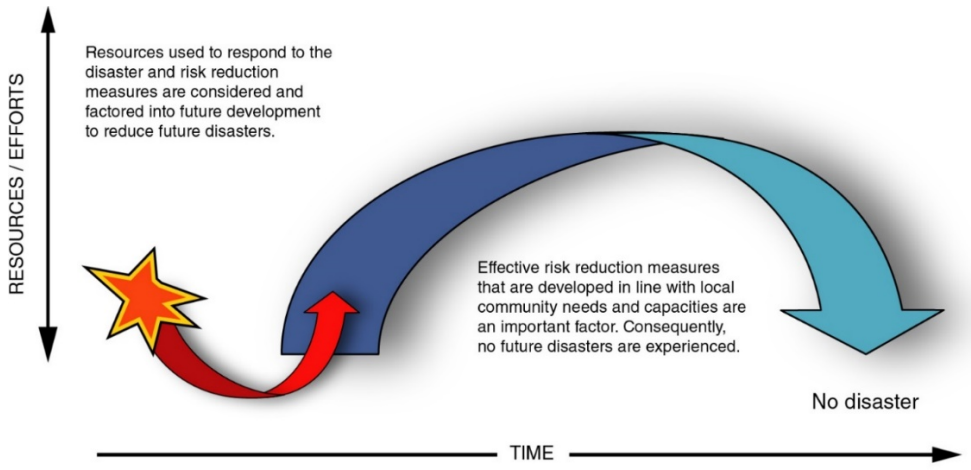

Figure 7: Helix diagram representing a realistic and effective DRM case scenario

Note: Red arrows indicate post-disaster phases (relief, response, recovery). Blue arrows indicate pre-disaster (or proactive if no disasters have been experienced) risk reduction activities (i.e. mitigation and preparedness).

Common case scenario (Figure 8): This scenario illustrates a typical situation where recurring disasters (for instance houses being flooded in known flood prone parts of England, or seasonal cyclones over Madagascar and Mozambique) are not effectively dealt with and the persistence of such 'events' impinges on abilities to respond, recover and reduce risks. This scenario is more akin to the illustration posed by the disaster cycle, where disasters appear at the start and end of the diagram. In these recurring 'events' there tends to be a disproportionate amount of resources and effort spent on responding to disasters and less efforts put into risk reduction activities that can help to reduce the likelihood (or impact) of future disasters. In the context of flooding in England, this case is exemplified by the typical unwillingness of insurance companies to invest in the resilient reinstatement of flood affected properties (i.e. use of resilient materials and property level flood protection measures that can make such properties less likely to be affected by floods in the future). In the case of seasonal cyclones, the nature and impact of the hazard exceeds the available resources in Madagascar and Mozambique. A subsequent hazard - of much less intensity - easily leads to a disaster because most resources have already been exhausted.

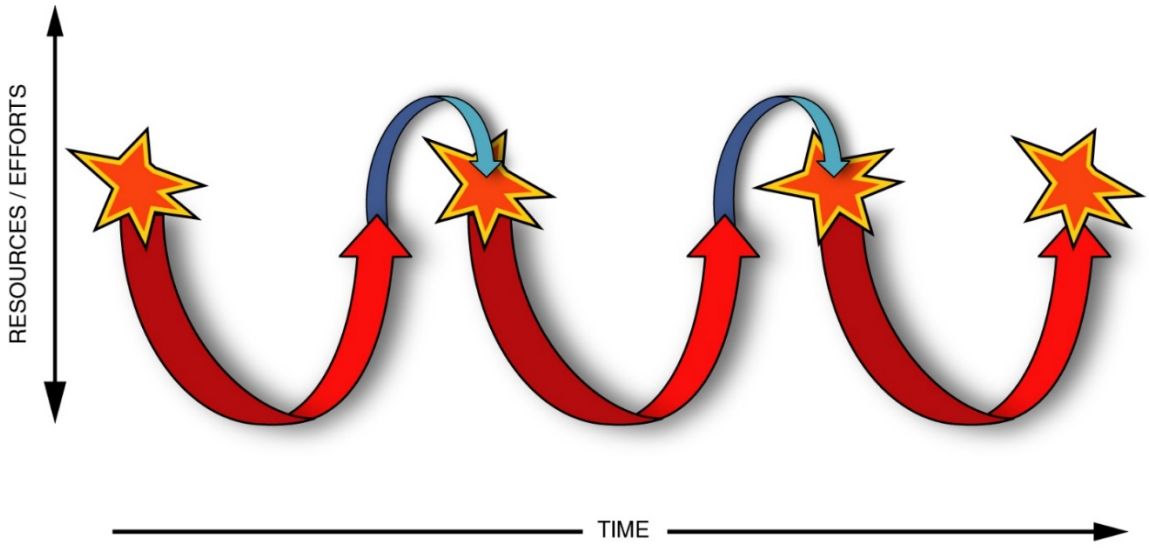

Figure 8: Helix diagram representing a common case scenario

Note: Red arrows indicate post-disaster phases (relief, response, recovery). Blue arrows indicate pre-disaster (or proactive if no disasters have been experienced) risk reduction activities (i.e. mitigation and preparedness).

REFLECTIONS AND SUGGESTIONS TO GENERATE DISCUSSION

The disaster cycle has become an ingrained part of many sectors in governments and remains the de facto model for explaining disaster (risk) management. In proposing a new helictical model, years of accepted truths are challenged and thus it is anticipated that the proposed model could be met with some resistance. However, enough research exists which clearly shows the inadequacies of the disaster cycle that persists in so much teaching and practice. The new model aims to show that disaster risk, vulnerability and hazardous impacts are dynamic processes and the management of disaster risk cannot be limited to merely one event. The DRM Helix visualises the direct link between resources and disasters and in this way acknowledges the fact that disasters are events which exceed coping capacities and resources. Lastly the DRM Helix more explicitly incorporates the temporal aspect of disaster risk (re)creation process.

Whatever, the thoughts the reader has of the helictical conceptualisation of DRM, we are confident that it offers a more dynamic diagrammatic representation of the DRM phases and in doing so provides a basis for some exciting discussions and future adaptations which it is hoped can better capture the dynamic (non-

cyclical) nature of disasters and their root causes. For instance, we feel that the DRM helix could be made into an interactive diagram where the phases and axes can be changed (i.e. contracted or stretched depending on specific scenarios). As suggested earlier, maybe an additional strand can be added to make the single-strand helix presented here into a double-strand or even triple-strand helix (with strands that represent any other processes that can create synergies or tensions with the process of DRM)? The helictical conceptualisation of DRM phases presented in this paper is intentionally positioned as being the start of a discussion (rather than an end point) on how best to move away from the constraints of the 'disaster cycle'.

CONCLUSION

Our understanding and depth of thinking about hazards and risks and how these factors can conspire to result in disasters is constantly evolving and norms are being challenged. The manner in which disasters, their causes and effects are portrayed has evolved over the last century. So too has critical thought into what creates disasters and how the manifestation of risks leads to undesirable outcomes. The 'disaster cycle' is still often used as a representation of the actions leading up to, and following, a disastrous event. Unfortunately, it remains the practitioners and educators of DRM who often still apply the outdated 'disaster cycle' to their training, daily planning and resource allocation. In challenging this 'inevitability' thinking, this paper aimed to provide an alternative representation of the different commonly accepted activities within the DRM realm.

The DRM Helix provides a new way in which DRM can be understood. Instead of linear stop-start activities, the DRM Helix suggests that the actions of DRM must be understood in complex linked systems. Portraying such actions as a helix allows for a heightened understanding of DRM as multi-scalar, uneven, non-repetitive and unstable while still being an unceasing process. The helix furthermore allows for the termination of disaster risk if such risk can be completely reduced. It also allows for an expansion where disaster risk reduction efforts have failed. This alternative way of portraying DRM might lead to a more realistic application of DRM activities in policy and practice.

ACKNOWLEDGEMENTS

In the spirit of what we believe is the need to refresh discussions about alternative ways of conceptualising the DRM phases, the authors wish to acknowledge in advance the important support of the wider 'disaster studies' community in these forthcoming discussions. Finally, we are grateful to Mr Rod Shaw for his graphic design skills that have helped us convert some very rough initial sketches into the Figures 4-8 that are presented in this paper.

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Endnotes

[1] We acknowledge that disasters are not necessarily one-off events framed within a specific timeframe.
[2] The phased aspects of the disaster risk management cycle have also been critiqued (Nojavan *et al*. 2018 provides a useful review and critique of various models) but the specific phases of disasters will not be the focus for this paper. Accordingly, we shall use the commonly used overlapping phases of response, recovery, mitigation and preparedness for illustrative purposes (see Figure 2).
[3] See Coetzee (2010) for an in-depth review of the historical development, implementation and transformation of the Disaster Management Cycle, which argues that the disaster management cycle has its origins in the work of researchers such as Prince (1920), Carr (1932) and Stoddard (1968).
[4] The single-strand helix is in contrast to the double-strand helix structure which is largely associated with the Deoxyribonucleic Acid (DNA) helix.
[5] It is noted that Torqaid’s (2021) ‘DRM Diagrammatic Framework’ illustrates a generic project management cycle and although illustrated as a simple spiral shape, it is still largely presented as, and is indeed called, a ‘cycle’.
[6] ‘Resources’ can take both tangible (i.e. financial costs and amount of built assets) and less tangible forms (i.e. knowledge, human resources and social capacity) and thus can be a difficult variable to accurately quantify.
[7] It is noted that in some countries the promotion of ‘localism’ and getting people to be better prepared does not always ‘build resilience’ because it can be a way of governments abdicating responsibility (through withdrawing funding from local authorities, communities). Thus, there needs to be a balance between people/households/communities being better prepared, but the government still needs to do its part to enable this.