

# Diversifying governance of fire risk and safety in informal settlements

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In informal settlements fire risk arises from unequal urbanisation where fire hazards and socio-economic vulnerabilities create and reinforce each other, and from a lack of recognition of diversity within the system. Recognising this complexity as an injustice, we argue emergent informal safety practices and systems could shape better policy and interventions.

Major findings:

1. Recognising and incorporating the spectrum and diversity of experiences and conditions is vital for complex systems approaches
2. Within a complex system, risk can result from numerous 'failures' in the system. Building on 'listening to diverse voices', we look critically at how failure may be defined differently by different actors in the system, 'whose reality counts?', who learns what from whom, and what needs to happen for learning for safety to go beyond performative commitments 'to learn'
3. A key feature of complex systems is their openness/permeable boundaries, which we consider here in terms of how fire risk and safety is influenced by political economy and governance decisions at different levels which flow from this

# Executive summary

Fires are an everyday occurrence in informal settlements in cities around the world. Their consequences can be catastrophic and include fatalities, long-term injuries, emotional trauma, destroyed homes and assets, and disrupted education and livelihoods. With a quarter of the world's urban population (approximately one billion) living in informal settlements, this risk urgently needs addressing.

Fire risk emerges through inequitable urbanisation, where fire hazards and multiple socio-economic vulnerabilities are created and reinforce each other. **Governance of fire risk therefore requires an understanding of fire risk as an issue of injustice.** Approaches involving models or interventions may be at best ineffective and at worst create, perpetuate, and amplify fire risk when they do not consider the experiences of residents of informal settlements or the realities of how fire risk emerges there.

Responses to fires in informal settlements often try to apply fire safety solutions based on formal mechanisms (such as fire safety and response infrastructure). However, a lack of understanding of **the social, economic, political, and environmental contexts within informal settlements, and how residents experience these, results in solutions that can be ineffective or increase risk.** For example:

- The wrong type of fire extinguisher may be provided for common types of fire in settlements. Those extinguishers may be distributed without guidance for use or sold onwards to manage competing needs.
- Technical guidance may recommend fire break distances between shelters or blocks, but attempting to maintain these can be highly political because of landlord-tenant or social relationships within the settlement.
- Local fire services might lack capacity, infrastructure, or be shaped by systemic inequalities leading to informal settlement fire response being deprioritised and

this has further implications for relations between responders and residents.

It is critical for formal governance approaches to engage with the informal fire safety practices that emerge out of necessity in a context of multiple inequalities and deprivations. These can then fill the gaps left by insufficient and inappropriate formal governance and safety mechanisms. These informal fire safety subsystems involve a range of actors such as residents and NGOs, and informal governance processes within informal settlements, such as community leadership. **Residents and communities develop their own safety mechanisms and governance systems which are highly adaptive and responsive to their immediate environment and based on local systemic knowledge.** However, while they meet an immediate need, they can place a high burden on residents living in poverty and can be risky; for example, while residents may form their own effective first responder teams via bucket brigades and quickly creating fire breaks, the lack of suitable safety/PPE equipment puts individuals at a high level of physical risk. Similarly, while residents may monitor the risky fire practices of their neighbours, this can place extra burden on households and can strain social relations within a community as responsibility falls to individuals. Informal governance also contains its own set of inequitable power relations, which can serve those with power, deepen existing inequalities, and heighten risk for the most marginalised.

By listening to a range of diverse voices and the dialogue between them, we found that **different actors perceive, experience, and define**

**failures within the system in different ways**, because of varying perceptions of acceptability and tolerance. This is a critical underpinning to identifying lever points (for example, mechanisms, conditions or spaces) for possible solutions. **For example, incentive structures within the broader political economy means that fire is not necessarily experienced as a 'failure' by all actors.** Inclusive governance practices could strengthen and bring together the formal and informal. This could then open spaces for holistic approaches to safety by addressing multiple points of failure and identifying responsibility and accountability throughout the system. Without gaining insights into why possible solutions might work, or not, the systemic problems remain hidden, unacknowledged, and are sustained by the system itself.

Three themes of enquiry guided this exploration of the complexities of governance of fire safety in informal settlements, **and of the possible solutions that emerge through working with hybridity:** listening to diverse voices, learning from failure, and political (in)actions have (unintended) consequences. Analysing these intersecting themes leads to the exploration of inclusive Communities of Practice as a form of governance, characterised by long-term collaboration, mutual learning and unlearning, creation of trust, and co-design of multifaceted fire safety practices. Exploring the effectiveness of collaborative communities supporting improved fire safety in informal settlements is necessary to ensure formal and informal governance works together to address immediate hazards as well as systemic injustices.

# Section 1: Introduction and narrative

## Introduction

This report explores the governance of complex systems to address the problem of fire risk in informal settlements. Fires are a frequent, everyday occurrence in informal settlements in cities around the world. Their consequences can be catastrophic and include fatalities; long-term injuries and emotional trauma; destroyed homes and assets; and disrupted education and livelihoods. With a quarter of the world's urban population (about one billion people) living in informal settlements, this risk is a problem that urgently needs addressing.

Our work looks at fire risk through the lens of complex adaptive systems theory (see Annex A). Fire risk and fire safety<sup>1</sup> are understood to emerge because of dynamic, adaptive, nonlinear processes and relations between different elements and agents in a context. Fire risk emerges from a complex system of processes of inequitable urbanisation, where fire hazards and multiple socio-economic vulnerabilities are created and reinforce each other (Antonellis et al., 2022). There is no one single, linear root cause that creates this risk, but rather a complex entanglement of environmental and physical conditions, social processes, and relations that interact to heighten fire risk for marginalised urban residents.

**Governance of fire risk therefore requires an understanding of fire risk as an issue of injustice.** Failing to consider the realities of how fire risk emerges and is experienced by residents of informal settlements, leads models, or interventions at best being ineffective and at worst creating, perpetuating, and amplifying fire risk.

Fire safety systems for informal settlements can be viewed as a hybrid system as opposed to a top down command and control system (Antonellis et al., 2022). They comprise engineered fire safety subsystems extended from formal areas and ad hoc fire safety subsystems practised by residents, community-based organisations, and NGOs, among others. These ad hoc, informally generated fire safety practices and system are highly emergent and therefore responsive and adaptive to these contexts shaped by marginalisation and limited resources.

Fire risk is identified, assessed, and managed via both formal and informal institutions, services, mechanisms, and practices, with interactions between multiple actors at different levels. We therefore understand working towards fire safety to be a complex relational process as it works on, with, and through these numerous connections. It also requires a holistic approach that takes into account socio-economic vulnerability. An integrated holistic approach would go beyond purely technical, hazard-based fire safety interventions which often fall back on managing linear cause and effect risk dynamics among technical 'experts'.

This report examines the governance of fire safety, looking at how emergent informal safety practices and systems might be considered to help generate appropriate, fit for purpose policy and interventions. The Kindling team explored holistic fire safety governance in Cape Town, South Africa and Dhaka, Bangladesh through facilitated roundtable discussions and engagements with and between key actors with a (potential) role in relation to the fire risk and fire safety. Our methodology (see Section 3 and Annex B) actively involved individuals who possess a vested interest in the subject, aiming to foster an ethos of coproduction. Further, we reflect on the challenges of coproducing research in this context, while envisioning its long-term contribution to sustainable change.

We share analysis of our learning via insights from empirical data on the complexity of fire risk and safety in informal settlements in the two cities in Section 3, before drawing out transferable learnings for complex system governance in Section 4.

<sup>1</sup> In the context of this work, 'fire safety' is considered to be the set of practices, institutions, and mechanisms to prevent or manage fire risk. Fire safety is responsive to fire risk.

## Hybridity: the emergent response to failures in formal governance

From a formal governance perspective, there is no centralised authority/no clear stakeholder or group with designated responsibility for fire safety in informal settlements in Cape Town or Dhaka, and thus no overall strategy for managing fire risk. This lack of designated roles and responsibilities, strategic decision-making, and implementation is reflected in the notable absence of urban fire safety from disaster risk reduction, urban resilience, and urban development discourses in both Cape Town and Dhaka.

The limitations and failures of formal practices of fire safety and governance, and systemic inequalities within the political economy result in ad hoc, informal fire safety practices that are shaped and enacted by informal governance. Within informal settlements, governance is practised by a range of actors on an everyday or informal basis through 'routine encounters people have with others, including public authorities, in the process of resolving the governance problems they face' (Anderson et al, 2023), for example:

- Residents manage and respond to fire risk in their homes and communities by taking everyday actions (for example, self-provision, mutual aid, community fire response, adapting activities around load shedding, collecting sand from sand dunes, evicting drunk people).
- The City of Cape Town Department of Disaster Management is engaging with a private sector partner to explore a potential technical intervention, application of a vermiculite-based product to the exterior of informal dwellings aiming to reduce the scale and speed of fire spread between dwellings. It should be noted a pilot project is underway and therefore this approach has not yet been demonstrated or evaluated.

- The Bangladesh Fire Service and Civil Defence has a programme to train public volunteers in basic fire safety principles and practices.
- Other forms of everyday governance in relation to fire include NGOs who deploy programmes and projects, such as the FireWise project by Landworks in Cape Town and a fire safety pilot project in an informal settlement in Dhaka by BRAC.

There are also a range of urban development plans, strategies, and tactics that target informal settlements and indirectly address fire risk and safety via changing housing conditions, such as upgrading, reblocking, evictions, and relocations. This can also include more punitive tactics such as withholding access to 'illegal' infrastructure such as electricity and other services, often under the guise of reducing risk, or improving living conditions, but which actually can work to generate further risk. Without affordable/accessible safe, legal options, residents may engage in ever riskier practices to meet their needs, putting lives and livelihoods at risk, and stressing municipal services when fires do occur.

The fire risk/safety system encompasses numerous components which connect and interact in different ways and at multiple scales, forming a network of interactive relations which produces risk/safety. This network includes national legislation and policy; infrastructural arrangements; land tenure systems; and key actors, such as residents and their everyday practices, fire and rescue services, NGOs, community organisations, and social enterprises.

Fire safety systems can therefore be considered **radically open**: they sit within and interact with urban systems and subsystems, such as infrastructure provision, urban planning, disaster risk management. They are also **contextual** in that they exist within a political economy

where political and economic systems interact and influence each other. Actors and elements can change over time in response to environments and each other: they are adaptive, dynamic, relational.

Gaps in regulation, responsibility, and accountability that could contribute towards safety have, to some extent, been filled by informal, day-to-day mechanisms enacted by a range of actors. The result is a hybrid spectrum of risk/safety governance practices, enacted everyday by diverse, self-organised actors and institutions who have various roles before, during, and after a fire, which may overlap or interact, but seemingly do so without much coordination or oversight. While some risks may be addressed, others may not and, so, safety gaps ensue.

It is vital to recognise the range of 'real' governance relations and practices. This allows the knowledge and capacities that different actors have, bring, and act on to be included and to understand to what extent they can be worked with collaboratively to increase safety across the urban system. Efforts to improve fire safety must consider existing governance practices and identify any blockages or opportunities that might exist for better coordination, collaboration, and inclusion of the wide range of experiences, perspectives, and resources.

An approach to fire risk that acknowledges its inherent complexity shows that there is no one linear route to understand fire risk, nor a single fire safety intervention that can address it alone. As Preiser et al (2018, p.3) note, Complex Adaptive Systems based approaches do not provide "magic bullet type solutions for solving intractable real world problems" but rather can help generate integrated frameworks and process-based modes of engagement for "understanding why these problems may be difficult (or sometimes impossible) to solve, which in turn can inform practical strategies for governing."



# Section 2: Methodology

## Context, complexity, and coproduction

This project involved case study research in Cape Town, South Africa and Dhaka, Bangladesh. The research required a multi-actor engagement and a methodology that reflected the thematic inquiries. To that end, it is guided by principles and ethics of coproduction.

Working through coproduction, “a way of developing policies and knowledge and providing services through the active involvement of professionals, affected groups and other members of the community” (Bussu et al., 2022, p.20), we sought to embed equity, inclusion, participation, and dialogue throughout the research process. By involving participants in its design, delivery, and dissemination, we sought opportunities to redress unequal power relations between the researcher and the researched. This is critical to ensuring research is part of the move to address the systemic inequalities around knowledge production that (perhaps unintentionally) preferences traditional ways of knowing and determines ‘whose reality counts’. Coproduction, therefore, strongly reflects one of our core themes – Listening to Diverse Voices’ – and led us to intentionally engage with a range of key actors (Figure 12) as part of the individual and small group conversations (Cape Town and Dhaka), and the roundtable (Cape Town).

In Cape Town, our attempts to work through an ethos of coproduction meant engaging with roundtable participants (some individually, others in actor groups) before the workshop to seek their perspectives on the agenda, format, and activities; engaging a local facilitator with excellent working relationships across the different key actor groups; structuring the day around dialogue and multiple ways in which

participants could speak directly to the research team, the facilitator and to each other (Figure 1). However, “It is not sufficient to gather all interested parties around a table and merely hope for the catharsis effect to emerge spontaneously” (Renn & Schweizer, 2009). Therefore, this pre-roundtable phase was critical to create a space that allowed for actors with traditionally less power and influence in such meetings to inform the agenda and process, and to create a sense of investment in the dialogic process.

Data collection included over 80 hours of audio recording with over 75 contributors in two country contexts, alongside the researcher’s notes from the roundtable, video reflections, roadmap drawings, and voice notes. Following the roundtable event and one-to-one or small group conversations, roundtable participants were invited to contribute to this report in the format/mode that best represented them and their concerns or interests. From this, we gathered images with audio commentary and contributor-created text boxes of information or reflection. With more time in the project cycle, participant contributors would have been more active in the analysis and ‘writing-up’ of the report. Within this report, we are limited to including quotations, photographs, text, and image-commentaries from participants using their words as one dimension of coproduction within the ‘output’ of this research. For example,

### Roundtable dialogue: multiple lines of communication

- Voice recorders on tables: participants spoke ‘notes’ and reactions directly to the research team
- Message cards: participants wrote reactions, questions, points to be raised on to small cards. This retained anonymity but brought the issue to the whole room
- Whole room discussion and small group activities with feedback
- Informal spaces: A walk through the informal settlement with residents opened an informal space to explore the morning’s discussion and set the scene for the afternoon session.

Figure 1: Roundtable methods for dialogue

the image and commentary below amplify settlement resident voices to reveal failings within the fire safety system in terms of prevention and response, and gaps in learning from those failings because these incidents continue. It shows that political inaction has consequences, as residents have experienced such incidents many times before.

Further reflection on methodology and the limitations of the project are detailed in Reflection on Methodology: Research as a complex system on Page 43. This includes acknowledging the positionality of

the research team (Figure 11 in Annex B below). The report is organised into the following sections: Key Findings, Analysis and Insights, Transferable Learnings, Conclusion. We intentionally intersperse boxes

with details that connect to the overarching themes but do not interrupt flow of analysis.



**The thematic intersections were evident in residents' images and commentary:**

“This is an informal settlement. There is no straight [road] so the fire brigade can come inside the settlement. So, these people were waiting for the fire fighters to come and fight the fire, so the fire does not spread to other houses . . . That’s why the people were waiting on the roof of the other shacks.”

*Image credit: Phelisa Seti, Cape Town*

Figure 2.

## Section 3: Key findings

Here we present headline empirical data related to the context and the three focus themes (Listening to Diverse Voices, Learning from Failure and Political actions have Consequences). Key findings are analysed in relation to broader issues of governance and complex systems in the following sections: Section 4 – Analysis and insights; Section 5 – Transferable learning.

### Context specific findings

- In Dhaka, informal settlement fires sometimes trigger the displacement of residents** and unofficially (but widely reported), arson is sometimes used as a tool specifically for this purpose, that is to reclaim land. Dhaka is a rapidly developing city and the government plans to become a ‘slum-free’ city by 2030, so displacement from fire and the resulting erasure of these visible physical spaces might have positive political benefits as well as economic benefits to individuals, companies, and political parties in the short and long term, even where fire is not intentional. Furthermore, Dhaka’s plan to become ‘slum-free’ includes the development of high-rise buildings and relocation of informal settlement dwellers into ‘formal’ high-rise buildings. This should not be assumed to be a transition for these marginalised groups from a less safe to a more safe environment in terms of fire.
  - Dhaka has a significant problem with high-rise building fires which have caused high numbers of fatalities, seemingly even more than informal settlement fires. The building fire regulatory system has significant weaknesses in Bangladesh and it was suggested by one key actor that low-income high-rise buildings also experience significant levels of fire risk due to a city-level lack of fire regulation.
- This highlights the need to consider **fire safety through the broader lens of urban development and its many forms of human settlement.**
- Legality and informality contribute to the emergence of fire risk in both contexts:** in Cape Town, many informal settlements are built on privately owned land, where there is no incentive for landowners to provide access to formal infrastructure such as electricity. As a result, residents engage in ‘illegal’ tapping, a fire hazard. Similar gaps in formal infrastructure are evident in Dhaka, though this applies to all informal settlements, regardless of whether they are located on land that is privately or publicly owned.
  - Illegality and Invisibility:** the illegality of informal settlements in Dhaka means they are ignored in government policy and explains gaps in legislative policy, guidelines, and even discourse specific to these settings. This contrasts with Cape Town where there is a specific department for human settlements and a strong constitution that establishes the rights of all citizens to ‘adequate housing’. In practice, this legal foundation conveys recognition within wider society and governance frameworks in South Africa.
- In both contexts, **hierarchies exist within formal and informal aspects of governance, leaving room for gatekeeping and corruption to limit participation and inclusion.** Notably in Dhaka, middle-men (referred to locally as ‘musclemen’) act as intermediaries between fellow informal settlement residents and landlords as well as local government officials and sometimes NGOs, enabling informal access to infrastructure and access to programmes such as shelter upgrading. In Cape Town, semiformalised approaches to informal settlement governance (for example, street committees and block leaders) establish mechanisms through which city government engages with settlement residents, though hierarchies can also be found, and singular lines of communication are often linear and, therefore, often ineffective.
  - In Cape Town, the intersection of listening to diverse voices, learning from failure, and political actions have consequences was evident in relation to the provision of relief kits:** after hearing residents’ struggles with provision post-fire, the process for administration and distribution of relief kits returned to city control. Further adaptations to the governance process could include residents’ perspectives on procurement to ensure items are appropriate.

- **Informal settlement residents have significant adaptive capacity and are key actors in the learning process.** In Dhaka, some informal settlements conduct their own community-led fire safety training, whereas in Cape Town self-organised

structures within the settlements are used to enable fire safety interventions, such as street committees or door-knocking on neighbours who cook late at night.

- **In Dhaka, opportunities to engage directly with women and gain their perspectives on fire**

**safety governance was extremely limited.** Representation of men and women across all aspects of the urban governance and fire safety systems was much more equal in Cape Town.

## Listening to diverse voices

- **Diversity of experience, knowledge, and perspective exists across the system.** Different actors within the system have different perspectives on the ‘problem’ and subsequently on possible or desirable solutions. Multiple and cascading failures emerge from a lack of recognition of layers of difference and diversity within the system and the relational dynamics that create and reinforce those different perspectives.
- **Homogenisation within actor groups runs the risk of exclusion** by (intentionally or unintentionally) preferencing voices and

experiences of those with (formal or informal) power within that group. Including diverse voices requires attention to difference and dynamics *within* actor groups not just between them.

- **Participation and inclusion are key relational elements of governance in a complex system but they cannot be conflated.** Whereas participation can encourage wider consultation, inclusion describes the connection between different actors that enable their contributions to be actioned. Recognising these core differences between inclusion and participation highlights the

consequences of how diverse voices are listened to within governance systems. For example, settlement residents in both contexts had experience of participation (of being in attendance, for instance), but listening was not always accompanied by action. Listening to diverse voices, therefore, should embed inclusion as a relational process of multi-actor connection and capacity building, where contributions are enacted through processes that are transparent, responsive, accountable, and promote equity.

## Learning from failure

- **Failures are defined differently by different actors within the system because of varying perceptions of acceptability and tolerance.** These variations are rooted in social, political, and economic dynamics that shape how fire risk materialises in people’s lives. How fire risk is perceived in comparison to other hazards shapes risk perception and willingness of different actor groups to invest in fire safety. Without examining different actors’ perceptions of failure and how these shape solutions to fire risk, the possibilities for learning are limited because lines of inquiry will be missed: learning from failure must consider the many differences in what is (and is not)

learned, by and from whom, in what ways, and with what effect.

- **Fires in informal settlements are not always considered a failure:** for some actors, the destruction of property enables the removal of tenants and the ‘freeing up’ of (often) sought-after land which can be sold for development: displacement is a direct consequence of fire in informal settings.
- **Failure is experienced by those who are not heard and who bear the brunt of risk.** Within the hybrid complex fire safety system where risks cascade, these marginalised groups are also the actors within the system who learn and adapt the most. These actors have to find solutions to navigate failures that

could have been addressed by other actors and mechanisms within the system. Residents of informal settlements are not passive actors, nor do they want to be. Rather, they are dynamic in how they respond to the consequences of political inaction and action and what actions are possible given the broader economic and social challenges already being navigated.

- **The enabling conditions within and around the system shape the possibilities for learning and unlearning.** Political actions or inactions and wider governance issues create or constrain the what, how, and with what effect aspects of learning from failure.



## Political actions have consequences

- A key finding that underpins those that follow concerns the creation of failure: **where spaces are not created to listen to (and act on) diverse voices, opportunities for failure emerge.**
- The safety of systems sits within a broader governance system. In other words, the broader political economy of the city shapes fire safety for all residents of Cape Town and Dhaka. Fire risk inequalities emerge within and through the political economy.
- Political inaction is evident in the lack of coordination between different actors, at various scales and subsystems within the broader governance and safety systems. **This lack of coordinated effort further intensifies unequal fire risk.**
- **Political actions reveal systemic exclusion:** in Dhaka, a decision was taken to place fire trucks strategically around the city to navigate congested traffic, however none of these were located near slum areas, leaving informal settlements without equitable provision of fire response services.
- Cape Town settlement residents argued that **political actions fail when they are not transparent or effectively communicated to those who are impacted by a policy.** The consequence is an erosion of trust.
- **Where policy initiatives are created without including a range of actors (such as end users) in their design, and without ensuring effective communication with all audiences, interventions can exclude or be ineffective for informal settlement residents.**  
In Cape Town, reporting problems with fire hydrants was facilitated by a city-wide app, but in practice this was used within the suburbs and residents of informal settlements were told to report via their ward councillor.
- Reblocking<sup>2</sup> in Cape Town caused significant contention between residents and government officials. **Political actions include the way decisions are made and implemented and include design and communication throughout a project cycle.** Many consequences arise from the action itself and how they are taken: some may be intended (for example, reducing shelter size may, in the long term, prompt some residents to leave) or unintended (for example, negative impacts on social cohesion).

<sup>2</sup> Reblocking: an approach to post-fire rearrangement of dwellings within a settlement. For details, see Spinardi et al. (2020).

# Section 4: Analysis and insights

This section provides analysis of each theme. Due to the theoretical intersections, a small degree of repetition is to be expected. See Major Findings above for a brief introduction to the guiding questions for each analysis and links to individual sections.

## Listening to diverse voices: resisting performative participation

Fire safety systems are open and complex: they comprise formal and informal mechanisms created and practised by a range of actors who contribute to, experience, and respond to fires in informal settlements. Diversity in voice and representation are, therefore, critical to understanding complex socio-technical problems such as fires in informal settlements, and to creating forms of governance that can lead to safer complex systems. In reflecting on listening to diverse voices, it is important to interrogate two elements that underpin perspectives on governance: participation and inclusion. Following Quick and Feldman (2011) we draw important distinctions between participation and inclusion which can so often be conflated: participation increases the breadth of input for decision-making (such as hosting meetings with large attendance), whereas inclusion asserts the importance of relations between actors that enable the capacity for designing and implementing those decisions.

The distinction between participation and inclusion is important because it draws attention to the potentially performative dimension of participation that can result in affected populations (in this case, informal settlement residents) being invited into spaces as a form of consultation but excluded from the design or production of solutions. Out of all the actors within the urban and fire safety systems, informal

settlement residents have the most significant direct experience of risk and the solutions that do or do not work, and what is or is not possible: “the communities know more about their communities than anyone” (roundtable, April 2023). Participation of residents is key, but inclusion builds on wider participatory engagement by ensuring the range of actors, including community members, are involved in finding solutions and decision-making processes.

### Politics and diversity within and across actor groups

In line with our first project, (Antonellis et al., 2022) we expected to find complex fire safety systems to comprise a range of actors who experience or have a role to play in the prevention, mitigation, preparedness, or response to fires in informal settlements (see Figure 12 for a list). We also expected power imbalances across the broader governance and urban system to be reflected in the experience of fire risk, the unequal levels of participation in how fire risk is understood, and a lack of inclusion in how solutions are designed.

Taking gender as an example highlights the invisibility of women in the conversation about fire in this Dhaka, in contrast to our experience in Cape Town. Although some women were present in meetings with NGOs, slum dwellers, and community-based organisations in Dhaka, any input about the technical, policy, and regulatory landscape was dominated

### Listening to lived experience

**“We need training. Fighting fire without knowledge is dangerous.”**

This resident in Cape Town talked of the community wanting access to knowledge for prevention and response, arguing that they were in more danger because of the lack of community-centred training. Importantly, residents understand there is little they can do to create the systemic change required to reduce fire risk and the impact of fire incidents in their communities, but they are clear about what they want in the immediate term.

Listening to the voices of those who experience fire risk and who live with its impacts establishes both the immediate and longer-term concerns, goals, and actions that connect different actors within the system.

by men. This gap appeared to reflect the composition of city government: Dhaka City Corporation has just 18 women councillors of a possible 74 (in 2023). The gendered inequality in participation and representation reduces inclusivity when creating systems that should create equity. This results in solutions that fail to

respond to how fire risk is experienced by all residents of a city, including the range of people who live in informal settlements. Solutions, therefore, are unlikely to be rooted in the daily lives of all slum dwellers and will enable risk to cascade within the system as both the problem and solutions are only partially understood.

This research aims to move the conversation about diversity within a system forward by highlighting diversity within the actor groups and hierarchies that, if not attended to, reproduce different inequalities. Traditionally, systems thinking and stakeholder mapping activities group actors without enough attention to internal power dynamics and the diversity within each group, thereby flattening the politics at work within each of these actor groups. Listening to a wide range of perspectives on and experiences of informal settlement fire from within each actor group is critical because we can start to understand how and why particular solutions emerge and what is needed in the future.

For example, in Cape Town, informal settlement residents respond to issues of fire safety through informal, ad hoc governance systems. In a discussion at the roundtable (April 2023), residents explored steps they have taken within their communities to respond to their experience of fires. One resident encourages others in her community to “do everything before load shedding starts so you don’t need to use candles ... if load shedding is 8pm, get everything done before this so 8pm is bedtime”, recognising that the systemic issues around electricity provision create fire risk for those without access to safe alternative power sources. Other individuals visit their neighbour if they smell cooking late at night “to check on the person who drinks” and reported that some settlements will evict residents who are known to cook while drunk because it is viewed as such a significant risk to the entire settlement. Although ad hoc steps are taken within informal



Figure 3: Roundtable participants included settlement residents, Cape Town

settlements, residents at the roundtable argued for a “collective solution ... like a neighbourhood watch scheme” rather than an ad hoc approach to fire prevention: “it’s all about changing the community’s mind, being there for each other.”

Alongside ad hoc approaches taken by residents to promote fire safety in informal settlements, layers of informal community organisation within Cape Town play a role. Various roles and responsibilities are allocated to and/or taken on by

residents, some with leadership roles at the settlement level and others for a collection of shelters (a ‘block’). Block leaders and street committees often contribute towards fire safety of their settlement by assigning responsibility for the day-to-day administration of the settlement to individuals and establishing lines of communication between settlement representatives and local government actors. While discussing the different ways settlements organise and function, some tensions about responsibility and autonomy were revealed: on the one hand, “the community is dependent on the street committee – they expect them to do everything”, but on the other one resident said “the idea has to start with them in order for it to get the go-ahead ... if you get on the wrong side of the street committee then you will never get a contract. You can’t go above them, you have to go through them” (Settlement resident, April 2023). There is a suggestion here that some residents’ voices had become constrained by either learned helplessness or informal power dynamics that prevented them exercising individual autonomy or participating fully in the design or implementation of fire safety activities. Importantly for our focus on diverse voices, it is the different experiences of informal



Figure 4: Informal electricity connections, Cape Town



settlement residents that is critical: whereas some are deeply invested in fire safety and reveal the possibilities of informal inclusive governance, other residents appear to feel excluded from participatory processes that could ensure their concerns are heard.

Semi formalised roles such as block leaders and street committees are just one example of how informal settlement residents create their own mechanisms of governance and how these reveal different spaces for and approaches to participation and inclusion. However, these approaches are informal and therefore not standardised or attached to structures of accountability or responsibility: “there is a spectrum of community leadership: there are some excellent examples of community leadership, and there are some contested versions. We need a holistic and wider approach but need to also look at the situations where we don’t have good community leadership... where is the plan b, plan c?” (NGO professional, April 2023). It is clear, therefore, the experiences of residents within a settlement cannot be assumed to be equal and attention must be paid to informal power dynamics that can prevent diversity in experience and perspective from being heard. Listening to diverse voices requires ensuring a range of perspectives are sought – the spectrum of community leadership noted above implies different experiences of fire, fire safety, prevention, response, and different relationships with different actors.

A further issue of diversity and power within the settlements themselves relates to tenure. Landlords in both Cape Town and Dhaka are often members of the community or related to someone in the community but live outside the settlement. The political, social, and economic incentives associated with fire safety are therefore different for different members of the community, particularly in the aftermath of a fire. In both cities, for example, external help to reconstruct destroyed

### Lack of access to electricity and safety

**“But the main, main cause in our community of fire is electricity. You don’t have electricity, so we’re stealing electricity knowing that it is dangerous ... It’s not even safe for the kids as well. And when those house wires are done, are tired, they just get burned. And that happens into the house. So that’s where most of the fire starts. So, you can warn people about fire, but I’m warning them, he’s gonna warn them, but they are still going to do the same thing because they need electricity. But it’s always good to be more careful. It is at the end of the day, our lives. Yeah.”**

**“To add more on what he’s saying. If our government can come closer, because we’re always willing to talk to government about the electricity that we need ... Just come closer, with Eskom, and talk to us. Because we are willing to buy electricity. Because even now, as we are stealing, there are people who are paying, those people those people who are connecting. They are paying R50 ... If we can meet with Eskom and government together like this, work together, I surely believe that people they can get an electricity by talking, you see. I think it is, it is what we want as Siyangena.”**

Godfrey Khiva and Lulama Coto, Siyangena Community members

dwellings largely benefits the landlord. For example, in Cape Town, immediate recovery assistance was noted as often being distributed to the landlord rather than the resident, adding further trauma to those directly impacted as the threat of homelessness is compounded by the struggle to meet basic needs. Additionally, in both cities fires can result in increased rental charges because of post-fire upgrading or can expedite plans to displace individual or groups of households beyond the settlement.

It is important to identify the many aspects and layers of diversity within an actor group and actively resist the homogenisation of experience based on a singular identifying feature (such as being an informal settlement resident). This is critical to understanding how risk is experienced and responded to differently, and why safety interventions might not work for everyone or create further exclusions or risk. This understanding comes from recognising the different ways in which power shapes the system. Listening to diverse voices, therefore, must go beyond a linear (top down) approach to governance that seeks representation from an actor group

without considering depth, difference, or exclusion within any given ‘community.’ To seek participatory and inclusive governance, attention must be paid to the power differentials that can shape who represents the range of perspectives and what implications a lack of diversity has for the actions that are possible.

### Finding two: Listening requires action

Government actors are integral to understanding and responding to the complexity of fire safety in informal settlements as they provide the link to policy and regulatory systems. In this regard, they reflect the essence of the theme ‘listening to diverse voices’ because, just as residents cannot be homogenised or treated as all the same, different actors within government will perform their role differently and listen with different intentions – the hope is that listening will lead to action.

This research found that government actors range from those with direct experience of ‘the fire problem’ (for example, those in Cape Town working directly within Disaster Management or a human settlements agency) to



**“I was involved in fire in 2008. I myself, my shack burnt down, my four-room shack. I lost everything, even my ID, and I suffered for a year to get my ID.”**

**Mavis Manvathi, Informal Settlement Resident, Cape Town, April 2023**

others whose perspective is rooted in a more distant form of policy knowledge. The actions taken, therefore, vary not just with positions of responsibility but also the depth of understanding of the problem and the potential solutions. For example, in Cape Town, ward councillors are key actors in representing informal settlement residents within the wider governance system. However, tenure impacts representation for informal settlement residents as one councillor admitted “I can’t speak to the rights of people on private land” (Roundtable, April 2023). In complex systems that lack regulatory frameworks, these gaps suggest the need for new thinking about how inclusive governance will respond to issues of inclusion that are based on specific forms of citizenship, particularly those attached to tenure. In other words, where access to support within a system is dependent on the formality of relationship an individual has to the mechanisms of the system, residents of informal settlements will inevitably suffer.

Government actors in Cape Town (such as ward councillors) who are engaged in the problem of fires in informal settlements have drawn on various approaches of community participation to develop solutions to other problems. For example, one group discussion in the roundtable involved settlement residents wanting the model of neighbourhood watch schemes that had been created with ward councillors to be

applied to fire prevention. While such a model is appealing to residents, scalability is a concern. A personal understanding of the human experience drives many within government to work on the fire problem: “I see the challenge and I see the hurt and I see the pain. I come from rural background and by God’s grace I am here, and I am just trying to give back. We need more culturally and socially sensitive humanised approaches because these are real life challenges that can lead to loss of life” (Government actor, Cape Town, April 2023). The consequence of relying on individual and personalised advocacy among those in positions of power is that activities such as fire prevention schemes will remain ad hoc.

A further insight into listening to diverse voices concerns who listens and how: we learned that some government agencies in Cape Town use external partners to conduct community engagement to avoid the heightened emotions that can emerge in such meetings and which, to some, limit productivity: “government will never host our own workshop where we will be face to face to the community” (Government actor, Cape Town, April 2023). While some might argue avoiding these forms of direct engagement with communities is a cost-effective – utilitarian – approach to participatory governance, the extent to which inclusiveness is possible when key actors engage through an intermediary is questionable, particularly in light of government actors admitting that it is the human experience that motivates them.

Similar gaps in how listening happens and the implications for action emerged from Dhaka. Engaging slum dwellers in participatory planning reflects, on the surface, an approach to inclusive governance. However, for

the participation of affected populations to have an impact on formal governance mechanisms such as policy, there needs to be clear lines of responsibility and a commitment for participation to lead to inclusion within action. As one interviewee commented, “where there is no clear legislative and policy and guidelines for informal settlements, which organisation is responsible to lead this? There is a grey area. The DNCC (Dhaka North City Corporation)<sup>3</sup> is taking the lead because the DNCC is an elected body. Other bodies are not elected so don’t have a social responsibility to the informal settlement... DNCC can only invest in where land belongs to DNCC” (Engineering professional, Dhaka, July 2023). In contexts where formal governance processes are enacted by informal rules associated with political power and incentives, meaningful participation that includes diverse voices and ensures listening leads to action is particularly critical. As is evident in Dhaka, without a department with responsibility for informal settlements that is accompanied by a supporting policy framework and systems of accountability, participatory engagements can become a performative element of the election cycle.

Listening without action fails to be inclusive, no matter how diverse the range of voices within the process, because it perpetuates inequalities associated with voice and representation, and unequal access to knowledge and fire safety. One consequence of inequalities in participation and inclusion is, to paraphrase a representative from an NGO in Cape Town, that failure happens to the people who are not heard.

2 Dhaka North City Corporation (DNCC) is one of two municipal bodies in Dhaka (along with Dhaka South City Corporation) that oversees the administration and provision of key infrastructure and services for almost 6 million people.

## Learning from failure: acknowledging systemic injustice

**“Some people had not even recovered from one fire when they were hit by the next one.”**

(Settlement resident, April 2023)

Fires in informal settlements happen repeatedly within the same settlement. From the perspective of learning from failure, repeated fire incidents in the same informal settlement suggests opportunities, spaces, or processes for learning are lacking. Any mechanisms to implement change based on learning are also inadequate. Thinking through complexity, we recognise fire safety emerges through interrelated networks of decisions and actions taken across multiple scales and domains; just as there is no one silver-bullet solution, there is no single cause of fire risk and fire incidents. This section will show learning from failure is a process that actors within the system could and should engage with to improve the wider fire safety system and consider the failure to learn as an indicator of the broader governance system that shapes what is or is not learned or unlearned, by whom and with what impact.

Five questions underpinned our focus, generating various insights into the relational dynamics of learning from failure within complex systems:

- **Who learns and who does not learn?**
- **How do people learn – formally, informally, nonformally, and incidentally?**
- **What is or needs to be learned and unlearned?**
- **Why does learning not happen and why does this failure to learn make sense?**
- **What is the possible effect of learning from failure?**

To explore the relational processes where learning from failure becomes possible, it is critical to engage different actors in a dialogue about success and failure in relation to fires in informal settlements and the ways in which successes are (or should be) replicated and failures addressed (or not). Drawing from the five lines of inquiry outlined above, we show that learning from failure within a complex system is relational: what is learned, unlearned, or not learned, by whom, in what ways, for what purpose, and with what effect are all factors shaped by relationships between different actors and networks within the system.

As this section moves forward, we use ‘failure’ generally to refer to the occurrence of a fire incident within an informal settlement. When necessary, specific aspects of an incident may be provided for extra elaboration (for example, failure of system to provide firefighting response or spread of fire beyond single dwelling).

### Defining failure: whose reality counts?

For transformative learning to happen that leads to improved safety, all actors within a complex system first need to acknowledge that there are different thresholds and perspectives of what it means ‘to fail’. For some, failure lies in the systemic inequalities that give rise to different experiences of fire, as one roundtable participant in Cape Town pointed out so starkly: “the main cause of fire in settlements is poverty ... it is rare to hear of fires in the suburbs.” The remainder of this section focuses on failings within the fire safety system but is framed through the recognition that systemic inequality is a failing of governance at local, national, and global levels, and is therefore a failure within the broader system in which the fire safety system sits. In other words,

structural social inequalities are a root cause of fire risk that contributes to the unequal impacts of fire on people living within, predominantly, low-resource settings.

### Failure is a matter of perspective

**Fires in informal settlements are not perceived to be a failure to everyone within the system. In fact, some actors benefit from fires that result in the destruction of property: fire can be used as a tool for displacement which, ultimately, enables the sale of land for urban development.**

**Identifying such (often hidden) incentives requires a longer-term analysis of the impacts of fire incidents.**

Different actors will have a different understanding and framing of a problem (Renn & Schweizer, 2019) so formal processes of learning such as critical incident analysis or post-fire investigation must be underpinned by multi-actor analysis of the many possible definitions of failure. Where thresholds of failure have been established and attached to specific measurements (for example, number of shelters destroyed), analysis is needed to interrogate how these thresholds were established, by whom, and the potential lines of impact – in other words, who decides when a fire is significant enough to be counted and what does this mean for the solutions or interventions that might be designed?

By listening to diverse voices, our investigation showed that, in the case of a complex fire safety system, there are different levels and types of safety and risk that will be tolerated by different actors. This results in multiple perspectives on what type of

safety ‘incident’ would reach the threshold of a failure and leads to a secondary problem regarding the collection of data to establish the actual number of fire incidents, a problem noted within academic studies on fire in humanitarian and development settings (Twiggg et al., 2017). By ensuring that diverse voices could present their perspectives about the problem of fires in informal settlements, our case studies established a range of intersecting factors to be included within definition of failure and highlight an important question for approaches to researching governance and safety: whose reality counts? This is critical because it is the perception of reality that defines the problem.

In the case of informal settlement fires, failure is most often defined through quantitative, finite, and time-bound measures such as numbers of lives lost, shelters destroyed, or the cost to rebuild. Failure, in this respect, is a measurable feature of the system with actors reflecting different levels of tolerance or acceptable loss. But these measurements are not even clear in the official declarations of a disaster: in Cape Town, there is no clear definition or trigger for how severe a fire event needs to be to become a ‘disaster’ thereby enabling

government resources to come into action. To explore the definition of success and failure within a complex fire safety system, we designed a multi-actor road-mapping activity designed to enable dialogue about ‘goals’ for fire safety. Cape Town roundtable participants were asked to establish their definition of failure – what would they tolerate? The discussions revealed differences about defining failure along the lines of role and closeness to the impacts of fire and reinforced the importance

of including diverse voices within these debates. In some groups, they would tolerate the loss of one shelter, but in others it was five. Others couldn’t agree on a number so opted for ‘less houses to be burnt’ (see Figures 5 and 6). What was clear, though, was a tacit agreement in all groups that loss of property was acceptable, but the loss of life was not.

### Temporality within definitions

So far, definitions of failure focus on the scale of a single incident. However, thinking temporally adds a different perspective on how failure is defined. For example, Figure 7 shows instances of fires in Imizamo Yethu settlement after the March 2017 fire that killed four people, destroyed 2,194 structures and left 9,700 people homeless (Kahanji et al., 2019). While there is scope to learn from individual fires in isolation (ibid), a systemic lens can help identify patterns of fire risk by looking at context, feedback loops, and cascading effects of action or inaction within the system that may have shaped one or many of those fire incidents. This broader, more systemic lens may also help identify and connect the before, during, after phases of a fire incident and enable greater connection between prevention, response, and short and long term recovery.

The implications of temporality on the boundaries of how the impacts of a fire are measured was a critical issue for settlement residents. Those who had experienced fire argued that definitions require a longer and more human-centred view. From the resident’s perspective, a common failing in post-fire support was the inadequate response to long-term mental health impacts of fire. Within the group activity, residents commented that failure to respond to the mental health impacts could limit the success of future interventions, such as education or creation and sustainability of volunteer fire brigades.

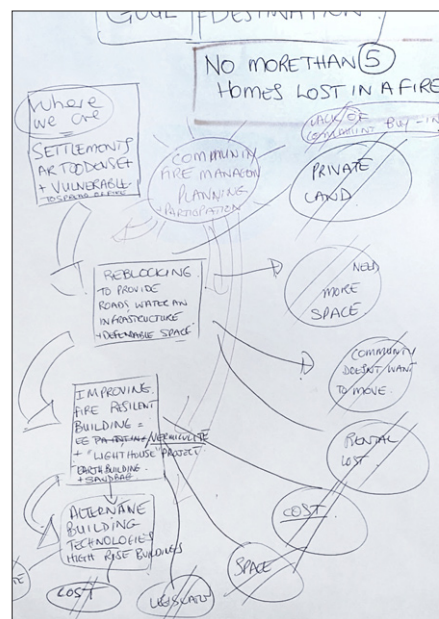


Figure 5: Group activity: defining goals in Cape Town

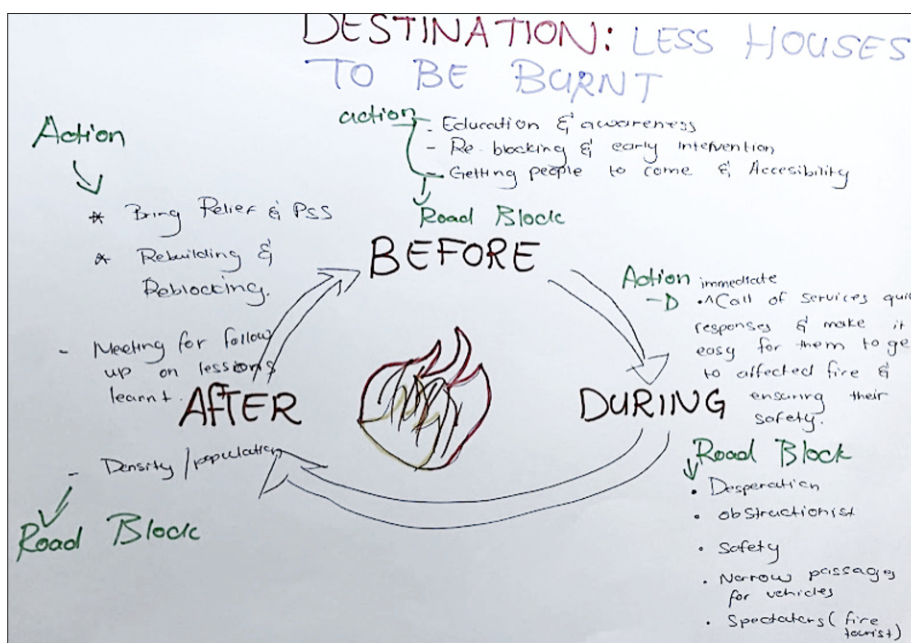


Figure 6: Group activity: defining goals in Cape Town (2)



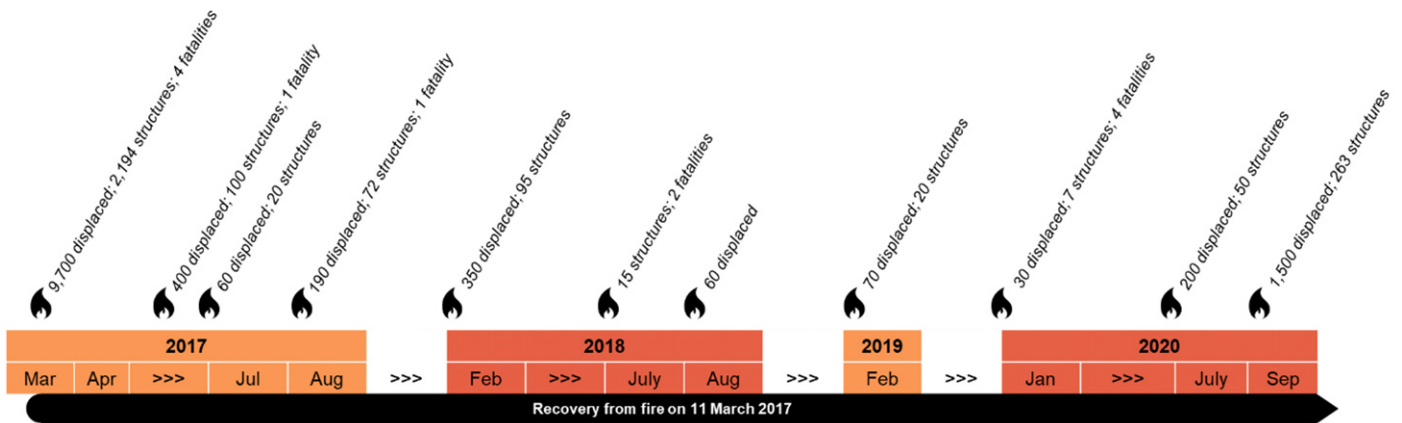


Figure 7: Timeline showing some of the fires in Imizamo Yethu informal settlement from March 2017 through September 2020, Antonellis et al. (2022), p.22.

Definitions of a failure within a complex system, therefore, must be alert to temporality and the different time boundaries of how safety failures are experienced. Such ‘temporal openness’ (Quick & Feldman, 2011, p.286) adds further complexity to the system, as the boundaries around the temporality of the incident change, different actors may be brought into the system and therefore have responsibility for an aspect of failure. To illustrate, disaster management teams have an initial role providing immediate relief and residents are visited during the recovery phase, but settlement residents in Cape Town felt strongly that there was a failure in the longer-term recovery plan because responsibility for mental health was not clearly defined and therefore lacked accountability.

### Is a fire in an informal settlement always a failure?

Importantly, we found that while ‘failure’ suggests loss or negative impacts, fire incidents are not always considered a failure, and certainly not for all actors within the system. The concept of tolerability provides some insight here. Fire prevention is always the most effective form of safety but it is impossible to prevent all fires. So, while a fire occurring is a failure of fire prevention, it is not necessarily a failure of safety systems. It is widely understood that many fires in informal settlements are limited to a

single dwelling with no injuries or fatalities. These incidents are often dealt with successfully by informal settlement residents. Stories of these fires are shared verbally by informal settlement residents and rarely captured by official fire statistics or reported on by the media.

Additionally, there are some who benefit from fires in informal settlements. For example, within an economic and legal framework that empowers landowners over dwellers and landlord over tenant, some actors with legal (or more secure) tenure can benefit from the destruction of a block of shelters. In both Cape Town and Dhaka, references were made to the increase in rental costs for tenants whose shelters are destroyed by fire and then rebuilt (whether materials are provided by local or national government, or at cost to the landlord / third-party). Increased rental costs are often prohibitive and contribute to a gradual displacement of residents. Entrenched inequalities ensure that it is the lowest-income residents who are most likely to lose access to shelter within the same settlement in the aftermath of a fire, subsequently losing social capital that is integral to livelihoods.

In Dhaka, informal settlement fires can trigger the displacement of residents and unofficially (but widely reported), arson is sometimes used as a tool specifically for this purpose

that is, to reclaim land. In the context of a rapidly developing city and the government’s plan for Dhaka to become a ‘slum-free’ city, displacement from fire and the resulting erasure of these visible physical spaces might have positive political benefits as well as economic benefits to individuals, companies, and political parties in the short and long term, even where fire is not intentional.

Furthermore, Dhaka’s plan to become ‘slum-free’ includes the development of high-rise buildings and relocation of informal settlement dwellers into ‘formal’ high-rise buildings. This should not be assumed to be a transition for these marginalised groups from a less safe to a more safe environment in terms of fire. Dhaka has a significant problem with high-rise building fires which have caused high numbers of fatalities, seemingly even more than informal settlement fires. The building fire regulatory system has significant weaknesses in Bangladesh and it is presumed that low-income high-rise buildings may receive less attention from a regulatory perspective, highlighting the need to consider fire safety through the broader lens of urban development.





### Tenure: 'Failure' after fire

**"This picture represents the next morning, the 12th March... people were very worried... some were left homeless ... directed to go and stay in halls. Some were sent to stay in tents nearby the soccer field, the police station. My little boy who was left homeless and traumatised. He was experiencing so much trauma that has been in so many people's lives ... we were very worried because we were left with no homes ... we struggled to build the houses because they wanted to build small houses. Some people couldn't build their houses so they were sent to live in halls."**

Nosipho, Settlement Resident, Cape Town

Figure 8.

### Failure and blame

Exploring the contention about defining failure was important for the analysis of fire safety systems in Cape Town and Dhaka because we gained insights into how power can shape the search for knowledge and therefore what is learned (or not) by whom. As one resident argued at the roundtable in Cape Town: "we want partnerships not blame", suggesting it was through collaboration that new solutions might be found, and that blame prevented learning from being productive. Similarly, where discussions of failure focus on technical failings (for example, "the fire spread because there wasn't a working fire hydrant for fire fighters" – NGO representative, April 2023), the power of solutions is placed in the hands of the 'expert', leaving residents with little space or reason to offer their perspectives. When blame remains central to the learning process, what is learned by different actors within the system is constrained to what is already known, as if a boundary is drawn around what knowledge exists and is worth knowing.

It is evident that where analysis focuses on attributing blame to the 'end user' and solution with the 'expert', the opportunities for collective and collaborative learning experiences that generate new questions are limited. Rather than

seeking to make sense of the complexity associated with diverse perspectives and how complexity could shape learning from failure, the networks of relations should be viewed as generating new imaginations of what success might look like and what might be possible. As Kernick (2021), p.80 argues, "adaptive solutions are discovered through collective wisdom rather than traditional expertise."

Narratives of blame reveal socio-cultural biases that have implications for learning, both in terms of process and content. For example, informal settlement residents are often stigmatised and, in some cases, their lives are viewed as less 'valuable' (as was revealed in one stark interaction in Dhaka). However, communities who live with, adapt to, and respond to fire risk in their daily lives have knowledge and experience that can benefit technical or bureaucratic 'experts': where, how, and when fires are most likely to start and spread; how they learned of a fire and raised an alarm successfully; challenges with evacuation, firefighting and other responses, and recovery; approaches to education and prevention that are relevant and appropriate, and more. A core issue for other actors within the system who have power to imagine a different approach to learning from failure is unlearning: what do they,

individually and as an actor group, need to unlearn about knowledge, power, and the possibilities that might emerge from collaborative learning relationships with actors they would not usually work with?

### Failure in communication

The failure to learn and unlearn was evident in discussions about communication. In Cape Town, fire departments engage in activities that would enable them to deliver community training within informal settlements. Residents who attended the roundtable event commented that these rarely take place: "we have to rely on the information trickling to the ground ... we live in communities that are word of mouth. How is information spread?" (Roundtable, April 2023). Similarly, it was noted that systems of communication largely depend on linear and hierarchical relationships: "Government to ward councillor to community leader to community member ... this only works well in a very, very small number of cases ... we need to think about this much more imaginatively about how to build opportunities" (NGO representative, Roundtable, Cape Town, April 2023).

Linearity within a complex system enables disconnection between the formal and informal spaces of the system, which has the impact of preventing multiple lines of

communication that are necessary to include the range of perspectives. In other words, depending on formal, linear mechanisms of communication contributes to failure and the inability to learn (and put into action learning) because the reality of how communication happens within an informal system is ignored.

### Processes of learning from failure

As a process, learning from failure may occur through an intentional and purposeful intervention to analyse an incident with the goal of gaining new understandings that can lead to change in policy or working practices (for example, fire investigation). However, not all learning is intentional or conscious: people experience failure with and through others so gain lived, situated, and (sometimes) anecdotal knowledge that reflects the incident as they and those around them lived it. These knowledges are spatial, temporal, and experiential; learning is not linear or fixed in a single moment. Rather the process of engaging with failure could be framed as a process of ‘spiral learning’, where knowledge and understanding builds gradually in layers, with repeated opportunities to engage with, question, and reflect on individual or multiple failures.

New possibilities emerge by thinking about the process of learning from failure in this way. Rather than a linear approach with fixed and singular definitions, a Community of Practice that brings together multiple perspectives could imagine new solutions. Through “iterative discussions of content and process over time, in contrast with single-issue or single-meeting approaches to public engagement, allow participants in inclusive processes to revisit and revise their questions and approach, to track how processes and issues change over time, and to expand community by creating more connections among issues and participants” (Quick & Feldman, 2011).

### Failure, adaptive capacity, and imagination: making sense of our failure to learn

One key finding in this theme is that it is settlement residents who seem to be the main actors ‘learning’. In Cape Town, residents adapt to the new environments, creating informal governance structures because of their learning from fire incidents, such as processes to check on neighbours who cook when distracted or intoxicated after visiting the ‘pub’. The fact residents learn and adapt makes sense: they are the people who experience and live with the consequences of failure at other points within the system: failure cascades towards communities. However, failure to learn still exists within the safety system as a whole. From a governance perspective, a significant question to ask is one posed by Gill Kernick (2021) in her analysis of the Grenfell Tower fire. Kernick argues analysis of complex system failure requires greater understanding of why decisions taken within the complex system made sense for the actors involved: essentially, why does the failure to learn makes sense?

In Dhaka, reflecting on the failure to learn about and take action to address the fire problem (which impacts informal settlements, high-rise buildings, marketplaces, Old Dhaka, and factories) makes sense if we consider more traditional approaches to complex systems and governance. Our interviews revealed various vested interests (such as those that benefit from informal settlement fires which can speed up the process of urban development); it is easier to settle with the status quo when the political incentives enable personal gain; and, where lines of accountability or responsibility are lacking, there are few consequences for anyone other than the victims.

Even in a broader governance system that recognises and has mechanisms in place to support informal settlement residents, failure

to learn might make sense. One contributor to the roundtable in Cape Town with many years’ experience within NGOs in South Africa remarked, “the city wants a quick fix ... it either works instantly or it’s a failure”, noting that blame is unfairly attributed to the community when these instant (generally technological) fixes ‘fail’. She argued, “you can’t expect to give something they’ve never had and expect them to use it in the way you expect without awareness raising, community engagement”. Failure to learn can make sense if there is a failure to examine the relationships that underpin different modes of learning and action.

As the discussion of definition highlights, all actors within a complex system enter into an analysis of ‘failure’ with different intentions, purposes, and goals, gaining different perspectives and knowledge through a range of processes, from and with different actors within the system. A key finding from our work shows that without complex definitions that explore (without necessarily reconciling) definitions of failure from different perspectives, the transformative potential of learning is limited. Inclusive risk governance, in this respect, does not require consensus but should enable individuals within the system to “shape the social structures surrounding them” (Renn & Schweizer, 2009, p.179) to ensure their understanding of failure is acknowledged.

### Failure to learn is political

This work examined learning from failure as a core theme and has established complexity around both terms – learning and failure – that needs to be explored. For instance, failure in governance is the failure to learn because the lack of interrogation, reflection, and action that is made possible from learning enables risk to cascade through the safety system. Failure to learn, therefore, is an example of political inaction having consequences –

whether intended or unintended. To illustrate, this takes us to thinking about different incentives and the benefits (perceived and actual, known and unknown) of particular action or inaction.

Making sense of the failure to learn exposes formal and informal mechanisms, truths, and states within both the safety and urban governance systems that contribute to a lack of fire safety. The inaction

surrounding the challenge to these is arguably political. We outline this in more depth in the analysis of our third thematic focus, political actions have consequences.

## Political (in)actions have (unintended) consequences: recognition and responsibility

**“We all agree fire is a development problem, unless you want to deal with fires but not deal with the cause of fires”**

Cape Town City Department for Disaster Management

A complex systems approach allows us to see that what flows from political actions and inactions may not always be linear or result in predictable, intended outcomes or consequences. This theme therefore concerns political action, inaction, and intended and unintended consequences. We recognise the dynamism and adaptivity of different actors and elements, the influence of wider contextual issues that shape an open system and how these issues work together to influence how a political action might create varying, different outcomes to increase risk rather than reduce it as intended.

The analysis of this theme is underpinned by two key insights

which connect but illuminate different aspects of governance:

- The inclusion or exclusion of key actors from formal governance processes (as explored in previous themes) is a political action that has consequences for the types of policies or interventions that are designed or created. Without the recognition, participation and inclusion of those who are most directly affected by risk or who may have to implement actions, policy- and decision-makers may enact inappropriate processes or practices that result in solutions that may not be fit for purpose. A consequence may therefore be continued or deepened risk.
- The political economy (political-economic context) of each city and actions stemming from these with regards to how city government/regulation engages or not with informal settlements has consequences for fire risk and safety. In other words, the political economy of each city speaks to

and creates the fire safety system. For example, in Dhaka, government approaches to informal settlements are underpinned by ‘slum-free city’ narratives, which aim to eradicate informal settlements, displacing residents to high-rise buildings. This would seem to indirectly remove residents from fire risk in informal settlements but displace them to equally risky environments in high-rise buildings which lack fire safety regulation. The issue of fire risk is displaced rather than eliminated.

Government actors involved in the Cape Town roundtable offered their reflection after the event, and presented an outline of, from their perspective, the key challenges in addressing fire safety (including recovery) across the city’s informal settlements (Figure 9). The points raised highlight the range of actors and relationships within the governance and fire safety systems that each play a role in addressing informal settlement fire.

### Some challenges experienced with fire safety

- Government is experiencing budget constraints that sometimes hamper assistance efforts.
- Currently, there is no overarching fire safety policy in government to articulate minimum standards, roles, responsibilities, and to guide fire safety activities within the province.
- People need shelter immediately after a fire, but government interventions activate around the 24-hour mark (or after) depending on supply chain matters, which is why after a fire, communities often start rebuilding on the affected site before a damage assessment has been conducted to determine the extent of damage and support required.
- Fire safety and prevention is most difficult in overcrowded informal settlements with no proper pathways for the entry and exit of informal settlements.
- Sometimes people in informal settlements build around the fire hydrant, making it difficult for fire brigades to fight fires.

Figure 9: Reflections from government actors

## Inclusion and exclusion in political actions

Our focus on listening to diverse voices shows that a critical issue for thinking about governance of safer complex systems concerns how regulations, policies, or programmes that enact political decisions are designed and whose perspectives are included or excluded. Before looking at specific aspects and examples of inclusion and exclusion, it must be acknowledged that informal settlements, by their very nature, epitomise exclusion: for instance, informality involves living with unregulated infrastructure (such as electricity), insecurity (like tenure) and marginalisation (for example, from political systems). In short, as the term ‘informal settlement’ suggests, exclusion is the status quo for the 1 billion people living in these settings and is indicative of a global social, economic, and political system that values some lives more than others. The consequence (intended or unintended) is the tacit acceptance of urban systems that fail for a majority of the people for whom the governance of that system should work.

Systemic exclusion is evident in actions within the fire safety system in Dhaka, a densely populated city with a reputation for congestion that can lead to longer response times from emergency services. While commenting on a decision within the fire services to place fire trucks strategically around city to navigate traffic issues, it was revealed that no provision was made to station any of those trucks near slum areas. From a complexity perspective, many issues are at play in this decision, including political incentives that ensure residents living in formalised areas of the city receive provision. While one (perhaps unintended) consequence of excluding informal settlements from this approach to provide fire response across the city was the emergence of informal fire safety mechanisms (such as community-led training and bucket brigades, which is also highly risky and inadequate) there are many other possible consequences: a diminished

sense of trust in fire services and weakened other actors associated with government.

An erosion of trust in politicians was also evident at the Cape Town roundtable: citing two programmes that were promised to be inclusive and empowering for residents of informal settlements, one participant commented: “no politician is trusted until they fulfil their promises ... Politicians fail to deliver ... funding goes to the wrong person” (Settlement resident, April 2023). For this resident, and others in attendance, there are consequences when politicians or government officials fail to ensure transparency (such as in the award of funding or allocation of city works roles) or communicate with them about decisions that have a direct impact on their ability to recover from a fire (such as the reasons why shelter rebuilding kits were stopped).

Communication is key to inclusion and can detrimentally impact relationships between different actors within the system if not inclusive and therefore involve action arising from the interaction. One government actor in Cape Town commented, “the structures don’t allow for real interaction, different actors feel disempowered and disconnected” (Pre-roundtable engagement, April 2023).

Sometimes, governance processes assume inclusion despite being designed in ways that might actually be exclusionary. For example, a city-wide project in Cape Town enabled residents to report issues with fire hydrants via an app, presumably with the assumption that even low-income households would access the resource. Officials remarked, “this is how it works in the suburbs” (Roundtable, April 2023). In the same discussion a representative from a Cape Town NGO that supports informal settlements on various issues, including fire, commented that reporting issues should be done via the ward councillor. Residents also report selling items they are given within relief kits, suggesting they have not been involved in the design

to ensure they met residents’ needs. By including residents in procurement processes, and addressing mechanisms of communication, technological solutions could be co-designed with populations who are most likely to be impacted and challenge a sense of exclusion that results from interventions which are not suitable for the needs of those most impacted by fire.

As is illustrated above, communication is critical to how political actions are experienced by informal settlement residents: “After 2017 government came up with reblocking. This divided the community and it divided the fire victims. Some wanted it and others didn’t. It was not properly explained before and was implemented and people’s houses were reduced in size ... If the government is introducing any idea, they need to first come to the people to explain” (Settlement resident, Cape Town April 2023).

Informal power relations and networks play a significant role in the implementation of fire safety governance in Dhaka. These relationships ultimately enable some to gain greater access to resources while excluding others. In addition to the musclemen/middlemen, organisations supporting development initiatives in Dhaka must navigate both the formal and informal governance system and build relationships with slum leaders to gain access to slums. Corruption and gatekeeping are features of networks of (inherited) power. They influence decision-making processes that include some settlement residents in shelter upgrading or recovery assistance programmes while excluding others.

## Political economy creates unequal fire safety systems

The effectiveness of any intervention to improve fire safety relies heavily on political and economic context and how this influences governance at national and local levels – this is arguably the key enabling/disabling factor to fire safety in informal



settlements. Political economy refers to the interaction between economy and decision-making processes and their implementation; how power and resources are distributed and contested, and implications for development outcomes (and in our case, safety outcomes).

South Africa has a progressive constitution with regard to housing for all, participation, informal settlement recognition to a certain extent by the state, and multistakeholder recognition of the problem of fire in informal settlements. This was shown by the range of participants at the roundtable event, yet the scale of the problem (in terms of the lack of affordable housing and implications for the development and perpetuation of informal settlements and thus fire risk) outstrips the state's ability and resources to manage it and, in this context, fires are increasing.

This is a much larger problem than just fire. This speaks to the complex causality and openness and scale of systems involved.

In Cape Town participants referred to the 'excuse' of lack of funds to address the issue, but wanted more transparency and accountability on how spending was decided upon and prioritised. Exclusion, lack of information, and broader issues of local context of democratic accountability all present challenges for the creation of an inclusive fire safety system.

In Dhaka, government approaches to informal settlements are underpinned by their illegality, and gaps in governance. This means there are no mechanisms or lines of responsibility to consider how fires in informal settlements are responded to. The aim of a 'slum-free city', is based on the eradication of informal settlements, displacing residents to high-rise buildings. This indirectly seems to address the issue of fire risk but in a context where there is a lack of fire safety regulation and implementation for high-rise buildings, the issue of fire risk is also displaced

rather than eliminated. Simultaneously, it provides incentive not to engage with informal settlements in terms of existing fire risk and safety.

Political economy impacts decision-making and implementation, has consequences for fire safety in different ways; wider issues of national or local governance regimes and mechanisms have implications for funding, resources, prioritisation, and accountability 'trickle-down' of a wider governance regime to fire safety governance. (in a context of complexity, these are not predictable, the two cities show two different outcomes for fire safety).

In the gaps left by government in dealing with informal settlement fire safety, participants recognised that other actors would seize the opportunity to step in. For example, the private sector with insurance against fire or in selling safety 'kit'; social enterprises implementing technical 'fixes'; or middlemen controlling access to shelter upgrading programmes. However, these actors operate on the basis of different motivations and interest as opposed to democratic mandate, and concerns were raised in the case of 'what recourse to compensation' would be available to residents should any external actors' technical fixes 'go wrong'. Along with extra layers of risk, lack of accountability cascades through the system via lack of clarity, transparency, or ownership.

# Section 5: Transferable learnings – governance and complexity

**“Governance redefined is what is needed”**

(City official, April 2023)

Our first report (see Annex A) highlighted a gap in formal governance of fire risk in informal settlements; there were no formally defined processes or guidelines that allocated responsibility and accountability to key actors for this specific risk, largely as a result of contextual conditions of informality. Fire risk in informal settlements was subsumed under urban fire risk in general, with engineered systems extended to informal settlements in a blanket approach, not taking account of the specificities of informal settlement fire risk that require a contextualised approach. The consequence of failing to bring contextual specificities into analysis of fire risk and associated safety

systems is that risks are cascaded through the system, resulting in deeper, more entrenched fire risk.

A complexity approach acknowledges that to achieve fire safety, the numerous, complex, nonlinear interdependencies, and interactions between people, places, politics, materials, and infrastructures that generate fire risk need to be looked at, going beyond 'traditional risk analysis' by technical experts. Systemic risk governance requires looking at how different actors, whether government, private sector, or civil society, organise themselves to manage the issue, acknowledging that everyone has something to contribute and that “mutual communication and exchange of ideas, assessments, evaluations improves the final decisions rather than impeding the decision-making process or compromising the quality of scientific input and the legitimacy of legal requirements” (Renn and Schweizer, 2009, p.175).

Engaging more deeply with governance and complexity during this project showed that governance is, in reality, practised in many ways: we have uncovered a hybrid / everyday quality to governance that responds to the complexity of a system characterised by hybridity (the coming together of formality/informality). We argue that any attempt to create fit-for-purpose and complexity-appropriate policy or regulatory structures must incorporate iterative learning and value these diverse everyday governance practices, which are underpinned by diverse experiences and perspectives

on risk, failure, and safety.

Focusing on everyday/hybrid governance allows for learning from success and failure. Formality and institutionalisation places boundaries around the system and therefore around the aspects of the system that are reflected upon. This can result in parts of the wider system being overlooked and learning from existing pockets of success or good practice that emerge through hybridity being missed.

Stepping back from the thematic analysis presented in Section 4, we share the following broader transferable learning for building governance for safer complex systems.

- Hybridity is integral to how settlement residents govern fire risk. **A hybrid/everyday approach can help to challenge top down, linear approaches to governance that potentially do not work in complex systems.** Understanding the numerous decision-making processes regarding safety that happen every day across scales, by or between different actors, that emerge because top down, formal, or linear governance does not work, doesn't apply, or is not extended to informal or illegal sites is necessary. The aim is not necessarily to try and 'formalise' these processes, but to make space and work with them.
- Looking at context and the openness of the system is vital. **How and to what extent do legal, political, economic and social contexts influence risk and safety governance (Renn & Klinke, 2011)?**

**“I’m sad that we’re actually further back in this discussion than I really anticipated. I thought the issues had been ventilated over the years so many times that the awareness of the issues of what they are would be so much greater than it is. And, while the discussion clearly is about solutions, we actually are quite far back. We’re still on the causes and sort of pointing the fingers of why isn’t somebody doing something about it. So, I mean, it’s eye-opening to say that is our reality. Which means we really do have a very long way to go.”**

Andrew Lashbrooke,  
CEO Erakis

- In the absence of formal governance of fire safety in the informal settlement context, looking at everyday governance and hybrid safety systems is required. How is decision-making, risk reduction, and safety implementation carried out informally as well as formally? Who is included or excluded, and how and why? We draw attention to the idea that power relations, often inequitable, shape these interactions and contexts, giving some actors more power to act than others. How can attempts to improve governance mechanisms confront **power relations** so that inclusion can happen on an equitable basis where everyone is heard and afforded equal respect, recognition, and influence?
- Participation and inclusion cannot be conflated: representation must lead to collaborative action. **Consultative processes such as workshops that involve intermediaries or other actors to engage with settlement residents on behalf of those in positions of power run the risk of being performative.** While useful knowledge may be gathered through the process, there are relational costs in terms of trust, equity, accountability, responsibility, and transparency.
- **Participatory practices expand the boundaries of whose reality counts while inclusivity seeks to take that complexity into implementation.** This goes beyond tick box exercises in terms of inviting key actor representatives to the table. It requires acknowledging heterogeneity in terms of needs, power, and influence within actor groups and analysis of the power relations between different actors that influences their participation in governance processes. It also requires looking at what extra resources, support, information, and mechanisms or practices some actor groups may need to

be able to participate equitably. This requires time and multi- or inter-disciplinary expertise to build and maintain sustainable relationships with or between actors throughout the process (as opposed to just having discrete roles for different actors such as just consultation, implementation, or imparting expert knowledge).

- **There is potential for models of governance to embed mechanisms such as Communities of Practice (CoP) as integral spaces and processes through which governance of complex systems (and systems within systems) can reflect values of equity, participation, and accountability.** A CoP is a voluntary group of people sharing a common concern who come together to explore these and share and grow their practice in a form of social learning which responds to the way in which top down or transmission of facts and ‘expertise’ does not necessarily lead to sustainable outcomes. Rather, a CoP is a process of becoming a member of a sustained community (Lave and Wenger, 1991, p.65), characterised by egalitarian membership, engaging with problems, trialling strategies together, trust, mutual respect, regular gatherings, shared success, failure, and developing shared resources.
- While more work is needed to understand the specific mechanisms that are suited to establishing and sustaining a CoP in different, complex contexts, for broader governance systems to learn from and respond to failure, there are clear principles as to how and why a CoP approach is critical to understand and enhance the governance of a safety system within the broader governance of society. **A central principle is that CoPs should be developed locally.**

## Collaboration and action through CoPs

Across the engagements in Cape Town, in particular, there were calls for greater knowledge, communication, partnership, and collaboration. A range of actions or intervention points emerged through this research to support these goals. It is evident that: “iterative discussions of content and process over time, in contrast with single-issue or single-meeting approaches to public engagement, allow participants in inclusive processes to revisit and revise their questions and approach, to track how processes and issues change over time, and to expand community by creating more connections among issues and participants” (Quick & Feldman, 2011).

**“We need one plan in place, one common objective ... everyone working together under one objective ... no-one seems to be working together, honestly ...”**

Roundtable participants, Cape Town, April 2023

As researchers engaged in thinking about complexity of fire risk and safety systems, it is important to recognise our own role, positionality, and contribution to the governance process: how was facilitating roundtables which brought key actors together, which had not necessarily happened before and itself was an act of governance, supporting governance? Positive feedback from participants on the workshop in Cape Town included ‘please don’t disappear’; an exhortation which will drive our work forward and ensure we keep reflecting on the different ways our role as an ‘outsider’, external partner, or perceived neutral party supports the process.

## Fire risk and safety CoP

A cultural step change in ‘listening’ ‘learning’, inclusion, collaboration is possible through mechanisms such

as a CoP. A CoP is not a new concept but one that may be useful for application to complex systems where different hierarchies and unequal power relations may exist which act as blockages to safety. We envision this space as an incubator for generating appropriate policy or processes of responsibility and accountability. It could work to a set of operational principles and guidelines, but have the ability to define its own process, define accountability, responsibility that is flexible to diversity, dynamic, and adaptive to the nature of the system (It can not be rigid as the system is adaptive, so wouldn't work), contextual, responsive, and adaptive.

CoP can lead the co-design of solutions through various activities and enable a range of learning engagements, though these are not prescriptive.

**Multiscalar and multiactor fire risk and safety system mapping**

Further work is needed to understand the multilayered networks of risk and safety as well as their interactions within a complex system at different scales and through different actors. Going beyond a stakeholder mapping exercise, this approach would explore layers of hybridity of complex system and consider adaptation; parts of the system such as specific institutions may have defined roles, responsibilities, and guidelines, but other parts may not. Incorporating an everyday or hybrid governance approach to improving safety may help in capturing and working with some of the nuances of complex interactions, that if unacknowledged can act as blockages in the system to solutions or interventions.

Relatedly, incentive structures must be explicitly identified through collaborative dialogue and learning from failure(s): analysis is needed of the different actors that benefit from fire, in what ways they benefit, and the implications of these weaknesses within governance fire risk to cascade throughout the safety system. Without this identification, intervention points cannot be identified.

**Community of practice**

**“We can’t deal with electricity quickly, we can’t solve the problem now ... for me a lot of these problems are long term and they need a lot of stakeholders involved. The first thing that needs to happen is an action plan where everyone is involved so at least everyone is aware of all of the risks, all of the challenges, what the next steps could be, so when a fire breaks out, these are the people we contact, this is what we do so it’s almost like a to-do list. What I have seen as well is that often communities and municipalities don’t have a strategy or a plan for a settlement so if they were to have an education campaign when the fire happens they know who to go to, who to phone, who to contact, it’s been inbuilt into their brains, but not a higher level awareness campaign. It has to be with the informal settlement; with the people who actually care about that settlement, who live there. And a lot of the responsibility doesn’t stay with them, but they know what they can do.”**

Provincial government actor, informal settlement support

**Evaluations and funding mechanisms**

Funders can support inclusive governance of fire risk and safety by making inception funding available in the beginning phases of a project for the co-design of research and interventions with CoPs that include settlement residents and the range of actors who have a role in fire safety. Related to this, funding could allow a longer period of time to evaluate interventions. Any technological interventions (such as giving equipment or implementing adaptations to shelters) need to be accompanied by inclusive and repeated community engagement and education activities.

Engaging CoPs within funding proposals and programme evaluations also builds new systems of governance.



## Conclusion

This research highlights challenges for those involved in the design of safer complex systems. A central concern relates to the people within the system who live with and experience fire risk. Critically, we ask, when designing safety systems: whose reality counts?

Questioning not just who participates but whose experiences, perspectives and goals are included in the creation of policy is key to avoiding repeated failures and a lack of learning about what works and what does not. Being cognisant of who experiences risk and safety (or the lack of each) means not just listening to the range of voices but enacting interventions that have been co-designed through inclusive practices that engender empowerment of all within the system.

Thinking about how to govern informality is also key. This requires us to acknowledge that everyday governance occurs throughout the fire risk and safety system within informal settlements. There are new possibilities being created in these spaces that can and do interact with formal governance processes, and that are necessary as contexts grow more complex through global realities such as climate-related migration. For this hybridity to be retained and harnessed, mechanisms for solutions can be put in place that reflect values of transparency, equity, and accountability. They should be decided, designed, engineered, and practised through collaboration, founded on a critical multi-actor assessment of the enablers and constraints to inclusivity and an enabling environment where hybrid governance is a space of innovation.

The analysis offered in this think piece highlights the importance of emergent informal safety practices and systems within complex systems thinking.

However, it argues for greater recognition of hybridity – the intersection of formal and informal – as a relational dimension of complex systems. It is not enough to acknowledge the existence of hybrid safety and governance practices and systems, rather greater understanding is needed of how formality and informality and their interactions are understood, acknowledged, and engaged with by decision-makers in governance processes.

Hybrid systems of governance and safety involve networks of actors and relationships, and processes and mechanisms which emerge from a broader global political economy. Engaging with the systemic roots of risk and vulnerability is critical to acknowledging why informal fire safety practices emerge in different contexts, and how these practices interact with and respond to formal mechanisms. For example, where infrastructure remains inadequate (such as road access or fire services), the burden falls on informal settlement residents to create informal fire safety and response solutions.

This research sought to connect theory, methods, and practice in an ethos of coproduction that would highlight how risk and humanity intersect within understandings of and approaches to governance of safer complex systems. Diverse voices must be included within each part of a complex system, including in its creation. Failure to do so, is a political action.

# Annex A: Thinking through complexity

Our previous work via the Safer Complex Systems programme focuses on fire risk in informal settlements in two cities; Dhaka, Bangladesh, and Cape Town, South Africa. In our first report we charted how root causes of fire risk were to be found in the political, social, and economic structures within a society that affect the allocation and

distribution of resources, wealth and power among different groups of people, and have driven how cities develop and operate inequitably. Informal settlement fires are not just technical and physical challenges to be managed at the site of ignition but reveal **causal complexity** in a wider urban system. Fire risk in informal settlements emerges from this

context which limits people’s choice of where to live, and how, leading to the creation of informal settlements, where ignition sources and material conditions that lead to fire spread proliferate. The complex systems map designed through our first project is replicated below (Figure 10).

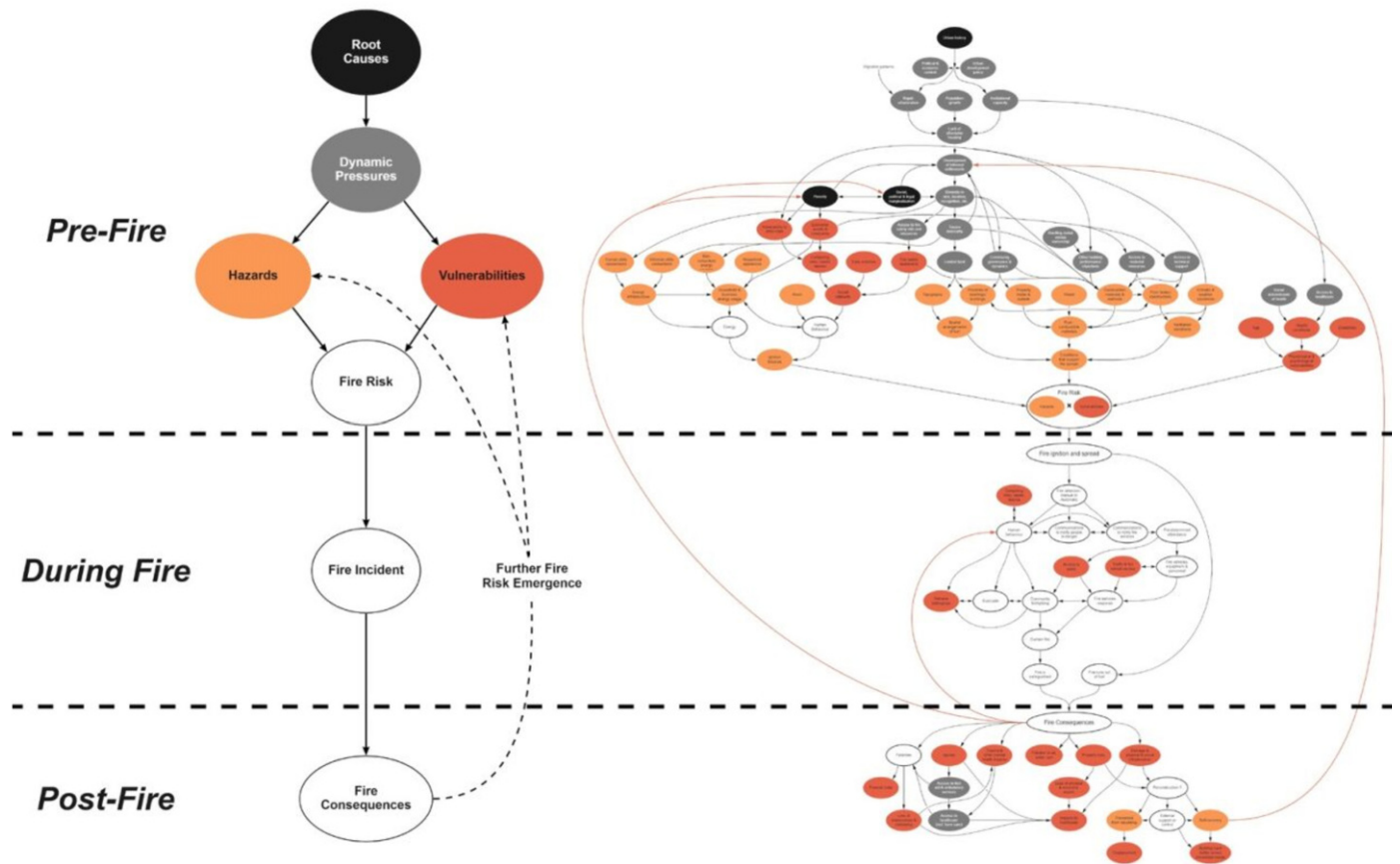


Figure 10: Fire risk in informal settlements: Complex Systems Map (Antonellis et al, 2022)

A foundation of our analysis is Complex Adaptive System (CAS) theory. This approach recognises complexity – many working parts of a system, all of which are connected in some way, adaptation – constantly changing, and systems – these are broad, operating over a range of

scales. CAS approaches focus on patterns and interrelationships within these systems, rather than focusing on cause-and-effect linearity. Such systems are “defined more by the interactions among their constituent components than by the components themselves” (Preiser et al, 2018)

meaning, “relations form the unit of analysis” in CAS. Such systems are therefore more of a process than a ‘thing’. Table 1 highlights some of the key characteristics of the CAS approach.

	Underlying feature	Key feature / attribute
<b>Structural features</b>	Constituted relationally	Interactions on multiple scales result in networks of interactive relations. CAS are defined by the interactions among their constituent components.
	Radically open	All systems exhibit hierarchy in that every system is part of a wider system and is made up of subsystems. Systemic interactions generate effects that have impacts across scales and domains.
	Context dependent	The identity and functions of CAS are defined by the context in which they exist.
<b>Process features</b>	Adaptive	CAS have self-organising capacities and can adjust their behaviour as a response to changes in their environments.
	Dynamic	Nonlinear dynamic processes bring about the behavioural patterns of CAS. Nonlinear feedback loops mean that small changes can have significant, cascading effects.
	Complex causality	Individual components interact to produce novel qualities and phenomena. The whole is more than the sum of its parts, meaning that systems cannot be understood, nor their behaviour predicted based solely on information relating to the individual parts.

Table 1: Key characteristics of a Complex Adaptive Systems approach (Preiser, 2018)

## Annex B:

# Reflection on research process

Although not designed to be a comparative study where points of comparison drove the analysis, the two cases – Cape Town, South Africa and Dhaka, Bangladesh – provide context specific insights and opportunities to make wider contributions to the broader themes of governance in contexts of informality. Three key themes guided the methodology and the methods, each one revealing dimensions of relations and relationships within the complex system and contributing towards a deeper understanding of fire safety within the broader urban system.

Coproduction of the research process – from design, delivery, output, and dissemination – is not without its challenges. While we were able to involve a wide range of actors in Cape Town in the research process (particularly in agenda setting for the roundtable workshop and in opening a space for reflection and continued engagement after the event), many layers of complexity (largely social and political, but also within the timelines of the research project) meant a different approach became necessary for our work in Dhaka. A wide range of actors were engaged within the process: more than 20 individual meetings were held with relevant actors from government, NGOs, academia, the private sector, and critically, informal settlements to explore the issues and invite participants to set the agenda for a roundtable, including two meetings with informal settlement residents from two different areas which were attended by more than 25 people in each setting.

Through these engagements, it became apparent that governance about fire safety was highly contentious and situated within a highly charged and contested system of formal and informal politics. Hierarchies were evident in every interaction; given that a key aspect of our work is the participation and

### The Research Team: Preconceptions and Biases

Kindling ([www.kindlingsafety.org](http://www.kindlingsafety.org)) emerged out of a recognition that purely engineered solutions were failing to understand or respond to the fire problem in informal settlements and humanitarian settings. The research team is explicit in their aim to offer holistic and integrated socio-technical analysis to a problem which has been dominated by fire engineering and fire science that lean towards technical ‘silver-bullet’ solutions. The approach connects fire science and engineering with social scientists, educators, and experts in Disaster Risk Reduction (DRR) to develop interdisciplinary thinking and approaches that recognise systemic and political issues related to knowledge production and policy creation in regard to fire safety.

inclusion of people who live with and are affected by informal settlement fire in the co-design of dialogue and solutions, this gave us pause. After reflecting on some of the discussions with individual participants in Dhaka, we felt we could not ensure a safe and open space for the roundtable where diverse voices were not just invited to participate but also felt heard and included in the exploration of possible solutions. The analysis, therefore, draws on these individual meetings and analysis of broader contextual characteristics, but does not reflect on observed interactions between actor groups.

Complexity is also evident within how we approached the analysis and the creation of this report. Making sense of the multitude of different perspectives and presenting them in a defined format is, in itself, a struggle of complexity. Therefore, we invite the

reader to engage with the thinking presented in this document as one possible narration. In further rounds of analysis or if interpreted from a different perspective, an alternative emphasis within the story may emerge. This is an important and valuable acknowledgement of rethinking how we approach and think about complex systems because it recognises complex systems, governance, and the theoretical and methodological lenses we use to create policy as dynamic: how we analyse and reflect on research ‘data’ does not end with the creation of an individual document, but continues to be informed by feedback loops within the research process itself. Furthermore, the data generated through this work can be used in future work to add depth to other questions and may also engender new perspectives.

### Key actor groups

- Residents of informal settlements
- Fire and rescue services
- Police services
- Non-governmental organisations (NGOs) and Community based organisations (CBOs)
- Urban planning and development authorities
- Service providers (e.g. electricity) – public and private
- Municipal governments
- Disaster management agencies
- Social services
- Local academic researchers
- Fire safety engineers
- Humanitarian agencies
- Private sector and social enterprises



## Reference list

- Anderson, C., Joshi, A., Barnes, K., Ahmed, A., Ali, M., Chaimite, E., Forquilha, S., Khan, D., Khan, R., Loureiro, M., Myanmar Research Team, Posse, L., Rowlands, J., & Shankland, A., (2023), *Everyday governance in areas of contested power: Insights from Mozambique, Myanmar, and Pakistan. Development Policy Review*, 41(Suppl. 1), p.2.
- Antonellis, D., Hirst, L., Twigg, J., Vaiciulyte, S., Faisal, R., Spiegel, M., Faller, G., Walls, R., Flores, N., & Messerschmidt, B., (2022), *A comparative study of fire risk emergence in informal settlements in Dhaka and Cape Town*, Royal Academy of Engineering Safer Complex Systems Case Study.
- Bussu, S., Golan, Y., & Wojciechowska, M., (2022), *Understanding developments in Participatory Governance: A report on findings from a scoping review of the literature and expert interviews*, Manchester Metropolitan University.
- Kahanji, C., Walls, R., & Cicione, A., (2019), Fire spread analysis for the 2017 Imizamo Yethu informal settlement conflagration in South Africa, *International Journal of Disaster Risk Reduction*, 39.
- Kernick, G., (2021), *Catastrophe and systemic change: Learning from the Grenfell Tower fire and other disasters*, London Publishing Partnership.
- Lave J., Wenger E., (1991), *Situated learning: Legitimate peripheral participation*. Cambridge, England: Cambridge University Press.
- Preiser, R., (2018), *Key Features of Complex Adaptive Systems and Practical Implications for Guiding Action*, Centre for Complex Systems in Transition.
- Quick, K., Feldman, M., (2011), Distinguishing participation and inclusion, *Journal of Planning Education and Research*, 31(3), pp.272–290.
- Renn, O., Klinke, A. & van Asselt, M., (2011), Coping with Complexity, Uncertainty and Ambiguity in Risk Governance: A Synthesis, *AMBIO*, 40, pp.231–246.
- Renn, O. and Schweizer, P., (2009), Inclusive Risk Governance: Concepts and Application to Environmental Policy Making, *Environmental Policy and Governance*, 19, p.176.
- Renn, O. and Schweizer, P., (2019), Governance of systemic risks for disaster prevention and mitigation, *Disaster Prevention and Management*, 28(6), pp. 862–874.
- Spinardi, G., Cooper-Knock, S. J., & Rush, D., (2020), Proximal design in South African informal settlements: users as designers and the construction of the built environment and its fire risks. *Tapuya: Latin American Science, Technology and Society*, 3(1), pp.528–550.
- Twigg, J., Christie, N., Haworth, J., Osuteye, E., & Skarlatidou, A., (2017), Improved Methods for Fire Risk Assessment in Low-Income and Informal Settlements, *Int J Environ Res Public Health*, 14(2), p.139.

