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Learning by doing: Community based landslide risk reduction

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Abstract 'Knowledge into action' and 'community engagement' are terms widely used in disaster risk management. We challenge the efficacy of such advocacy by reviewing knowledge gaps that restrict delivery of landslide mitigation on-the-ground in the most vulnerable communities in developing countries. We outline a holistic strategy which embraces *both* 'action into knowledge' and 'knowledge into action', and which engages all stakeholders throughout implementation cycle. This strategy formed the basis for the development of a community-based landslide risk reduction programme (MoSSaiC – Management of Slope Stability in Communities) in several Eastern Caribbean communities during the period 2005-2011. Outcomes included changes in policy (support for *ex-ante* DRR), new institutional practices (creation of a cross-ministry Government team), enhanced the local skill base (communities learned construction skills) and raised awareness (of landslide 'science' and hazard reduction). Such outcomes support the view that 'learning by doing' offers considerable benefits in the delivery of landslide mitigation measures.

Keywords Urban, Community, Developing Countries, Learning, Landslide Hazard Reduction

Introduction

Landslide risk is increasing, especially in developing countries. Rapid urbanisation, the consequential growth of slum population (Buckley and Kalarickal, 2005), and development of communities on landslide-prone slopes are powerful drivers in a cycle of risk accumulation. Property on landslide prone slopes is cheaper to rent, so it is unsurprising that the most vulnerable live in these areas. Planning control policies would typically aim to restrict development in potentially hazardous zones; for example, suggesting that no houses should be built on slopes that exceed 14 degrees (Schuster and Highland, 2007). In reality, informal settlements are often found on considerably steeper slopes. Such development usually involves deforestation, earthworks, slope loading, and drainage changes which can, in turn, further decrease slope stability. This is a particular issue in the humid tropics where deep weather soil profiles are prone to rainfall-triggered landslides. Any climate change induced increase in the intensity or duration of these triggering events will inevitable exacerbate the situation.

Practical implementation of landslide hazard reduction measures is rare, and so too is the evidence that disaster risk mitigation works or is cost-effective in this context (Wamsler, 2007). Reversing landslide risk accumulation is hampered by the fact that risk reduction is a complex issue, and is viewed as "ranking low on the tractability dimension" (Prater and Lindell, 2000), being difficult to implement. It requires an understanding of the interactions between the physical and human risk drivers (hazard, exposure and vulnerability), and importantly, how to assess the risk and deliver solutions at a scale that relates to these risk drivers. This necessitates a multi-disciplinary approach and the engagement of the complete spectrum of stakeholders – from residents to policy-makers.

Despite the broad policy recognition of Disaster Risk Reduction (DRR), there is a lag in funding and the effectiveness of those policies 'on the ground'. The knowledge and practices identified at international and national scales aren't trickling down fast enough to achieve the Hyogo Framework of Action goals (Wisner, 2009). This could be accounted for by the fact that three inter-related components are missing: the evidence-base for investment (benefits lie in the future and are 'unseen'); the scientific basis for reducing the hazard (top down drivers do not focus on the scale of the hazard trigger); and the community basis for delivery on the ground (generally a failure to involve those most at risk in the process). Current policies for landslide risk reduction often emphasise the translation of 'knowledge into action' without always turning 'action into knowledge', and focus on vulnerability reduction without always investigating ways to address the landslide hazard. Finally, the relative lack of on-the-ground delivery is to some extent also encouraged by key literature on disaster risk management that commonly makes use of such terms as 'coping strategy' , 'resilience' and 'capacity build', without defining them (Wamsler, 2007).

We report an alternative strategy which identifies and addresses landslide hazard drivers at the appropriate local scale, acknowledges that communities can be part of both "the cause of the problem *and the solution*" (World Bank, 2010), and demonstrates that 'action leads to knowledge'. Such a strategy makes the following clear distinctions regarding knowledge and action:

"1. Knowledge-to-Action (K-A): Events are designed, run, and debriefed primarily to enable or encourage participants to apply previous knowledge to some practical situation.

2. Action-to-Knowledge (A-K): Events are designed, run, and debriefed primarily to enable or encourage participants to generate understanding, learn new skills, and gain new knowledge from a concrete experience."

(Crookall and Thorngate, 2009, p19)

Accordingly, our strategy adopts a holistic, 'complexity paradigm' (Malamud and Petley, 2009) which integrates natural science and social science, and recognises the need for *both* 'action-into-knowledge' and 'knowledge into action'. We implemented this strategy in deploying a community-based landslide risk reduction programme (MoSSaiC – Management of Slope Stability in Communities) in several Eastern Caribbean communities during the period 2005-2011.

The MoSSaiC 'learning by doing' strategy

The concept began with a critical review of current landslide hazard and community vulnerability reduction activities (Tab. 1). We regarded the relative lack of evidence of landside hazard reduction at the community level as a rate limiting step in delivering measurable risk reduction on-the-ground. Hazard reduction was therefore at the heart of the conceptualisation of MoSSaiC.

The MoSSaiC strategy for landslide hazard reduction sought to be holistic by ensuring that physical hazard drivers were identified and understood (science) and by engaging teams of stakeholders throughout the project cycle (communities, Community Based Organisations, Government managers, engineers and development practitioners, policy-makers, and landslide experts). Each stakeholder is then able to both share knowledge and learn from the other stakeholders. Communities become the classrooms in which all of the elements of the project are grounded.

The 'knowledge society' (a fashionable term in the developed world) implies that knowledge is the only reliable basis for effective action (Crookall and Thorngate, 2009). Here, training and education could be seen as the start of the process – *inputs* – as they are in so many disaster risk reduction 'capacity-build' programmes. Contrary to this viewpoint, our programme saw these elements as *outputs*. The programme deliberately started with community-based mapping and the *implementation* of landslide hazard reduction measures by the residents. Engaging residents in detailed

Table 1 Conceptualising current landslide risk drivers, actors and risk reduction strategies with respect to vulnerable urban communities in developing countries.

	Community vulnerability	Landslide hazard at the community scale
Risk drivers (risk as the product of hazard, exposure and vulnerability)	• Root causes (limited access to power and resources, political and economic systems) • Dynamic pressures (lack of local capacity, population change, urbanisation, national debt, unfair markets) • Unsafe conditions (exposure: living in hazardous locations, lack of building control, low income, lack of preparedness)	• Physical preparatory factors (slope angle, material properties, hydrology, vegetation) • Physical triggers (e.g. rainfall) • Human aggravating factors (cutting/filling slopes, altering drainage, loading the slope, removing vegetation)
Research disciplines	• Social scientists • Economists	• Scientists • Engineers
Risk reduction policy makers and practitioners	• International development agencies • Government social development agencies • NGOs and CBOs	• Engineers • Very few dedicated landslide *hazard reduction* policies and practices at community scale
Risk assessment methods	• Wide-area vulnerability assessment • Quantitative and qualitative studies of community vulnerability • Participatory Disaster Risk Assessment (e.g. Vulnerability and Capacity Assessment)	• Wide-area (GIS-based) susceptibility analysis or hazard zonation mapping • Participatory Disaster Risk Assessment to generate landslide susceptibility maps • Site-specific hazard assessment and modelling for hazard reduction
Risk reduction options	• Exposure reduction (relocate at-risk households or communities) • Preparedness and mitigation of impacts (public awareness, emergency warning, disaster planning and training, sustainable livelihoods, poverty reduction, micro-insurance)	• Exposure reduction (avoid landslide hazards through planning controls) • Landslide hazard reduction using engineering measures (retaining structures, geotextiles, drainage, bio-engineering) • Improve slope management practices to reduce hazard
Risk reduction reality	• Vulnerability 'assessment mapping' for vulnerability reduction is the most common activity with respect to landslide risk	• *Very few reports of landslide hazard reduction projects in communities*

slope mapping revealed localised slope features related to the landslide hazard and provided the context for discussing the 'science' with both the community and with the Government team. In particular, the concentration of rainfall runoff and infiltration of household waste-water was identified as a key driver for this hazard in the majority of the communities involved. In each case, the local knowledge and mapped information allowed a user-friendly dynamic slope stability model to be used for assessing the potential effectiveness of surface water drainage measures for improving slope stability. Government engineers, planners and community development personnel then worked alongside the communities to design appropriate drainage networks to manage surface water. Community members tendered for projects, procured materials, constructed drains and led sessions in subsequent technical training events and wider conferences.

Starting with all the stakeholders 'on-site', and making the community the focus of activities, yields a powerful platform for learning by doing. MoSSaiC provides a case study for this approach to landslide education, training and capacity development which needs both exposition and, in due course, further impact analysis (Holcombe *et al,* 2011).

The MoSSaiC 'learning by doing' case study

In disaster risk reduction the critical word is "delivery", the key to which is local knowledge (Wisner, 2009). In light of this, MoSSaiC sought to deliver landslide hazard reduction measures in at-risk communities with the active engagement of a broad local stakeholder base. At the onset a target was set to spend 80% of funds in the community (in the form of local contracts, labour and materials). To ensure effective delivery and financial efficiency, a management committee comprising *existing* Government staff (the MoSSaiC Core Unit – 'MCU') was established. The hazard reduction approach centred on the identification of landslide prone slopes in vulnerable urban communities, and ascertaining whether surface water management (construction of intercept drains and holistic management of household grey water and roof water) would deliver significant improvements in slope stability.

Over a 6 year period, using this community-based approach, mitigation measures were undertaken in 12 communities (~3000 households) in the Eastern Caribbean. This strategy deliberately recognised that "we must avoid romanticising indigenous knowledge, and combine it with scientific knowledge" …and that "…bridging the learning-action gap requires innovative programming, external recognition and financial investment" (Pelling, 2007).

Table 2 summarises how the synthesis of the knowledge and actions each of groups of MoSSaiC participants contributed to delivery of landslide hazard reduction measures. The need to identify and solve problems as the presented themselves on-site created a dynamic learning environment and helped to bridge the learning-action gap. This outcome could not have been achieved if any one of these groups (and hence, their knowledge) had been excluded, if the landslide hazard drivers had not been identified, or if the process had started in a classroom. Thus, the community-based mapping process enabled residents' knowledge of the local slope features and history to be combined with engineering and scientific knowledge of slope processes. Landslide hazard drivers could then be identified at the correct scale and everyone learned where and why there was a slope stability problem, and how it might be solved. Scientists and local engineers worked together to further analyse the physical hazard drivers and determine the most effective mitigation approach. Again in the community, local contractors contributed their experience and detailed knowledge of local construction practices to drainage design (Fig 1). For many residents knowledge of good construction practices was achieved through their involvement in drain construction and the associated on-site guidance from engineers and experienced local contractors (Fig 2).

Figure 1 Knowledge-to-Action (K-A): Community contractors discussing local construction practices and contributing drainage design ideas.

Figure 2 Action-to-Knowledge (A-K): Community residents commencing drainage construction in a vulnerable community in which houses had previously been destroyed by landslides.

Table 2 Conceptualising current landslide risk drivers, actors and risk reduction strategies with respect to vulnerable urban communities in Small Island Developing States (SIDS).

Participants	Typical landslide hazard assessment and hazard reduction knowledge in SIDS	Typical landslide hazard knowledge-action gaps in SIDS	MoSSaiC case study: Action-to-Knowledge (A-K) and Knowledge-to-Action (K-A)
Households and local contractors	• Slope and community history • Detailed familiarity with slope features (drainage, cuts/fills, soil depth, signs of instability)	• Good slope management practices to avoid increasing landslide hazard • Good construction practices for improving slope stability	• Contractors used from within the community (K-A) • Residents involved in the process see the direct results of good slope management practices and simple measures in their own household (A-K) • Good construction practice shared between contractors (A-K)
Government engineers	• General slope history and soil properties • Topographic survey methods • Soil shear strength testing • Static slope stability assessment methods for single-sites • Design and construction of generic slope stabilising structures at single sites (retaining walls, gabion baskets, benching)	• How to work with communities to identify detailed slope-stability features • How to identify slope stability controls for a whole hillside • How to design integrated slope stabilising measures to protect a whole community • How to work with community-based contractors and labourers	• Delivery of high quality construction supervision (K-A) • Government team members develop new local knowledge and practices whilst working with local contractors in the communities (A-K)
Community development practitioners (NGOs, Social Funds and Social Government Ministries)	• Awareness of landslides in communities – their physical and human impacts	• Awareness that there are ways to reduce landslide hazard at a community scale	• Delivery of high quality community liaison (K-A) • Learning the science from other team members and integrating community mobilisation skills with hazard reduction agenda (A-K)
Government project managers and politicians Development agencies	• Awareness of landslides in communities • Identification of broad landslide hazard zones from national or municipal scale maps • Awareness of pilot studies to reduce landslide hazard	• How to reduce landslide hazard at a community scale using cost-effective methods and local knowledge • How to interface with the scientific basis for assessing and addressing landslide hazard at community scales	• Multi-ministry MoSSaiC management committee briefed on science of landslide hazard reduction (K-A) • Existing project management skills employed in new way (K-A) • Report of MoSSaiC projects provides new evidence-base for policy (A-K)
Researchers and engineering consultants	• Slope hydrology and stability processes • Sophisticated slope stability assessment models (typically data- and computationally-intensive) • Sophisticated engineering design for landslide hazard reduction (typically high cost)	• How to work with communities to identify detailed slope features affecting stability • How to interface local knowledge and science • How to work with local practitioners, project managers and policy-makers to implement appropriate landslide hazard reduction measures	• Application of landslide theory 'in the field' (K-A) • Refinement of approach to landslide research – experience of working with end-users results in new priorities, scientific methods and ways of communicating (A-K)

Community members were also involved in managing the procurement of materials and speaking at community meetings and post-project conferences. This level of participation was seen to be a direct result of their initial engagement in the mapping process. Within the Government the experience resulted in new knowledge of managing community contracts, maintaining standards of construction and developing innovative policies to enable more interventions.

Conclusions

'Learning by doing' for landslide risk reduction has a core advantage for *all* participants – the speed of education and training is rapid and highly focussed. Community residents and researchers alike broaden their knowledge and skill-base with enthusiasm because they can see the results. Familiarity with the science of the hazard reduction measures is an integral part of the process; so much so that community members are subsequently able to participate in technical training days and to provide instruction to Government staff. Sohail and Baldwin, (2004), in a review of community partnered projects, confirm them to be as successful as conventionally contracted small projects, but additionally have wider socio-economic benefits. Our experience confirms this and asserts that creating an 'action-learning' environment of itself creates a learning experience for everyone.

By starting with community-based activities as the classroom, the MoSSaiC approach has shown that:

- the core skills and local knowledge conjointly exist within communities and governments for this starting point in the educative and training cycle (Anderson et al, 2007);
- immediate, and enduring, community engagement occurs because of the immediacy of construction activity (Holcombe and Anderson, 2010)
- landslide hazard can often be reduced through improved drainage (Anderson et al, 2011)
- benefit-cost ratios of such projects can be ~3:1 (Holcombe *et al*, 2011)
- Donors and Governments have learned from the experience, due to the short delivery times for the community contracts and the rapid availability of quantitative performance measures. By contrast, capacity build in many projects is ill-defined, and of unspecified duration (Holcombe and Anderson, 2009).
- Donors are supportive of a 'learning by doing' approach (Anderson and Holcombe, 2011).

This process is strategic and incremental since each example of effectiveness on the ground enables greater learning and adoption. Donors, governments, social funds, community members and academics (and thus 'society' in the broadest sense) have all participated in this process, supported construction from the start, and recognised behavioural change to be an *outcome*. The approach has witnessed changes of policy (budget support for *ex-ante* mitigation), new practices (cross-Government MoSSaiC management team), enhanced local skill base (community residents learn and develop construction skills) and awareness (communities fully involved in the 'science' of mitigation) (Anderson et al, 2011). We believe such outcomes supports the view that 'learning by doing' offers considerable major benefits in the delivery of landslide mitigation measures.

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