

**AN ASSESSMENT OF LITERATURE ON  
INDICATORS MEASURING THE EFFECT  
OF COMMUNITY ENGAGEMENT ON RISK  
REDUCTION**

A REPORT TO THE CFA

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## **Executive Summary**

### ***Background***

The Country Fire Authority (CFA) works with individuals and communities through community engagement programs to reduce risk by assisting them to recognise hazards and risks, build knowledge and capability, and prepare for emergencies. It is currently building capacity for outcome and impact evaluations of its community engagement interventions, and this assessment is a step in that process.

### ***Research questions***

This rapid assessment of peer-reviewed papers and reports, and material examines the appropriate:

- indicators for measuring the effects (outcomes and impacts) of community engagement for risk reduction (enhancing individual and community resilience and preparedness)
- methodologies for evaluating these effects, including means of establishing attribution.

### ***Search, exclusions, and outcomes***

Following a search of four databases, Scopus, Web of Science, Science Direct and Google Scholar, two hundred and sixty-nine papers were identified after removing duplicates. One hundred and eighty-three studies were excluded at the title and abstract stage primarily if they discussed the physical impact of a hazard, did not include outcome or impact, focused on recovery or were only health related. A further twenty-six articles were excluded as full texts mainly because of an inadequate community engagement focus, primary climate change focus, or theoretical discussions. After these exclusions, sixty papers remained for analysis.

The assessment failed to find literature specifically addressing the most effective ways of measuring the effect of community engagement in reducing risk. Some papers and reports described reviews of individual community engagement programs and a few groups of programs. Evaluations completed globally over almost thirty years and addressing a wide diversity of hazards, including earthquakes, floods, tornadoes, landslides, and bushfires in Australia, were limited in number.

### ***Meaning of risk reduction***

Disaster risk reduction comprises a range of activities undertaken to minimise vulnerabilities and disaster risk throughout a society, to avoid or to limit the adverse impact of hazards. Agencies engage individuals and communities to reduce the risk they face from hazards through interventions to enhance their resilience and preparedness. Risk is reduced through community engagement for resilience and preparedness.

### ***Community engagement frameworks and processes***

Frameworks in which indicators measuring the effects of community engagement in reducing risk were identified. A leadership-based continuum of community engagement outlines different levels of engagement ranging from agency-controlled processes to community

control. It is characterised at one extreme where information, awareness raising and education emanate solely from agencies, progressing toward an agency-dominated partnership; then participation, power sharing, co-creation and learning by sharing ideas and perspectives, building relationships and shared understandings of risk, responsibility and values; creating a capacity and impetus for community leadership. The International Association of Public Participation's Engagement Spectrum [1] reflects a similar continuum of communication outcomes, from inform, consult, involve, collaborate and empower with tools and tactics. A stepped, activity-based framework (Australian generative model of community engagement) begins with community profiling, establishing relational ties, building individual and community capacity, establishing community programs, and preparing for locally identified risks. At all steps of the model, monitoring, evaluation, and learning can be undertaken.

### *Outcome and impact measures*

Community engagement's effects (outcomes and impacts) need to be conceptualised and measured using systematic and comprehensive indicators to make a consistent and robust assessment of outcomes and impacts possible. This can only be achieved by first establishing clear objectives for the intervention, and specifically, in relation to risk reduction, within a comprehensive program logic and possibly, for more complex programs, a theory of change. In most instances, a good impact evaluation will start at the design of an intervention and continue throughout implementation.

Impacts include social action taken, broad social or community-wide effects such as enhancing awareness of other perspectives, empowering community members, and building social capital. Appropriate measures depend on the objectives and processes involved in community engagement interventions.

The definition of 'impact' is contested by scholars and practitioners. Impact is defined by the Commonwealth Department of Finance as 'The ultimate difference made by fulfilling a purpose defined in an entity's corporate plan. Compared to the combined outcome of activities contributing to a purpose, impacts are measured over the longer term and in a broader societal context' [2]. Impact refers to justifiable causal claims about observed changes produced by an intervention. These claims are made when the design approach, and the methodology have been interrogated for validity threats, and when the findings and conclusions have been delivered with statements about the limitations and cautions around the confidence that we can have in the findings. (Ref DH). Rogers defines impact evaluation as 'an evaluation that provides information about the impacts produced by an intervention. It can be undertaken of a programme or a policy, or upstream work – such as capacity building, policy advocacy and support for an enabling environment'[3].

Indicators are defined as 'an explicit measure of an important factor relevant to the subject of interest, in this case, disaster risk and its reduction, where the indicator can be used to monitor changes in the status of that factor and thereby to monitor progress towards a desired outcome' [4]. They are 'quantitative or qualitative variables that provide reliable means to measure a particular phenomenon or attribute. ...it provides a sign or a signal that something exists or is true. It is used to show the presence or state of a situation or condition.' [5].

Indicators of individual and community development of critical competencies and enablers can measure the outcomes and impacts of community engagement in reducing risk.

Outcomes include recognition of risk and community members' unique connections through that risk with each other and agencies; taking responsibility, planning, motivating, supporting and cooperating; and exercising cooperative leadership in a capable, flexible, and trusted network.

### ***Methods of community engagement in emergency management***

Australian studies of community engagement interventions for risk reduction have identified up to eighteen sub-types. The number and variety of community engagement interventions with many objectives and contexts suggest that diverse evaluation effect measures and methodologies are required.

### ***Need for evaluation of community engagement***

Evaluation and subsequent learning should guide all community engagement activities. Evaluation can explore the relevance, effectiveness, efficiency, impact and/or sustainability of the community engagement intervention [6]. Learning is possible if success and failures can be objectively assessed, and improvements identified. Applying the lessons that are learned improves engagement practice and supports continuous improvement [7] and enables fire agencies to not only imagine but plan and deliver improved services to communities.

### ***Impact evaluation methodology***

Research methodology is the procedure used to identify, select, process, and analyse information about a topic. A systematic, comprehensive and robust methodology is the foundation of the validity and reliability of the research findings [8]. Evaluation methodologies incorporate the procedures of best-practice research and in addition reflect the formative or summative purpose of the evaluation.

The strength of the evaluation methodology, including the sophistication of the theory of change in which CFA community engagement interventions function, the strength of the intervention's logic model, baseline data, and data collection methods and analysis, is the basis of the validity and reliability of the findings. A wide range of methodologies are used in the evaluation of community engagement interventions reflecting the unique characteristics of the intervention and its specific evaluative challenges, the purpose of the evaluation (priorities and uses), available resources and constraints [2] and the use of many types of interventions to reduce hazard risk through resilience and preparedness.

A robust methodology must:

- support effective measurement of effect,
- support a systematic and comprehensive evaluation methodology, where possible and appropriate,
- address the counterfactual if possible and appropriate.
- enable longitudinal comparison.
- use mixed methods and triangulation.

### *A way forward*

A more rigorous, robust, and systematic approach to the evaluation of community engagement interventions requires the following:

- Clarity on the objectives of community engagement for risk reduction
- Avoiding a ‘one size fits all’ approach
- Agreed whole of organisation purpose, priority and authority
- Establish fundamental community engagement impacts in the CFA fire risk register
- A position paper clarifying definitions of key concepts including impacts and impact evaluation, principles, values and minimum standards.
- Theoretical frameworks for measuring the outcomes and impacts of community engagement interventions.
- Agreed indicators of community engagement effects.
- Identified and agreed principles to guide the selection of and/or a possible suite of evaluation methodologies.



## **Background**

Emergency management organisations, including CFA, have adopted community engagement programs to work with communities to recognise hazards and risks and prepare for emergencies. But evaluation of the effectiveness of these programs has been limited, so evidence on the effects of engagement interventions is not broadly based or well developed. This is in part due to the nature of community engagement programs, creating difficulties linking them to risk reduction impacts as is possible with other risk reduction activities such as planned burning and land use planning. The effects of engagement interventions are consequently not understood in similar terms and are siloed in their planning and conduct.

The objectives and contexts within which community education, awareness and engagement activities are implemented are diverse and complex. Consequently, communities are engaged in many ways for two primary purposes, to promote preparedness and resilience in individuals and communities.

While the forms of community engagement employed within CFA are various, they generally involve working with individuals and groups to provide information and learnings, promote changes in attitudes and behaviour and encourage active participation in decisions and actions that affect or interest individuals, households, and communities.

CFA intends to build capacity to conduct outcome and impact evaluations of its community engagement programs. This assessment is a first step in the process. As such it identifies and clarifies issues requiring resolution for the creation of a robust and high-quality design for the assessment of the outcomes and impacts of CFA's community engagement interventions. It considers the function and nature of outcome and impact assessment of community engagement in keeping communities prepared for and safer from fire.

## **Structure of report**

The structure of this assessment report is as follows. First, the purpose of the assessment and the methods used are discussed including the literature search and analysis of the data. Second, the meaning of risk reduction as enhancing resilience and preparedness is discussed. Third, engagement theory, definitions and objectives of community engagement in emergency management, and community management frameworks are canvassed. The effects of and processes of community engagement in emergency management and the measurement of those effects is then discussed. Fifth, methods used by emergency agencies in engaging the community, and the usefulness of segmenting groups in the community and targeting interventions are examined. Next, the rationale for evaluation of community engagement interventions is canvassed and the bases of outcome and impact indicators revealed. Methodological issues for the evaluation of community engagement are then summarised. Finally, on the basis of the themes identified in the assessment of the literature directions for the development of evaluation outcomes and impacts are proposed.

## **Statement of research purpose and questions**

The purpose of this assessment is to identify advanced indicators for measuring the outcomes and impacts of community engagement programs on risk reduction.

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 Research questions:

- 1) What are appropriate indicators for measuring the outcomes and impact of CFA's community engagement on fire risk reduction? (RQ1)
- 2) What methodologies are appropriate in evaluating the outcomes and impacts of community engagement on risk reduction? (RQ2)
- 3) How will the methodologies facilitate the evaluation of the contribution of CFA's CE programs to overall community outcomes and impacts (RQ3)? How can they attribute outcome or impact to CFA CE programs (RQ4)?

**Research methodology**

An adapted rapid evidence assessment was conducted to provide an overview and assessment of material relating to the evaluation of community engagement interventions for risk reduction with a specific focus on the measurement of the outcomes and impacts of community engagement. A rapid review is a form of knowledge synthesis that adopts the systematic review process, in which components are simplified or omitted to produce timely outcomes [9].

**Search strategy**

Search terms summarised in Table 1 were identified on the basis of the research questions,

Table 1: Search terms

Category	Search terms
What	"community engagement" OR "community education" OR "community participation" OR "community involvement" OR "community led" OR "community preparedness" OR volunteer*
AND	
What	impact OR outcome
AND	
What	"risk reduction"
AND	
What	measure* OR assess* OR evaluat* OR indicator OR index OR matrix OR tool*
AND	
What	bushfire OR wildfire OR grassfire OR hazard

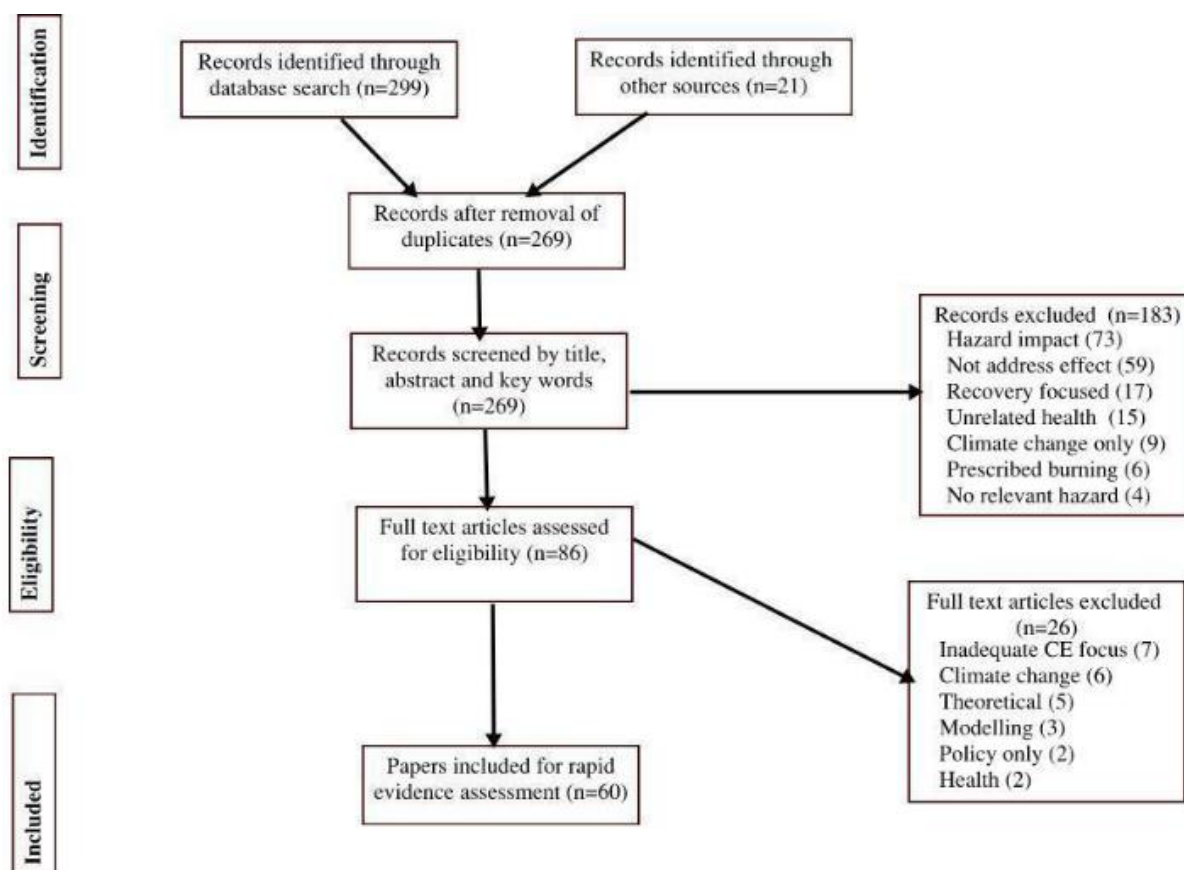
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Peer reviewed literature, unpublished grey literature and emergency management sector policy and practice documentation were searched for coverage of the research terms in Scopus, Web of Science, Science Direct and Google Scholar. These databases provide good coverage of hazard and disaster risk reduction in the peer-reviewed and grey literature. Reports, working papers and other grey literature were gathered from within article references and a snowballing strategy was used to build the list of papers. Seven emergency

management practitioners and policy makers were consulted about reports, presentations and other materials that may not have been identified in the search of databases. Systematic literature reviews of the effectiveness of community engagement for disaster preparedness produced by Ryan et al. [10, 11] provided important material for this assessment.

### *Inclusion and exclusion criteria*

Papers addressing the topic were included for assessment if they were published since 1995 in the English language. Two hundred and sixty-nine papers were identified after the removal of duplicates. One hundred and eighty-three studies were excluded at the title and abstract stage primarily if they discussed physical impact of a hazard, did not include outcome or impact, focused on recovery or were only health related. A further twenty-six articles were excluded as full texts mainly because of an inadequate community engagement focus, primary climate change focus or were theoretical discussions. After these exclusions sixty papers remained for analysis.



**Figure 1: Inclusion and exclusion flow diagram**

### *Literature search, screening, and data extraction*

The database search was first conducted in late February 2023 with a further search to identify relevant papers published in March 2023. One reviewer screened the search results by title and abstract and papers falling outside the criteria, excluded. The full text of remaining papers was screened by the same reviewer to identify final papers for assessment.

***Quality assessment of studies***

No quality assessment of the papers was conducted. Papers not meeting quality standards were intended to be excluded from the assessment, but none were deemed to be poor quality.

***Data extraction and synthesis of final papers***

The full text of the included papers was imported into NVivo software (QSR NVivo 12) and searched for references to the assessment topics. The reviewer sorted extracted data from all included studies and coded them into themes and sub-themes. These were organised into broad descriptive themes based on the content of the codes and the authors' knowledge. A summary of the coded text was collated and used to identify twelve analytical themes emerging from the descriptive themes across the included studies. The descriptive themes were background, community engagement objectives, CFA mission and purpose, community, definitions of terms, evaluation issues, impact, methods for evaluation, outcomes, outputs, preparedness and types of community engagement.

Not all papers addressed every aspect of interest to the assessment but all 60 offered data for the synthesis.

## **Meaning of risk reduction**

Disaster risk reduction comprises a range of activities undertaken to minimise vulnerabilities and disaster risk throughout a society, to avoid or to limit the adverse impact of hazards, within the broad context of sustainable development [4]. Individuals and communities are engaged by agencies through interventions to enhance their resilience and preparedness to reduce the risk that they face from hazards. Risk is reduced through community engagement for resilience and preparedness.

## ***Resilience***

The UNDRR defines resilience as ‘the ability of a system, community or society exposed to hazards to resist, absorb, accommodate, adapt to, transform and recover from the effects of hazards in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions through risk management’[12]. Australian Institute for Disaster Resilience (AIDR) emphasises identifying and mitigating risks, absorbing disruptive events, pre or post adaption to those events and returning to a functioning state [6].

Every [13] reported three dimensions of resilience that could be applied to the Country Fire Service (CFS) programs: Social factors such as trust, connection and leadership; personal factors such as resourcefulness, self-efficacy, problem solving and critical decision making; and information, bushfire awareness, and bushfire preparedness. The nurturing of capacities within these dimensions through involvement in CFS programs can enhance individual and community resilience.

## ***Preparedness***

Preparedness is one of the four priorities for action in the Sendai Framework for Disaster Risk Reduction [12, 14]. Preparedness has individual, community, organisational, and societal dimensions. It is defined as a state or a process by the US Department of Homeland Security as ‘a state of readiness to respond to a disaster, crisis or any other type of emergency situation’ or ‘a continuous cycle of planning, organizing, training, equipping, exercising, evaluating, and taking corrective action.’

McNeill[15] identified five dimensions of preparedness: physical (to defend property, evacuate and increase fire resistance); planning for bushfire; availability of social support; ability to respond and recover; and knowledge of bushfire behaviour and how to act safely. This knowledge, capacity and social and community support during and after fire all contribute to preparedness to deal with bushfire and reduce the risk of injury, death and destruction of property.

By enhancing individual and community resilience and preparedness, community engagement interventions reduce risk to individuals, households and communities.

### Engagement theory

CFA engages with Victorian community members through connection, interaction and communication, by informing and collaborating with them to enhance preparedness and resilience and reduce risk to life and property.

Engagement... ‘is a dynamic multidimensional relational concept featuring psychological and behavioural attributes of connection, interaction, participation, and involvement, designed to achieve or elicit an outcome at individual, organization, or social levels’ [16]. It is conceptualised as ‘an iterative, dynamic process, where participation, experience, and shared action emerge as central components’ [17]... and through interaction and exchange...meaning is cocreated, and through dialogue, understanding is achieved.

Engagement facilitates decisions that contribute to interpersonal, organisational, community, and civic social capital and provides a conceptual, and applied framework to understand and respond in meaningful ways to real-world problems [17].

Johnston [16] presents a multilevel model of engagement (Figure 2) founded on a series of propositions that are supported in the literature. Cognitive, affective, and behavioural dimensions of engagement are activated by communication interventions (dialogue, advocacy, and interaction) that mediate an individual state of engagement, that precede and influence social engagement. Collective levels of engagement involve five dimensions: collective action and group participation (behavioural); and orientation, intention, and experience (affective and cognitive). These attributes contribute to group levels of engagement and intervention through programmatic interaction, advocacy and dialogue mediates social level engagement. Engagement outcomes at this social level feedback to modify individual cognitive, affective and behavioural dimensions.

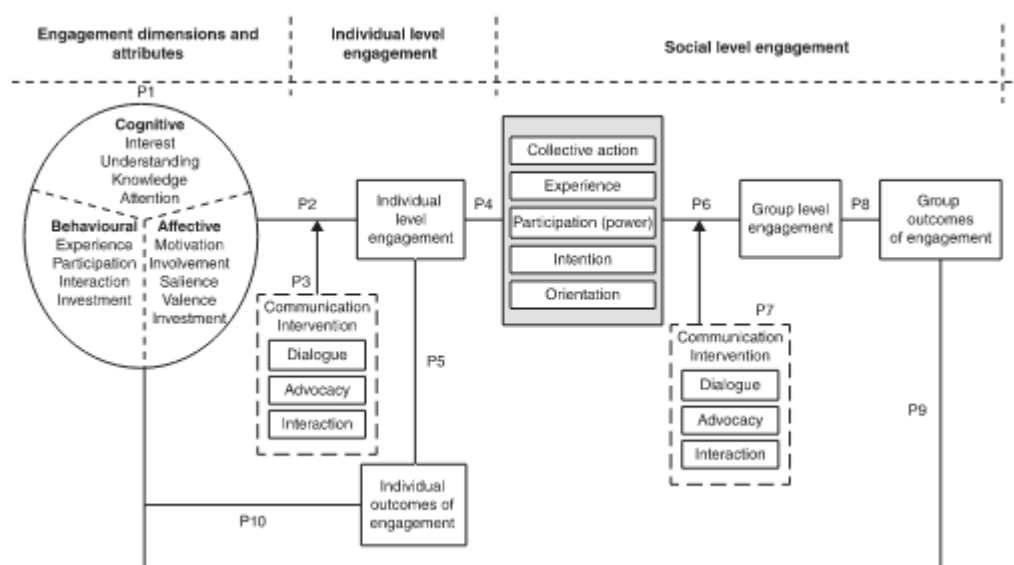


Figure 2: A multilevel model of communication engagement. From Johnston 2022 [16]

## **Definitions of community engagement in emergency management**

The definition of community engagement in emergency management has considerably evolved as the status of, and activity in the field has grown.

In 2013 the National Strategy for Disaster Resilience Community Engagement Framework defined community engagement as ‘... the **process** (my emphasis) of stakeholders working together to build resilience through collaborative action, shared capacity building and the development of strong relationships built on mutual trust and respect.’ It argued for agencies working ‘...in partnership with the community, building on existing networks, resources and strengths, identifying and supporting the development of community leaders and empowering the community to exercise choice and take responsibility.’

In 2020 AIDR defined community engagement as ‘the process of communities and partners working together to build resilience through collaborative action, shared capacity building and development of strong relationships built on mutual trust and respect.’ [18].

Adapting the Victorian Government Public Engagement Framework 2021-2025, in 2022 CFA described community engagement as ‘...a planned process with a specific purpose to empower communities to prevent and prepare for fire. It involves working with individuals and groups to encourage active involvement in decisions that affect them or are of interest to them. It includes educating people about fire safety, obtaining feedback about plans and projects, and working directly with communities to address fire risks.’ (CFA 2022)

## **Objectives of community engagement in emergency management**

Reflecting on evidence within the literature, Johnston and colleagues [19] conclude that agencies undertake community engagement to ‘collaborate with and through community members to address, respond or mitigate issues that affect the health, well-being or social status of the community’ by facilitating ‘understanding and evaluation, involvement, exchange of information and opinions’ [20]. Community engagement seeks to build community connection, resilience and trust... empower and involve the community ...and meet the needs and risk profile, of community [19].

Also reflecting an agency lead approach, Gilbert [21] proposes that community engagement programs intend to increase ‘people’s perception of their risk of bushfire and to generate changes in behaviour to reduce their bushfire risk.’ Community safety programs seek to assist households to understand and accept bushfire risk and plan their protective actions [5, 21-23]. Effective interaction between the community and emergency agencies to increase understanding and coordination, plan and prepare for fire, share responsibility, and create effective community partnerships[22, 24], are also central aims. It promotes self-reliance and awareness through knowledge, motivation and capacity to ‘manage risks in their own communities as an active partner with fire management agencies’ [25].

AIDR argues that community engagement aims to develop understanding of local risks and the appropriate response; share local insights about community assets, strengths and capabilities; facilitate knowledge, skill and idea sharing; and promote local disaster risk reduction and resilience activities. It provides learning opportunities, enhances collaboration, trust and partnership through networks of shared responsibility [6].

For individuals, community engagement can increase bushfire risk awareness and knowledge; confidence in managing bushfire preparation and planning; and understanding and co-operating with agencies. For communities it enhances group capacity to prepare and respond; strengthens relationships; mutually supports personal safety; and empowers protective decision-making [26].

Community engagement to reduce risk therefore seeks to advance the readiness and capability of individuals, households and communities to plan, prepare and respond to a hazard event by establishing a common understanding of and posture toward risk; building connections for support and collaboration within the community (including with emergency services); and continuously improving the knowledge and physical and psychological capacity of community members to safely respond to threat posed by a hazard.



## Community engagement frameworks

AIDR places emergency management community engagement, encompassing information, participation, consultation, collaboration and empowerment, within a framework of principles, purposes and context (Figure 3). Information is shared to create greater understanding between agencies and the community and facilitate shared responsibility. Involvement establishes relationships that build trust and ownership. The dynamics of consultative interaction ventilates and vitalises ideas, establishes dialogue and facilitates feedback. Developing collaborative partnerships helps identify broader options, better solutions, and mutually acceptable ways to action these solutions. Communities and individuals are empowered to recognise risk, accept responsibility (or at least shared responsibility) and implement actions and solutions.






The white and grey literature presents the forms of community engagement as ranging from a ‘deficit based’ model [27, 28], or top-down, agency-centred approach [7] involving one way information transfer, awareness raising and education based on an assumption of expert knowledge and command and control [7, 28]; progressing through an agency dominated partnership with the community slowly moving toward equilibration; to participation, power sharing, co-creation and learning through the sharing of diverse ideas and perspectives [19, 27], involving long-term relationship building and mutual recognition of risk, responsibility and values [7, 27]; creating a capacity and impetus for community leadership [7]. The International Association of Public Participation’s Engagement Spectrum [1] reflects a similar continuum of communication outcomes, from inform, consult, involve, collaborate and empower with tools and tactics. However participative, power sharing approaches to community engagement are hampered by bureaucratic, temporal, and financial constraints [29].



*Figure 3: Community engagement model for emergency management. From Community engagement framework. Australian Institute for Disaster Resilience, 2018. [30]*

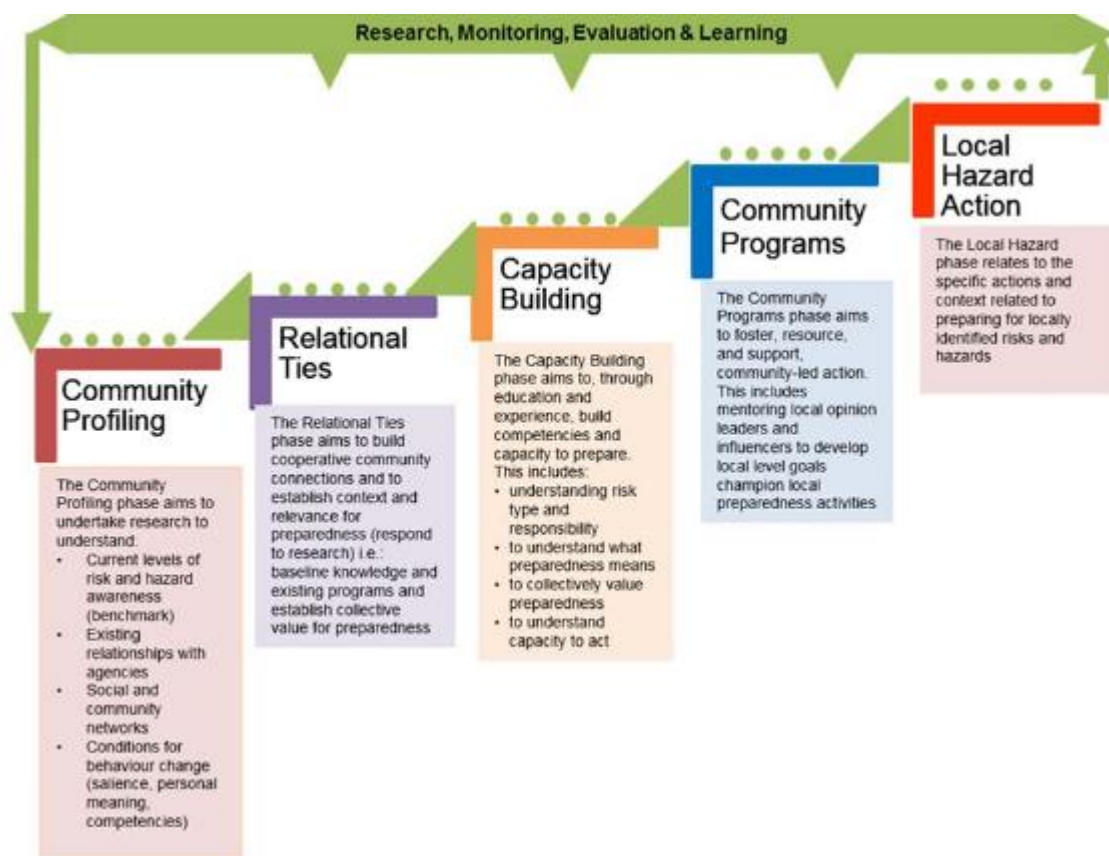
AIDR’s 2020 community engagement handbook (Table 2), reflects these forms beginning with decision-making solely in the hands of an agency, agency leadership with community input, agency, and community cocreation, community leadership with agency support and community design and delivery.

**Table 2: Approaches to community engagement for resilience - basis of engagement. Adapted from AIDR (2020) [18]**

Who leads the process	 Partner designs and delivers to community	 Partner leads with community input	 Community and partner work together	 Community leads with partner support	 Community designs and delivers
<b>Basis of engagement</b>	Partner provides community with information, options, solutions or services for a given situation or issue.	Partner provides leadership to community. Community provides input to the process.	Community and partner form a partnership. They co-design and develop options and solutions.	Community provides leadership to partner. Partner provides input to the process.	Community designs, decides and implements all actions. Minimal or no engagement necessary from any partner.
<b>Stated or implied, contract between external partner and community</b>	Partner understands the issue or situation, provides community with what they need and keeps community informed through the process.	Partner provides guidance, listens to community concerns and issues and takes them into account. Community input is considered necessary to ensure success.	Both community and partner bring expertise to the relationship. Mutual participation or collaboration contribute to success.	Community understands its own context and situation. Partner offers expertise and knowledge. This input is offered to support community-led action.	Community has a thorough understanding of its own context and situation and the hazards that may affect them. Community will ask for support when and if needed. External organisations may not be aware of projects at all.

The role of the agency develops progressively from providing all information and direction to the community; considering relevant community input; collaborating with the community; offering expertise and knowledge to support community action; to a point where it plays no part in community led actions.

Professor Kim Johnston, Dr Barbara Ryan and Professor Maureen Taylor documented Australian approaches to community engagement supporting preparedness for natural disaster, based on a review of the literature and interviews and workshops with community engagement practitioners. Johnston et al. [7, 19] created a model of community engagement for the emergency management sector that takes a broad perspective by incorporating the aims of community engagement, the tools and strategies that can be utilised and how the outcomes and impacts of engagement can be evaluated. The Australian Generative Model of Community Engagement (Figure 4 establishes the aims of community engagement, comprising foundational steps for each of those following and is circular so learnings at each step inform future engagement.)



**Figure 4: Australian generative model of community engagement- Aims. From Johnston et al. (2019) [19]**

The six steps of community engagement are: community profiling, establishing relational ties, building individual capacity and within the community, establishing community programs, and preparing for locally identified risks. At all steps of the model, monitoring, evaluation, and learning can be undertaken.

The first profiling step builds an initial understanding of the community, providing a benchmark for comparison following community engagement interventions. It describes key factors including risk and hazard awareness, community networks, community and agency relationships, and the perceptions and attitudes of the residents including self-reliance, capability and protective intentions.

The relational ties step builds connections within the community, shared attitudes and understandings around key factors such as risk, community capability and the value of preparedness.

Competency and capacity are built in order to understand: risk and how it applies in an individual, household and community context; what is necessary to be prepared and to collectively value preparedness; and what is required to take effective protective action.

The step into Community Programs fosters, supports, and resources community established and led activity to enhance preparedness through planning and action and developing and harnessing local leadership.

Local Hazard Action is informed and directed by the risk context and the specific circumstances of the community. Local Hazard Action is made possible by community engagement outcomes of the earlier steps.

Research, monitoring, evaluation and learning can occur at any step in the community engagement process to inform, guide and measure engagement actions by agencies and the community. The first profiling step provides benchmark information to the community and at subsequent stages, provides insights to improve relationships and understanding, build individual and community capacity, inform strategic program interventions, and evaluate outcomes and impacts of programs and actions.

## **Effects of and processes in community engagement in emergency management**

Encouraging or assisting individuals and communities to prepare for a natural hazard and to support greater resilience has required emergency agencies to address ‘economic, cognitive, social, and physical barriers’ [10] with a diversity of programs and tools to inform, advise and assist on risk, planning, preparation (personal and property) and decision-making. The practice of community engagement for emergency management, reflected in those programs and tools, is informed by the theory of engagement and the principles, beliefs, theories, and dogmas that prevail within the sector.

In 2009 Elsworth and colleagues [31] captured the prevailing theories and principles around Australian bushfire safety programs (Figure 5) in a review of evaluative studies of community education, awareness and engagement. Their review concluded that desired community safety outcomes: awareness of risk and fire behaviour and safety knowledge, ‘household and community...planning, physical and psychological preparation..., and a safe response... to fire [31]’ were critically reliant on four causal processes: engagement, trust and self-confidence, confirmation and re-assessment, and community involvement and collaboration. The deep synthesis of data exposed how and in what ways the engagement process worked within the context of Australian bushfire safety programs. Elsworth’s findings mesh closely with Johnston’s [16] theoretical model of engagement and with a study of Australian community engagement for preparedness. Together these point to the key indicators with which outcomes and impacts of community engagement should be measured. This will be elaborated in a later section.

Elsworth’s engagement process [31] reflects Johnston’s cognitive, affective and behavioural engagement dimensions and attributes [16] and the communication interventions of dialogue, interaction and advocacy. Agencies act to interest, motivate, and engage Elsworth’s individuals, households and families, building their trust in agencies and self-confidence and trust in their own capabilities. Agencies’ engagement with individuals lays the groundwork for resident involvement, collaboration and learning based on dialogue and interaction with neighbours and other community members and self-advocacy. At the end of this causal chain residents plan and prepare individually, within households, with neighbours and with local brigades for a safe response to bushfire [31]. The actions and behaviours described in these causal steps reflect individual engagement, the cocreation of social levels of engagement where residents act collectively, participating as a group; share knowledge and insights; and share and support each other’s intentions, exercise decisional power and create social capital [16].

Elsworth et al.’s [31] causal processes mesh with Johnston et al.’s [19] findings a decade later when they investigated practitioners’ views on how community engagement could best support preparedness. They concluded that community members should understand the nature of the risk and its implications for their attitudes and behaviour. They need to recognise that emergency agencies may not be available when required so it was necessary to take responsibility for preparation including planning and implementing activities and supporting community preparedness. Community supported and led activities are valued, resourced and promoted through sharing and connection. Practitioners also reported four key enablers of strong community preparedness: the connections and relationships community members have with each other; community recognition that they owned the risks that were

locally unique to them, and consequently created deep connections with each other; community leaders that are trusted and credible communicate with and motivate community members; a highly accessible community problem-solving network capable of flexibly and adaptably responding to individual and community needs.

Johnston et al.'s generative model of community engagement is based on this analysis (Figure 4 – **Aims**) and focuses on the **tools** (Figure 6) required to pursue the key objectives and activities at each step in the engagement of the community. Community Profiling requires primary and secondary data collection to establish a baseline of information on the population, the environment, and agencies.

Relational Ties identifies existing networks and connections, common social, cultural, economic, political, and psychological beliefs and values, and the points of conflict and agreement and possible collaboration.

The Capacity Building step builds individual and collective competency and capacity through education, training, immersion, reflection and sharing insights and experience.

The Community Programs step uses community and agency resources to co-design activities to build planning and preparedness capability and harness local leadership as champions, motivators and creators of social norms. Agencies mentor leaders, and support, guide and recognise community effort as a 'critical friend'(not my emphasis) [19].

The Local Hazard Action step involves actions around response to specific local hazard(s) including household and neighbourhood preparation, communications and warnings, brigade response, planning of protective response and effecting evacuation.

The insights reported in the Elsworth et al. paper [31], supported and extended by Johnston's frameworks [16, 19], provide a base for formulating and assessing indicators to measure the effects; the outcomes and impacts of community engagement in reducing risk.

Community engagement needs to support the development of key competencies and enablers including recognition of risk and community members' unique connections through that risk; taking responsibility and planning, motivating, and supporting each other; and exercising cooperative leadership in a capable, flexible, and trusted network.

Johnston et al.[19] demonstrated how these key competencies and enablers could be promoted through community engagement based on the generative model (Figure 7) to increase preparedness. The Relational Ties step promotes capacities around connectedness and cooperation that are important to individuals establishing relationships with neighbours, local brigades, and influencers for understanding the extent of risk, community capability and the types of response that may be necessary and possible.

Through education and experience people further personalise risk, plan preparation and evacuation, enhance cooperation through their neighbourhood and community networks and increase their knowledge and clarify their protective decisions (Capacity Building step).

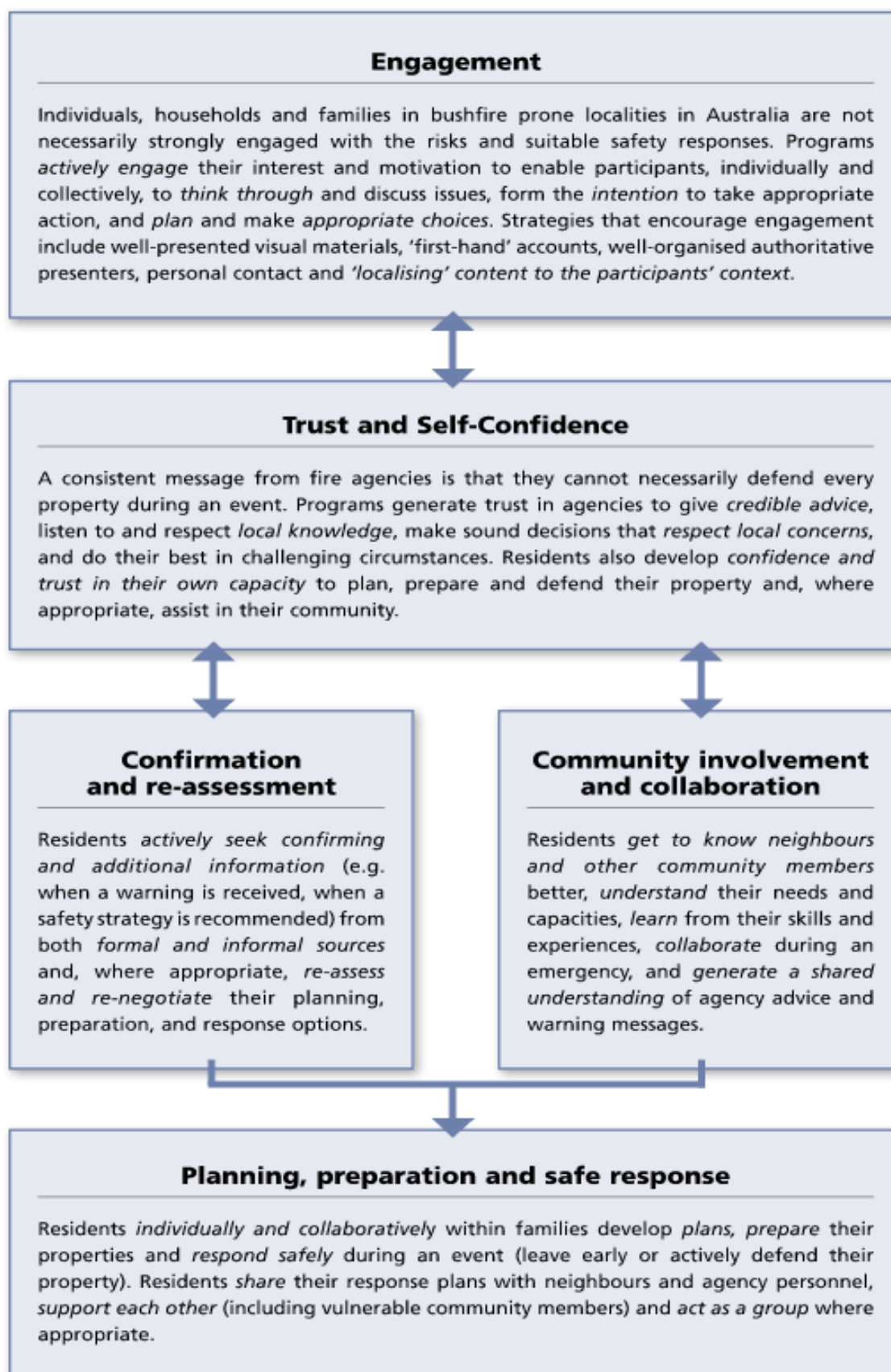


Figure 5: Theory model of community engagement/education initiatives. From Elsworth et al. (2009) [31]

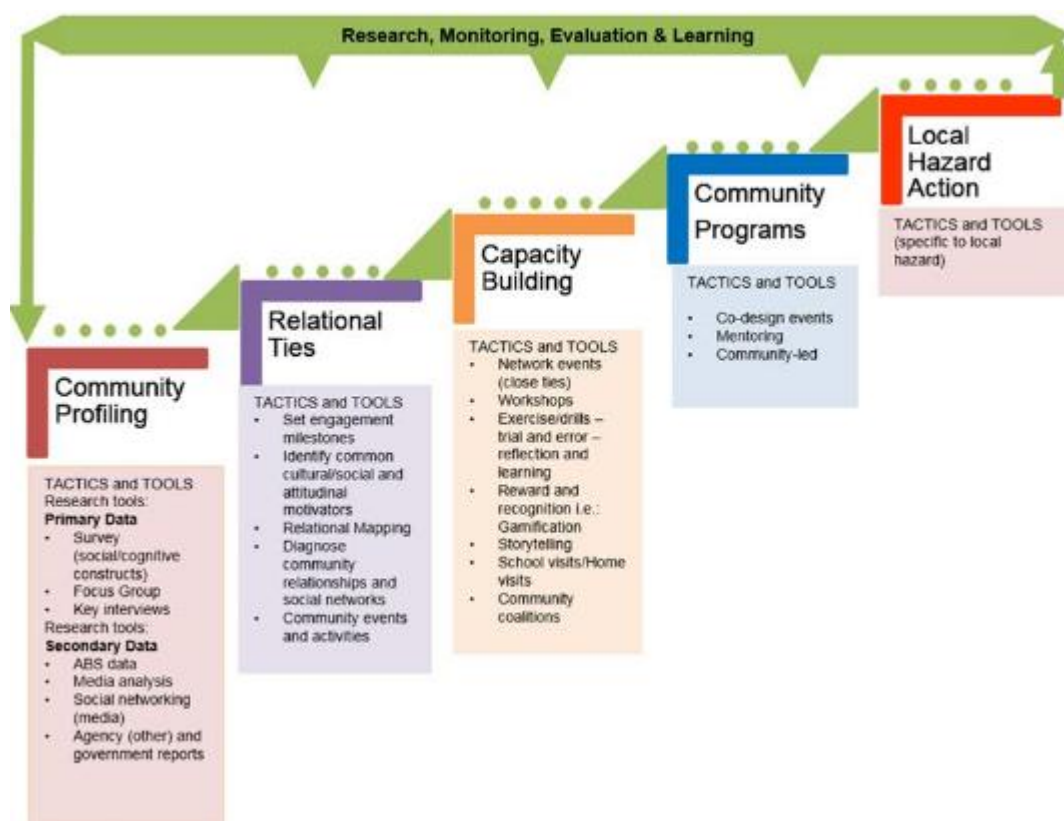


Figure 6: Australian generative model of community engagement- Tools. From Johnston et al. (2019) [19]

The Community Program step directly resources and supports community led action that facilitates the refining and testing of plans, building cooperative community networks, establishing trusted local leadership, and strengthening relationships with agencies. Community programs also build individual and community knowledge and capability and provide practical foci for community members to concentrate effort, motivate action and strengthen social norms around preparedness.

This systematic presentation of both the appropriate forms of community engagement objectives to enhance preparedness and suitable engagement processes, provides a guide to the type and nature of measures of community engagement effects. It provides a comprehensive framework to clearly enunciate measurable community engagement evaluation objectives and consequently, meaningful measures. The model also provides a systemic view of community engagement for preparedness that facilitates systems-based evaluation of community engagement interventions.

The Elsworth and Johnston models are the only peer-reviewed frameworks of community engagement in the emergency management sector identified in the literature search.



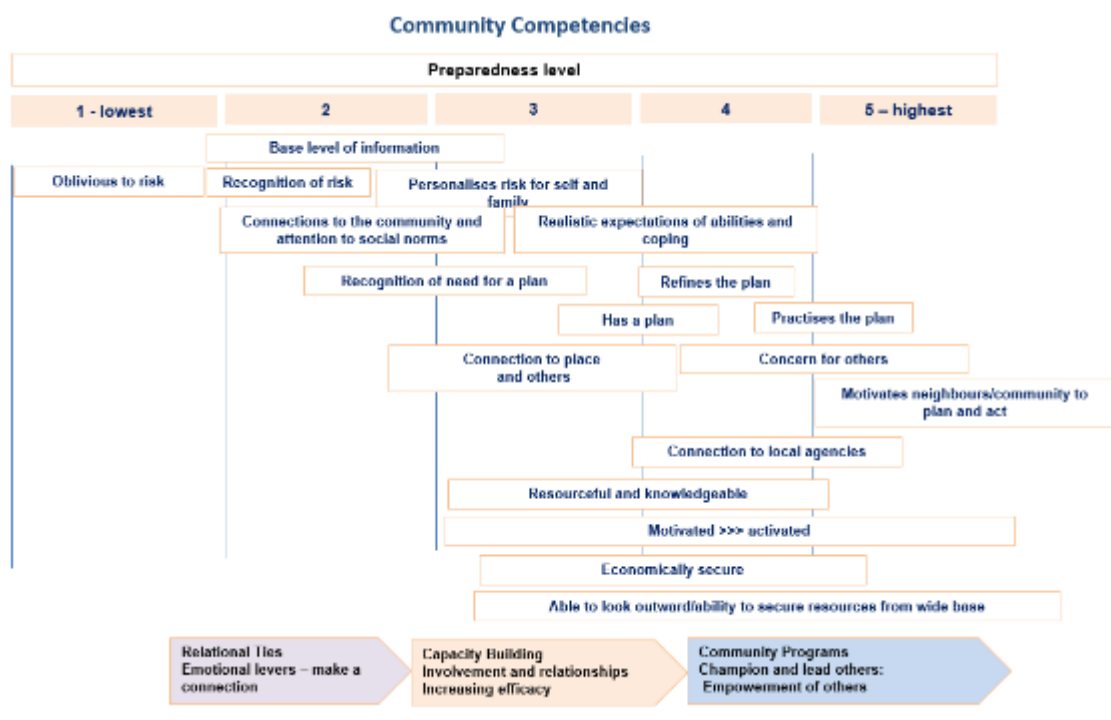


Figure 7: Community competencies for preparedness. From Johnston (2019) [19, 32]

## Measuring the effects of community engagement

The effects of community engagement need to be conceptualised around clearly defined objectives and measured using systematic and comprehensive indicators in order that consistent and robust assessment of outcomes and impacts is possible.

Taylor et al. [5] reported Johnston and Taylor's [17] study that evidenced three tiers of measurement of engagement with low-level measures or output indicators at the base, 'mid-level understanding and connecting or outcome indicators, and (at Tier 3) 'impact'(my emphasis) indicators, suggesting higher-level action and change.' Table 3 details three tiers at which the effect of community engagement can be measured.

The first level or Tier 1 proposes measurement of the effect of community engagement based on the level of activity such as counts or amounts (e.g., the number of people attending a meeting, social media page likes or the number of residents using an online tool) indicating receipt of content. These are the necessary, but not sufficient, activities for community engagement.

### *Outcomes*

Outcomes are observed and measurable changes that relate to a particular variable of interest. But it is not always the case that the changes that we can see and observe are causal consequences. Outcomes relate therefore to changes that we can see and are measurable, but those changes could have happened for many reasons, including but not limited to how we have manipulated the environment.

Tier 2 measures the quality and extent of relationship, interaction, connectedness, and dialogue between community members and between agencies and community members including trust, reciprocity, and openness and acceptance of attitudes and leadership. Measures of behavioural, cognitive, and affective improvements through better relationships such as household and neighbourhood cooperation in planning and preparation and acceptance of mutual responsibility.

The earlier discussion of Elsworth et al.'s [33] focal effects and processes in community engagement in promoting individual and community preparedness points toward specific kinds of measures of outcome and impact that can be classified or organised within these three tiers.

Johnston et al.'s [19] Community Competencies Index [32] also provides a group of indicators that can be adapted and used as measures of the effects of community engagement on individual psychological capacity, knowledge and ability, connectedness and planning capacity.

### *Impacts*

The definition of 'impact' is contested by scholars and practitioners. Impact is defined by the Commonwealth Department of Finance as 'The ultimate difference made by fulfilling a purpose defined in an entity's corporate plan. Compared to the combined outcome of activities contributing to a purpose, impacts are measured over the longer term and in a broader societal context' [2]. Impact refers to justifiable causal claims about observed changes produced by an intervention. These claims are made when the design approach, and

the methodology have been interrogated for validity threats, and when the findings and conclusions have been delivered with statements about the limitations and cautions around the confidence that we can have in the findings. Rogers defines impact evaluation as ‘an evaluation that provides information about the impacts produced by an intervention. It can be undertaken of a programme or a policy, or upstream work – such as capacity building, policy advocacy and support for an enabling environment’[3].

Impact evaluation requires establishing clear objectives for the intervention, and specifically, in relation to risk reduction, within a comprehensive program logic and possibly, for more complex programs, a theory of change. Impact evaluation goes beyond looking only at goals and objectives to also examine unintended impacts. Impacts may be intended or unintended and include preventing negative or positive change.

The unpublished CSIRO Impact Evaluation Guide [2] cites a range of possible types of impact including ‘an effect on, change or benefit to an activity, attitude, awareness, behaviour, capacity, opportunity, performance, policy, practice, process or understanding of an audience, beneficiary, community, constituency, organisation or individuals in any geographic location whether locally, regionally, nationally or internationally.’ Impact is defined in an operational sense depending on context, type and need of the evaluation of an intervention. An organisationally agreed definition of impact that accommodates a broad range of evaluation activities must be established.

Taylor et al.[5] suggest higher level (Tier 3) indicators for the impact of community engagement measuring social action taken, or broad social or community wide effects such as enhancing awareness of other perspectives, empowering community members or building social capital [17] including enhancing community leadership capability. Tier 3 measures sustained change and impacts. Few efforts to construct frameworks or taxonomies for the measurement of the impact of community engagement have been reported and are limited to the health [34-37] and education [38, 39] sectors. These frameworks were specific to the subject around which the community was engaged including HIV/AIDS [34], the millennium development goals [38] and health research [39].

AIDR links high level impacts of engagement with empowering communities to reduce risk and increase resilience, citing effect measures including knowledge, connection and relationship, community capacity to participate or undertake formal disaster risk reduction , disaster preparation and overall learning to maintain and improve resilience’ [6] .

The search of the literature did not uncover specific discussion of appropriate means of measuring the effects of community engagement in the context of disagreement or conflict within the community in relation to an intervention. It also failed to identify specific considerations in the development and application of effect measures relevant to the perspectives and experiences of women and vulnerable populations.

In a few cases social and economic modelling has been used to evaluate community engagement interventions [40, 41], employing cost-benefit analysis including valuing contributions to social capital and social networks, lives and property saved, and critical infrastructure protected [5].

**Table 3: Conceptual tiers for measuring engagement [17]**

<i>Tier</i>	<i>Possible measurements</i>
1. Low level <ul style="list-style-type: none"> <li>• Presence</li> <li>• Occurrence</li> <li>• Manifestation</li> </ul>	<ul style="list-style-type: none"> <li>• Indicator of activity</li> <li>• Counts and amounts of interactivity</li> <li>• Social media likes, page visits, click-through</li> <li>• Monitoring—social media and traditional</li> <li>• Reading/viewing/visiting/impression/awareness</li> </ul>
2. Mid-level <ul style="list-style-type: none"> <li>• Understanding</li> <li>• Connecting</li> </ul>	<ul style="list-style-type: none"> <li>• Indicators of relationship qualities</li> <li>• Trust, reciprocity, credibility, legitimacy, openness, satisfaction, understanding</li> <li>• Interaction quality</li> <li>• Diffusion—patterns and networks</li> <li>• Dialogue</li> <li>• Voice</li> <li>• Indicators of engagement dimensions at individual level measuring affective/cognitive/or behavioral outcomes, for example, user-generated effects or neuroscience/unobtrusive/implicit measures</li> <li>• Antecedent and outcome</li> </ul>
3. Higher level <ul style="list-style-type: none"> <li>• Action</li> <li>• Impact</li> </ul>	<ul style="list-style-type: none"> <li>• Indicators of social embeddedness</li> <li>• Of self and others</li> <li>• Social awareness and civic (greater good) indicators</li> <li>• Acknowledgment of other (diversity/empowerment)</li> <li>• Indicators of action, change, and outcomes at social level</li> <li>• Engagement in ecological system</li> <li>• Recognition of diverse perspectives</li> <li>• Social capital</li> <li>• Agency and coordinated action</li> </ul>

Work by Gibbs et al. [40] that was identified through our search (and by Johnston [19]) was the only Australian study that addressed community engagement impact at the level of social costs and benefits. Community Fireguard, a CFA facilitated community capacity building program encouraging neighbours to collaborate with one another to prepare for bushfire, taking a whole of society perspective, was found to have reduced property loss from 35% to 21%; fatalities by 40%; and assuming 1 in 100-year fires, each Fireguard group saved \$217,116 in property and life loss cost to their community.

Given the lack of an impact measurement framework for community engagement in emergency management, the Australian Research Quality Framework (RQF) and the Australian Research Council (ARC) definition has been adapted to the needs of this paper to define impact as “a demonstrable contribution that community engagement makes to the economy, society, culture, national security, public policy or services, health, the environment, or quality of life...”[42. p.5]. This definition recognises that community engagement for disaster risk reduction has a diversity of impacts including on, human safety (health and wellbeing), critical infrastructure (national security) and public and private land and capital (economic).

When measuring the impact of community engagement four issues are relevant. Impact assessment may be forward or backward tracing. Engagement may be traced to any resulting impacts, or from a known outcome the community engagement activities can be identified at the beginning of the pathway of impact. Second, the timeframe in which impact occurs must be clear. The impact can be measured at points from initial engagement, to continued interaction, to ultimate impact. In the short term, process measures may be impact steps

leading toward a measurable outcome. Longer term measures ‘may be needed to account for changes in population health, behaviour change, socioeconomic change or environmental change arising’ [43] from community engagement. Community engagement interventions may require behaviour change involving complex steps [31] if an effect is to be achieved and such change may require long time frames and multiple interventions [23].

Another key consideration for establishing the impact of community engagement is the question of “attribution”, or contribution [44-46]. In many cases, it is problematic to say with any certainty that specific engagement activities influenced an outcome; behavioural, cognitive, environmental, or economic. Many factors affect a community’s preparedness or resilience. Context influences measured effects which are consequently likely to be only partially attributable to the intervention, so unqualified conclusions or comparisons are not possible [23]. Difficulties in attribution also arise from time lags between engaging with the community and any potential or perceived impact. It may be possible to more readily establish that an intervention has contributed to producing an impact or made a difference (cf. Appendix 1). While attribution remains the benchmark for impact evaluation, theory-based evaluation and contribution theory has been increasingly advocated and used as a legitimate alternative to confirm the effect of program interventions through their contribution.

Finally, impact can be measured qualitatively, quantitatively or using mixed-methods metrics. Quantitative metrics are often preferred as more objective than qualitative measures, and randomised controlled trials and cost-benefit analysis seen as the gold standard. However increasingly more sophisticated qualitative methods are being developed and used in impact evaluation.

The frameworks for the measurement of community engagement impact relating to emergency management [5, 16, 19] that have been discussed in this chapter provide a foundation for developing overarching objectives for community engagement interventions within theories of change implicit within the frameworks. Objectives that are likely to be common to community engagement interventions for risk reduction are:

- Awareness of risk
- Trust in emergency services
- Self-confidence
- Willingness to collaborate.

These issues will be further elaborated in the discussion of ‘Indicators’ in a later chapter.

## Methods of community engagement in emergency management

Specific methods of engagement, have been posited by the AIDR (Table 4) [18] that to a large extent reflect the contrasting influence of the agency and the individual/community. Agency-led engagement is dominated by group and one-on-one meetings to provide community information and training, the distribution of printed materials and traditional and social media campaigns. At the next level, agencies facilitate community input through consultation, quantitative and qualitative data collection and social media. Cooperative engagement involves the parties in co-led working groups, information collection and collaborative projects. Community-led engagement uses meetings, consultations, and forums and community led projects and research. Engagement based on community design and delivery employs the same methods as the agency led approach with the addition of community led projects, research and working groups.

In 2007 Gilbert [21] identified sixty community safety programs categorized into eleven types: media campaigns, warnings, printed publications, interactive publications, local brigade activity, street and community meetings, community briefings during and after a fire, community groups with preparedness focus, community groups with predominant response focus, community development approach and one-on-one consultations. Following this research, Elsworth et al. [33] classified Australian community engagement programs into five main categories:

- warning systems and associated community engagement and education (EAE) activities
- public information provision
- localised information provision
- localised community EAE activities and programs, and
- community consultation, collaboration and development approaches.

Within these five categories a large number of sub types were identified:

- General hazard warnings
- Warnings of imminent threat
- Electronic warning systems
- Media campaigns
- Telephone information lines
- School education and other programs targeting children
- Publications tailored to local area/ household
- Local agency activity (Fire brigade, State Emergency Services (SES), local government)
- Telephone information lines—local information
- Community meetings
- Community groups
- One-on-one consultation
- Planning incorporating community consultation
- Agency initiated community development approach
- Community development activities initiated during recovery
- Community- initiated community development






- Specific issue partnerships
- Activities that incidentally reduce risk

The number and variety of community engagement interventions with many objectives and contexts suggest that diverse evaluation indicators and methodologies are required.

On its face Johnston et al.’s model of community engagement explicitly and implicitly shares many of the methods of community engagement canvassed in the AIDR report [18]. These include surveys and focus groups, media analysis, meetings, workshops, and consultations. However, Johnston et al.’s engagement activities have a rigorous focus on relationship and capability building, including local leadership, and more community and locally specific activities for preparedness, planning and action. Detailed community profiling is foundational to the model and is not included as a key method in other frameworks.

Therefore, if this generational model is used as a guide to the community engagement process by emergency management agencies, the types and the framing of the indicators that are most appropriate to measure outcomes and impacts of engagement must be reconsidered. Evaluation methodology is also influenced by these considerations. The measurement of community engagement effects and the appropriate methodologies will be discussed in later sections of this assessment.

**Table 4: Approaches to community engagement for resilience – methods of engagement. Adapted from AIDR (2020) [18]**

Who leads the process	 Partner designs and delivers to community	 Partner leads with community input	 Community and partner work together	 Community leads with partner support	 Community designs and delivers
Methods of engagement	<ul style="list-style-type: none"> <li>• Meetings</li> <li>• Presentations</li> <li>• Information sessions</li> <li>• Training and seminars</li> <li>• Fact sheets</li> <li>• Brochures</li> <li>• Newsletters</li> <li>• Letter box drops</li> <li>• Door knocks</li> <li>• Online instruction videos or information</li> <li>• Traditional media</li> <li>• Social media</li> </ul>	<ul style="list-style-type: none"> <li>• Meetings</li> <li>• Seminars</li> <li>• Consultations</li> <li>• Online or analogue surveys</li> <li>• Partner-led workshops and focus groups</li> <li>• Partner-led projects</li> <li>• Traditional media</li> <li>• Social media</li> </ul>	<ul style="list-style-type: none"> <li>• Co-chaired committees and working groups</li> <li>• Deliberative, participative and co-led workshops and focus groups</li> <li>• Online collaborative spaces</li> <li>• Shared research projects</li> <li>• Collaborative community-based projects</li> <li>• Traditional media</li> <li>• Social media</li> </ul>	<ul style="list-style-type: none"> <li>• Meetings</li> <li>• Seminars</li> <li>• Consultations</li> <li>• Forums</li> <li>• Online or analogue surveys</li> <li>• Community-led workshops and focus groups</li> <li>• Community-led projects</li> <li>• Informal conversations</li> <li>• Traditional media</li> <li>• Social media</li> </ul>	<ul style="list-style-type: none"> <li>• Meetings</li> <li>• Presentations</li> <li>• Information sessions</li> <li>• Training and seminars</li> <li>• Fact sheets</li> <li>• Brochures</li> <li>• Newsletters</li> <li>• Letter box drops</li> <li>• Door knocks</li> <li>• Online instruction videos or information</li> <li>• Community-led working groups</li> <li>• Community-led projects</li> <li>• Traditional media</li> <li>• Social media</li> </ul>

### Focusing community engagement - segmentation

Rhodes et al. [47] identified four groups within the community with varying motivation to act in response to the bushfire risk and engage with CFA community safety programs and services varies accordingly. They are: the “‘active and involved’ group, motivated to act and actively involved in dealing with bushfire risk; the ‘ready and interested’ group, who are motivated to do something about the risk but are less committed; the ‘done it already’ group, who are not highly motivated to take action and believe they have done what they need to do; and the ‘not into bushfire’ group, who are the least motivated to act and significantly less informed about the risk than other groups.”

They concluded that the success of CFA’s current approach to enhancing capacity to deal with bushfire risk was concentrated within the groups motivated to engage, and generally already active in bushfire preparation and planning. Some groups are poorly motivated and only partly engaged or feel well informed and prepared but are not. A significant group are not interested in bushfire and believe their risk to be lower than other more interested and engaged groups. For this group bushfire is not a salient issue and basic efforts towards bushfire preparation are seen as adequate. Approximately 60% of the ‘active and involved’ group, but only 20% of the ‘not into bushfire’ group, participated in the Fire Ready Victoria program and the ‘active and involved’ group dominated demand for the home bushfire assessment service [47]. This segmentation model is illustrated in Figure 8.



Figure 8: Model of CFA community programs based on levels of readiness. From Gibbs (2015)[40]

Other studies [48] have demonstrated that the extent of engagement in disaster resilience activities varies between groups on the basis of social cognitive characteristics. For example, a Community- Oriented group was positively associated with interpersonal communication, self-efficacy, outcome efficacy, and knowledge about earthquake preparedness, which are all factors known to engage the public in disaster preparedness and response [49].

More recently a study of self-evacuation decision-making in bushfire identified seven archetypal groupings encompassing distinctive values, beliefs, and attitudes reflecting a diversity of personal and social factors that influence a complex process of assessment and appraisal of bushfire threat and response. These archetypes are an elaboration of the CFA’s segmentation framework and suggests more nuanced ways for community



engagement programs to encourage householders to ‘reflect on, discuss and review their protective action judgements, intentions and choices in collaboration with (other) community members and the emergency services, (and) to build shared understandings, respect trust and confidence in their own capacity to successfully respond to bushfire threat’ [50].

Community engagement is a process of moving people through a continuum of relationships of varying depths of information, consultation, and participation. By recognising differences in the perceptions and needs of community members, the targeting of community engagement interventions can create better, deeper, and more durable relationships with agencies and better meet the needs and expectations of those community members. Johnson et al. report that segmentation is seen as necessary in the community engagement literature and see the CFA segmentation framework as a base for fine-tuning design and targeting of community engagement interventions [19].

## **Need for evaluation of community engagement**

Evaluation is defined by Scriven [51] as the planned, periodic and systematic determination of the quality and value of a program, with summative judgement as to the achievement of a program's goals and objectives". Others have described it as 'the systematic application of research procedures to understand the conceptualisation, design, implementation, and utility of interventions' [52] or as 'a periodic assessment of a program's relevance, performance, efficiency, effectiveness, and outcomes (both expected and unexpected) in relation to stated objectives' [53].

Evaluation and subsequent learning should guide all community engagement activities. Evaluation can explore the relevance, effectiveness, efficiency, impact and/or sustainability of the community engagement intervention [6]. Learning is possible if success and failures can be objectively assessed, and improvements identified. Applying the lessons that are learned improves engagement practice and supports continuous improvement [7] and enables fire agencies to not only imagine but plan and deliver improved services to communities.

Clearly articulated outcomes enable the impact of community engagement interventions to be evaluated. A well-articulated outcome requires that a logic model provide a clear indication of the objectives of the intervention and how the intervention, with its inputs, activities and outputs, will operate to achieve them [6, 23]. Community engagement interventions also operate within 'theory of change' which captures the broader context in which the program operates and takes account of the factors outside the program that may influence its outcomes. A logic model may not be explicit but revealed through a program's assumptions and activities. Evaluation will assess the validity of the logic model and in conjunction with a fully articulated theory of change, the extent to which the intervention contributes to achieving its desired outcomes can be established [47]. The theory of change and program logic are the foundation of the evaluation design.

Using the reasoning of the model, baseline measures of the planned effects (outcomes and impacts) can be formulated, and appropriate research methods designed. Taylor et al. [5] argue that the basis of any evaluation is to set measurable objectives and measure meaningful outcomes and that the programmatic reporting of these effects is best practice [54, 55]. The lack of a logic model makes a rigorous and robust evaluation difficult.

A baseline provides a beginning point of reference against which change can be measured, is established from credible and authoritative data, and describes significant features of risk or its reduction [4].

## Indicators of outcomes and impact

Indicators are defined as ‘an explicit measure of an important factor relevant to the subject of interest, in this case disaster risk and its reduction, where the indicator can be used to monitor changes in the status of that factor and thereby to monitor progress towards a desired outcome’ [4]. They are ‘quantitative or qualitative variables that provide reliable means to measure a particular phenomenon or attribute. ...it provides a sign or a signal that something exists or is true. It is used to show the presence or state of a situation or condition.’ [5].

Indicators should have the following characteristics:

- Able to demonstrate measurable change (from a baseline measure).
- Target the factor to be measured avoiding ambiguity and arbitrariness.
- Enable comparison over the different life-cycle stages of program and between programs.
- Intuitively and easily comprehensible.
- Directly relevant to the issue measured and based on clearly understood linkages between the indicator and the phenomena under consideration.
- Able to reflect small changes.
- The time of an indicator’s measurement, or the interval to which it applies, should be appropriate and clearly stated. [4, 5]
- Enable demographic and geographic comparison

Indicators measure output, outcome, or impact. Output indicators demonstrate short term results of an activity such as the number of people attending a Community Fireguard meeting. Outcome indicators measure the consequence of a project, program, or policy such as increased risk awareness following attendance at Community Fireguard meetings. Impact indicators: measure long-term or higher-level effects of a program or project such as increased neighbourhood connectedness following the conduct of Community Fireguard meetings.

Outcome and impact indicators measuring the effect of community engagement on risk reduction, or as has been emphasised, individual and community preparedness, are the focus of Research Question 1 (RQ1) and this discussion. It is inappropriate to develop specific indicators because their formulation depends on the type of intervention and the nature of the evaluation. However, some guidance to address RQ1 can be provided from the literature discovered in the search. Engagement attributes relevant to risk reduction and preparation against hazard provide a basis for the development of appropriate indicators. Engagement attributes reflecting cognitive, affective and behavioural dimensions [16], the generative model of community engagement [19], and the Tier 2 and 3 levels of engagement [5] provide a framework for the development of outcome and impact indicators.

Johnston’s [16] continuum of engagement attributes, based on her multilevel model of community engagement, suggests a broad range of indicators with which to measure the effects of community engagement on risk reduction. Both the description of the attribute and the points on the continuum suggest specific indicators of both outcome and impact on risk reduction of community engagement. For example, the outcomes of participation in a Community Bushfire Planning workshop in a local community could be measured using knowledge, belief, motivation, and connection attributes shaped specifically around the

objectives of that workshop in that locality which may include awareness, understanding, planning, physical preparation and psychological readiness [22].

*Table 5: Continuum of engagement attributes: cognitive (C), affective (A), and behavioural (B) dimensions of engagement. Originally from Johnston (2018) [16], sourced from Johnston (2019) [19]*

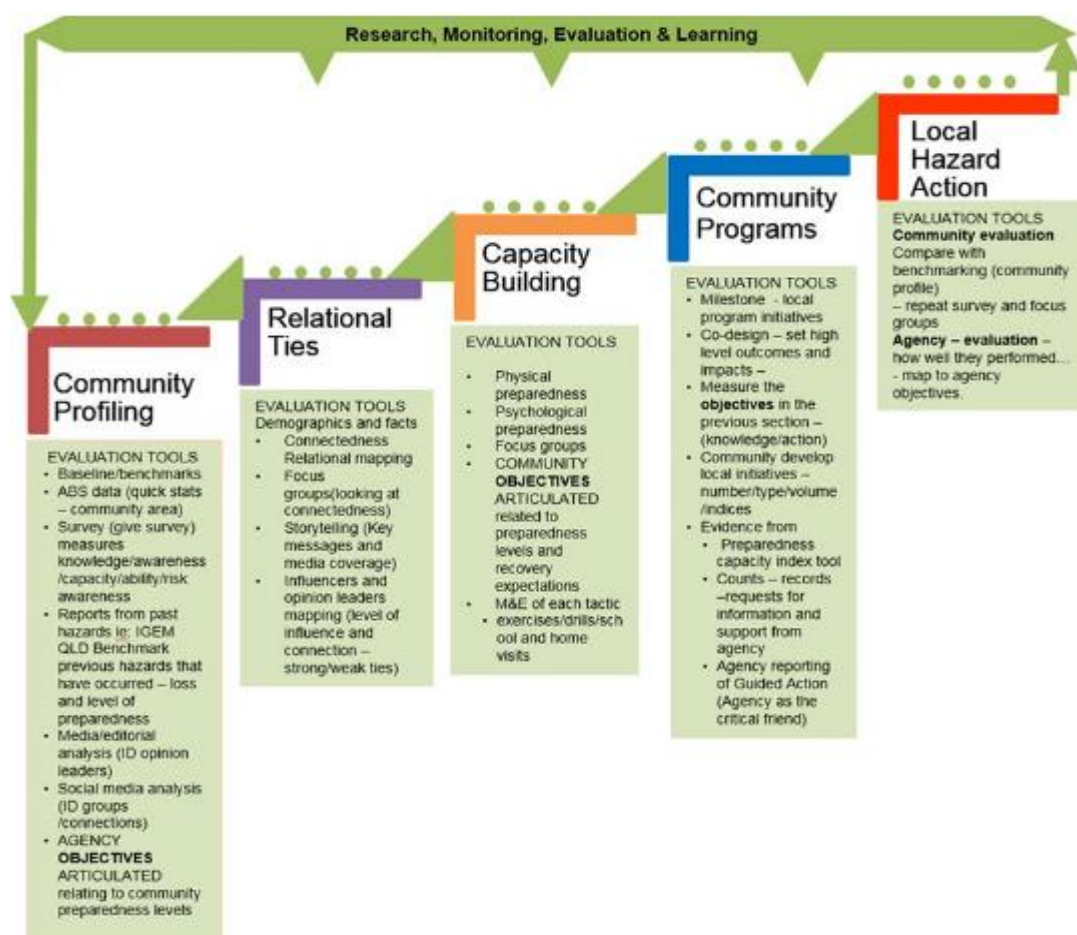
Construct/ attributes	Description	C/A/B	Disengaged- nonengaged		Engaged idealised
			Very low	Very high	
Knowledge	Knowing—level of information/facts (deduced/induced/co-created/ experience based)	C	Unaware, uninformed, and unfamiliar	Knowing, aware, and informed	
Understanding	Level of comprehension	C	Indifferent, misunderstand, and uncertain	Comprehension, recognition, and absorption	
Attention	Level of notice and interest	C/A	Apathy, indifference, unaware, and disinterested	Interest, curiosity, awareness, and salience	
Beliefs (internal) Attitude (expressed)	Range of opinions, principles, and philosophies	C/A	Distrust, suspicion, scepticism, and doubtful	Trust, faith, consideration, and confidence	
Motivation	Range of intrinsic/extrinsic reason/cause	C/A	Uninspired, detached, and removed	Inspired, connected, and rationale	
Connection	Level of actual/perceived relationship	C/A/B	Disassociated and detached	Association and bond	
Experience	Level of encounter	B/A	Unwilling to encounter	Encounter and feeling	
Involvement	Level of connection	A/B	No connection Unwilling involvement	Connection, contribution, attachment, and immersion	
Interaction	Level of contact	B	No contact No transfer	Contact, transfer, transmission (co-creation outcomes)	
Action	Level of action	B	No action	Deed, act, do, and accomplish	
Participation	Level of participation	B	Uncooperative Non-participative	Cooperate, combined, shared, two way, and mutual	
Orientation	Level of disposition	C/A	No intention Lacks preference	Emphasis, tendency, and preference	

Increases in knowledge about risk [56] and, in that context, how to plan for a bushfire; motivation to complete and practice the plan and be physically and psychologically ready; and connection with neighbours to help each other in the planning process, may be measurable outcomes using specifically crafted indicators of the effect of this engagement with the community.

The impacts of a series of Bushfire Planning Workshops across Victoria could be measured using similar attributes but taking a longer and broader view of the objectives of the intervention. For example, impacts of the workshop program could be measured in terms of

confidence in evacuation plans (beliefs), enhancement of community networks (connection) and the implementation of plans.

Johnston et al.’s generative model of community engagement for preparedness [19] offers a process perspective for the development of outcome and impact indicators that address RQ1. At the community profiling stage, it suggests indicators to establish baselines for cognitive, affective, and behavioural measures that will be used for outcome and impact evaluations from primary data collection in the future. It also suggests baseline indicators using secondary sources such as the Australian Bureau of Statistics (ABS) Census, population and industry collections, government health and hazard data and financial and economic information. The relational ties step suggests the development of indicators around connectedness, interaction, networking, and influence. The measurement of the effects of the capacity building phase involves personal and community-based preparation and planning indicators. Indicators in the community programs step focus on the evaluation of the outcomes and impacts of specific programs or projects against their objectives (within their program logic). The local hazard action step is likely to require community impact indicators to capture effects against broad, long-term objectives.



**Figure 9: The Australian generative model of community engagement for preparedness – evaluation. From Johnston et al. (2019) [19]**

Through analysis of the literature and practitioner views, Ryan [32] identified capabilities necessary for preparedness which can be used as indicators as sought by RQ1, including:

- Personalisation of risk
- Well established community connections
- Strong information base and access
- Sound personal resources and resourcefulness; resulting in ability to be outward looking
- Motivated/activated (knowledge to action)
- Realistic self-efficacy and self-sufficient coping
- Recognition of need for a plan/capacity to plan; having a plan in mind; a written plan; sharing the plan with others in the household; practicing the plan
- Responsible for preparing
- Connection to place; longevity in place
- High level of knowledge
- Physically able
- Connection to an agency/agencies
- Strong mental health; proactive mental protection
- Positive approach to situational framing
- Knowledge of/experience with the hazard

Taylor et al. [5] suggest indicators according to the tier of community engagement. At a mid-level (Tier 2) indicators of the qualities of relationship and interaction are appropriate including measures such as trust (in agencies [56] and oneself), reciprocity, and openness; legitimacy and credibility (local leadership and agencies); and understanding and acceptance. Measures of individual and community confidence in what has been learned, and their roles and responsibilities [56] and ability to face the hazard. Measures of connectedness including the extent and ease of interaction, honesty of dialogue and negotiation and the strength of the local networks should also be considered. Taylor suggests that indicators of affective, cognitive and behavioural effects [16] are also relevant at Tier 2.

Tier 3 are indicators of social embeddedness and include measures to capture individual and community actions arising out of participation in programs or projects or from hazard experiences. Impact indicators also include measures of social awareness and the greater good; recognition and acknowledgment of others (diversity, empowerment); societal action and change; engagement in ecological systems; building of social capital; and actions of emergency agencies to positively shape communities. These Tier 2 and 3 indicators address RQ1.

Early evaluation studies [57] identified household level outcome measures consistent with the products of the three models discussed above. These measures are awareness and recognition of the wildfire risk; knowledge of fire behaviour and fire safety measures; planning for the event of fire; physical preparations of property and household; and psychological readiness involving confidence and self-reliance.

The societal impacts identified in the Research Impact Framework (RIF) developed by

Kuruwila [58] and adapted to a hazard context suggests dimensions upon which indicators of community engagement impact might be framed. These dimensions are knowledge, attitudes and behaviour; hazard literacy; hazard status; health status; equity and human rights; macroeconomic/related to economy; social capital and empowerment; and culture and art. Societal dimensions such as those in the RIF have been applied in international frameworks for climate action including the Hyogo and Sendai frameworks.

Impact dimensions identified for the Hyogo Framework's include impacts on society, such as reduced vulnerability to hazards, or greater security of livelihoods, substantial reduction of disaster losses, in lives and in the social, economic and environmental assets of communities and states. Indicators reflecting these dimensions include the number of deaths, total economic losses and the number of people affected by natural hazard events [4] which could be used in relation to populations exposed to hazard including bushfire hazard.

A subset of twenty-two of the thirty-eight indicators identified to measure global progress in the implementation of the Sendai Framework for Disaster Risk Reduction [14] was extracted as potential limited indicators of health and hazard status, equity and economic impact that address RQ1 (Table 6). Indicators of the effects of community engagement are also able to measure a broad range of positive improvements in preparation and resilience.

**Table 6: Global targets for the Sendai Framework [14]**

<b>Global target A: Substantially reduce global disaster mortality by 2030, aiming to lower average per 100,000 global mortality between 2020-2030 compared with 2005-2015.</b>	
<b>A-1 (compound)</b>	Number of deaths and missing persons attributed to disasters, per 100,000 population.
<b>A-2</b>	Number of deaths attributed to disasters, per 100,000 population.
<b>A-3</b>	Number of missing persons attributed to disasters, per 100,000 population. <i>The scope of disaster in this and subsequent targets is defined in paragraph 15 of the Sendai Framework for Disaster Risk Reduction 2015-2030 and applies to small-scale and large-scale, frequent and infrequent, sudden and slow-onset disasters caused by natural or man-made hazards, as well as related environmental, technological and biological hazards and risk.</i>
<b>Global target B: Substantially reduce the number of affected people globally by 2030, aiming to lower the average global figure per 100,000 between 2020-2030 compared with 2005-2015.</b>	
<b>B-1 (compound)</b>	Number of directly affected people attributed to disasters, per 100,000 population.
<b>B-2</b>	Number of injured or ill people attributed to disasters, per 100,000 population.
<b>B-3</b>	Number of people whose damaged dwellings were attributed to disasters.
<b>B-4</b>	Number of people whose destroyed dwellings were attributed to disasters.
<b>B-5</b>	Number of people whose livelihoods were disrupted or destroyed, attributed to disasters.

<b>Global target C: Reduce direct disaster economic loss in relation to global gross domestic product (GDP) by 2030.</b>	
<b>C-1 (compound)</b>	Direct economic loss attributed to disasters in relation to global gross domestic product.
<b>C-2</b>	Direct agricultural loss attributed to disasters. <i>Agriculture is understood to include the crops, livestock, fisheries, apiculture, aquaculture and forest sectors as well as associated facilities and infrastructure.</i>
<b>C-3</b>	Direct economic loss to all other damaged or destroyed productive assets attributed to disasters. <i>Productive assets would be disaggregated by economic sector, including services, according to standard international classifications. Countries would report against those economic sectors relevant to their economies. This would be described in the associated metadata.</i>
<b>C-4</b>	Direct economic loss in the housing sector attributed to disasters. <i>Data would be disaggregated according to damaged and destroyed dwellings.</i>
<b>C-5</b>	Direct economic loss resulting from damaged or destroyed critical infrastructure attributed to disasters. <i>The decision regarding those elements of critical infrastructure to be included in the calculation will be left to the Member States and described in the accompanying metadata. Protective infrastructure and green infrastructure should be included where relevant.</i>
<b>C-6</b>	Direct economic loss to cultural heritage damaged or destroyed attributed to disasters.
<b>Global target D: Substantially reduce disaster damage to critical infrastructure and disruption of basic services, among them health and educational facilities, including through developing their resilience by 2030</b>	
<b>D-1 (compound)</b>	Damage to critical infrastructure attributed to disasters.
<b>D-2</b>	Number of destroyed or damaged health facilities attributed to disasters.
<b>D-3</b>	Number of destroyed or damaged educational facilities attributed to disasters.
<b>D-4</b>	Number of other destroyed or damaged critical infrastructure units and facilities attributed to disasters. <i>The decision regarding those elements of critical infrastructure to be included in the calculation will be left to the Member States and described in the accompanying metadata. Protective infrastructure and green infrastructure should be included where relevant.</i>
<b>D-5 (compound)</b>	Number of disruptions to basic services attributed to disasters.
<b>D-6</b>	Number of disruptions to educational services attributed to disasters.
<b>D-7</b>	Number of disruptions to health services attributed to disasters.
<b>D-8</b>	Number of disruptions to other basic services attributed to disasters. <i>The decision regarding those elements of basic services to be included in the calculation will be left to the Member States and described in the accompanying metadata.</i>



How effectively outcome and impact indicators can be used in measuring effect depends on the strength of the evaluation methodology that is employed including the sophistication of the theories of change in which CFA community engagement interventions function, the strength of the intervention's logic model, baseline data, data collection methods and analysis. This will be discussed in a later chapter.

## **Impact evaluation methodology**

Research methodology is the procedure used to identify, select, process, and analyse information about a topic. A systematic, comprehensive and robust methodology is the foundation of the validity and reliability of the research findings [8]. Evaluation methodologies incorporate the procedures of best-practice research and in addition reflect the formative or summative purpose of the evaluation. Formative evaluation occurs during program development and implementation. Summative evaluation is any combination of measurements and judgements that permit conclusions to be drawn about the impact, outcomes or benefits of a program or intervention. It is directed at decisions on establishing, continuing or extending an intervention.

A wide range of methodologies are used in the evaluation of community engagement interventions reflecting the unique characteristics of the intervention and its specific evaluative challenges, the purpose of the evaluation (priorities and uses), available resources and constraints [2] and the use of many types of interventions to reduce hazard risk through resilience and preparedness. Ryan et al.'s systematic review of the literature reporting community engagement directed at preparedness identified forty-one studies. A variety of quantitative, qualitative, and mixed method methodologies were used including mail and online surveys, face-to face interviews, social network analysis, case studies, content analysis, focus groups and observation and the use of existing data. The quality of these studies also varied considerably with many assessed by the authors as rated on or below a 50% quality score [10].

In addressing RQ2, an assessment of the literature has established that the suitability of methodologies for the evaluation of community engagement interventions depends on a wide range of factors specific to the evaluation task. Research design, sampling, and methods of data collection and analysis have to fit together and meet the evaluation problem [8]. Appendix 3 outlines the broad options around sampling, data collection, the use of mixed methods and data analysis that can be considered in establishing suitable impact evaluation methodologies. In many circumstances a resource intensive evaluation methodology such as pre and post surveys of intervention and comparison groups supplemented with qualitative interview or focus group data may not be appropriate to the nature, scale, and resources of a community engagement intervention. However, a robust and defensible methodology is desirable.

In response to RQ3, the following key methodological issues emerging from the assessment influence the quality of evaluation of community engagement interventions in reducing risk.

### ***Measurement***

The reliability and validity of the measurement of the variables used to measure the effects of a community engagement intervention is central to the quality of the evaluation. This is one of the most important methodological issues and the 'Indicator' section suggests logical theoretical bases for the formulation of valid outcome and impact measures. Evaluation design and data collection and analysis also influence validity and reliability of findings.

### ***Comprehensive approach***

A systematic and comprehensive evaluation methodology is desirable. Elsworth et al. [33] noted the strength of Rohrman's evaluation studies [59-61] (including Community Fireguard) because they were grounded in a reasoned and evidence-based evaluation framework including a logic model and criteria for content, process and outcome evaluation. A multi-method approach was used incorporating a longitudinal survey study (pre-test followed by two post-test waves with intervening exposures to intervention), a focus group discussion with residents and fire experts, and expert appraisal of the materials [33].

### ***Control/ Counterfactual***

The rigorous comparison of an intervention with control and comparison communities using experimental and quasi-experimental designs allows for effects of the intervention to be differentiated from background changes that may occur because of other programs outside of the study [62]. It enables a distinction to be drawn between what would have happened in the absence of the intervention and what actually happened (the factual) establishing a basis for attributing (RQ4) an effect (Appendix 1). Experimental, quasi-experimental and non-experimental research designs can be used to enable casual inferences to be drawn (cf. Appendix 2).

A comparison of two newly formed Community Fireguard groups against two groups of non-participating residents from the same areas showed that the view that the fire agency was responsible for fire safety decreased in the Fireguard group over an initial six-month period of membership more than it did in the comparison group [31].

A randomised experimental trial using a pre- and post-test control group design, with an additional 'hanging control group' (a group that received neither pre-test nor intervention) was used in a study of the psychological preparedness of Cairns residents. Four hundred and forty residents completed two consecutive surveys (pre- and post-test), and 200 residents (the hanging control group) completed only the post-test survey. Half of the 440 residents who completed the two consecutive surveys received a copy of the psychological preparedness guide (the intervention group). The remaining half received no further information and completed only the sequential surveys (the control group). Participating households were selected using a stratified 'street and house' random sampling procedure and were then randomly assigned to the three experimental groups [33].

When it is not possible to create a credible counterfactual, for example when an intervention operates at a system level or in conjunction with other interventions, other evaluation methodologies including those discussed below, are relevant. This is commonly the case because interventions are made in complex, constantly changing environments and where external factors can make it difficult to link an intervention to the changes observed. Impact evaluation in these cases can provide evidence to support a theory, developed as an integral part of the evaluation, that links specific and broader changes to the specific intervention [2].

### ***Research and survey design***

In research-based evaluation, understanding how a program - intervention results in change is achieved by comparing a treatment with no treatment (or alternative treatment). Randomised control trial design (RCT) involves participants being assigned to two (or more) groups

through a rigorous randomisation process involving sophisticated statistical techniques. This results in control and experimental groups respectively. While this research design is considered in some contexts to be the ‘gold standard’ (e.g., medical research), in social research RCTs are often not feasible or acceptable. In such circumstances, quasi-experimentation is more feasible, commonly accepted and endorsed. Comparison is achieved by establishing comparison groups (not control groups as this terminology is reserved for randomised control groups). Comparison groups are created in two broad forms—comparison over time and across groups or participants, or settings. Surveys are most commonly used to collect data for means of comparison and can be administered in different forms depending on the research design and the resources and capabilities available. When the research design requires comparison over time, survey designs can include time series, interrupted time series, or before and after survey designs. When groups (rather than time) are compared non-equivalent group designs, where participants self-select their group, and survey data is collected post intervention only, may be used. All research designs have strengths and challenges, and all involve challenges to the reliability of the data (validity threats). Research design and survey design selection should be undertaken judiciously and using the appropriate expertise.

### ***Pre and post comparison***

Data collection surveys prior to and after a community engagement intervention enables comparison of outcomes and impacts, and attribution or contribution of effect. This can be achieved assuming similarly sized survey samples, randomness, and independence [63] although the application of statistical techniques may make these requirements less onerous. A matched pairs experiment in which the same subjects are surveyed before and after the intervention is a more powerful method [64]. For example, surveys conducted before, during and after both the FloodSmart and StormSmart pilot programs enabled comparison and analysis of the impacts of the two programs on their respective communities. [65]

### ***Mixed methods***

A mixed methods approach increases the reliability and validity of impact evaluation because the results of one method can be used to confirm or extend those of another. All available information, from all data sources from the various methods, are used to form an evaluative judgement that weighs all evidence.

Mixed methods research involves the integration of more than one method of design, data collection or data analysis within a single program of study. Qualitative, quantitative or other combination of methods/analyses constitutes a mixed method approach [66]. Application of mixed methods have four significant advantages. First, the integration of different methods creates complementarity that clarifies and illustrates results from one method to another. Second, preliminary results from one method can shape subsequent methods or steps in the research process. Third, research commenced using one method can stimulate new research questions or challenge the results obtained through other methods. Finally, the use of a number of methods adds richness and detail to the study by harnessing the strengths of each method [67].

Rhodes et al. reported a study employing a mixed-methods approach in Queensland employing focus groups that explored projects implemented at the community level, semi-structured interviews with community development officers and an online survey. Another

study comprised a desktop review and analysis, group interviews with the practitioners, and seven days of site observations in a variety of locations across the State [47].

### ***Triangulation***

Triangulation is achieved using a mixed methods approach and is a means of confirming the interpretation of data by drawing on several sources to measure the same variable or effect. The consistency of findings obtained through different instruments can be tested and multiple causes influencing results assessed. Evaluation methodologies based on principles of triangulation were used to evaluate a community engagement intervention reported by Elsworth et al. [33].

## **A way forward**

The purpose of this assessment is to identify outcome and impact measures that can be used to measure the effect of community engagement interventions for risk reduction.

A search of white and grey literature supplemented by a recent systematic review of papers on community engagement for preparedness and reports and materials provided by CFA and other sources has failed to reveal significant material addressing the assessment's purpose. The reviewed literature in fact confirms this lack of information.

However, the assessment has identified substantial material that suggests the elements of a high quality and systematic approach and indicates bases for improvement to the evaluation of the effects of community engagement interventions. The assessment also suggests the issues that need to be addressed and strategically crystallised to move toward a more rigorous, robust and systematic approach to the evaluation of community engagement interventions. The information and themes emerging from this assessment in combination with the professional experience and judgements of myself, the subject matter experts advising this project and stakeholders within CFA inform the elements of a way forward that follows.

### ***Clarification of the objectives of community engagement for risk reduction.***

Community engagement programs reduce risk by enhancing individual and community resilience and preparedness. Consequently, indicators of resilience and preparedness outcomes and impacts are most appropriately measured for the evaluation of community engagement interventions.

### ***No one size fits all approach.***

A one-size-fits-all approach is not appropriate to evaluate the diverse activities and interventions implemented by the CFA. The CFA conducts a wide diversity of community engagement interventions with a variety of program objectives, under the umbrella of risk reduction. The interventions are executed within different contexts and communities, differentiated by geographic, social and economic factors. Community engagement programs may be evaluated for formative or summative objectives and are subject to resource constraints including time, expertise, and data. Other agencies and actors play a role in some interventions influencing evaluation objectives, methodology and resources.

### ***Agreed whole of organisation purpose, priority and authority***

Given the complexities, challenges and constraints of impact evaluation identified through this assessment, if the outcomes and impacts of the CFA's community engagement programs are to be evaluated to a high level of quality the following factors need to be addressed:

- Adequate resourcing including access to external expertise when required
- A systematic, whole of organisation strategy
- An agreed purpose for impact evaluation
- Authoritative leadership to build internal support and interest among critical stakeholders.

***Establish fundamental community engagement impacts in the CFA fire risk register***

Further work is required to establish how the effects of community engagement interventions can be meaningfully translated into improvements in CFA's fire risk register through their reduction of risk. This will involve establishing direct links or relationships between community engagement activities and fundamental indicators of impact including reduction of death and injury, homes saved, and critical infrastructure protected.

Links may be established by selecting strategic community engagement interventions and executing systematic and well-resourced impact evaluation strategies over a long time frame to address fundamental indicators central to CFA's risk register.

Analysis of current evidence including existing research reported in the literature can assist in establishing connections between particular individual or community actions, in preparing and responding to hazard, that are related to increased survival and reduced impact on property.

***A position paper clarifying definitions of key concepts including impacts and impact evaluation, principles, values and minimum standards.***

While impact may be defined broadly in terms of the difference made by fulfilling an organisation's purpose measured over the longer term and in a broader societal context [2], an impact evaluation of an intervention requires specification of the broad definition.

The definition of impact needs to be established in an operational sense depending on context, setting, type and purpose of the evaluation and on the balance of values to which the organisation aspires. An organisationally agreed definition of impact that accommodates a broad range of evaluation activities should be established to facilitate impact evaluation in CFA. A position paper clarifying these and other issues including foci for evaluation and decision principles including program readiness, scale, maturing, and stability; financial constraints; limits imposed by the availability of expertise; and the need to ensure value for money, should be developed as a priority.

***Theoretical frameworks for community engagement effect measurement***

A consistent approach to defining and conceptualising the outcomes and impacts of community engagement for risk reduction is needed. There are well developed engagement and community engagement frameworks whose application suggests specific evaluation foci (e.g. agency lead collaboration vs community leadership) and consequently, outcome and impact measures. There is a need to consider and agree on how community engagement for risk reduction works in general as a basis for the consideration of specific interventions. The application of theoretical frameworks can inform a broad theory of change relevant to the agency's community engagement activities and the logic models upon which specific interventions are based.

***Agreed indicators of community engagement effects***

There are a wide range of potential outcome and impact measures that could be used in the evaluation of community engagement interventions and a strong case for a systematic consideration of them and organisation wide agreement on their usage. It may not be possible

to establish specific wording or formulation of indicators in all cases but a general form and/or the principles to applied to their construction should be established.

***Identifying and agreeing appropriate methodologies for evaluation of community engagement interventions***

A model or integrated models of theory of change for community engagement interventions in CFA should be agreed as a basis for the design of impact evaluations by establishing causal connections between inputs and outputs and making assumptions explicit. Given this framework, appropriate evaluation methodologies can be considered. In all cases, best practice suggests evaluation should be based on a mixed methods approach, a clearly defined baseline and efforts to establish effects of the intervention through the use of pre and post intervention measurement and, whenever possible, control groups.



## **Glossary**

Term	Definition
Community engagement	<p>The process of communities and partners working together to build resilience through collaborative action, shared capacity building and development of strong relationships built on mutual trust and respect.</p> <p>Adapting the Victorian Government Public Engagement Framework 2021-2025, in 2022 CFA described community engagement as ‘...a planned process with a specific purpose to empower communities to prevent and prepare for fire. It involves working with individuals and groups to encourage active involvement in decisions that affect them or are of interest to them. It includes educating people about fire safety, obtaining feedback about plans and projects, and working directly with communities to address fire risks.’</p>
Counterfactual	What would have happened in the absence of the intervention.
Effects	<p>In experimentation or quasi-experimentation, effects relate directly to the counterfactual –here the effect is the difference between what would have happened and what did happen.</p> <p>In situations when we can measure change on a variable and attribute a quantification - there will be estimates of what part of the change we can attribute to the program and what part of the change that can be attributed to other factors - and effect is that quantified portion of change that can be attributed to the program.</p>
Evaluation	The planned, periodic, and systematic determination of the quality and value of a program, with summative judgement as to the achievement of a program's goals and objectives
Formative evaluation	Formative evaluation occurs during program development and implementation. Process is a type of formative evaluation.
Impact	<p>Impact refers to justifiable causal claims about observed changes produced by an intervention. These claims are made when the design approach, and the methodology have been interrogated for validity threats, and when the findings and conclusions have been delivered with statements about the limitations and cautions around the confidence that we can have in the findings.</p> <p>Impact is a demonstrable contribution that community engagement makes to the economy, society, culture, national security, public policy or services, health, the environment, or quality of life.</p> <p>This definition recognises that community engagement for disaster risk reduction has a diversity of impacts including on, human safety (health and wellbeing), critical infrastructure (national security) and public and private land and capital (economic).</p>
Impact evaluation	An impact evaluation provides information about the observed changes or 'impacts' produced by an intervention. These observed changes can

	<p>be positive and negative, intended and unintended, direct and indirect. An impact evaluation must establish the cause of the observed changes. Identifying the cause is known as 'causal attribution' or 'causal inference'.</p> <p>Essential characteristic of impact evaluations involves both seeking to measure or elaborate changes that have occurred but also the role and the scope of the the particular program, policy, etc., in producing these changes. This includes causal attribution, causal contribution or causal inference. Depending on what type of causal conclusion we are aiming for there are different ways of examining causal relationships in program evaluation, using a combination of research design and related data collection and analysis strategies.</p> <p>In social programs in dynamic social settings, causal relationships often require a long period of time to establish with any reliability.</p>
Indicator	<p>Indicators are defined as an explicit measure of an important factor relevant to the subject of interest, in this case, disaster risk and its reduction, where the indicator can be used to monitor changes in the status of that factor and thereby to monitor progress towards a desired outcome.</p> <p>They are quantitative or qualitative variables that provide reliable means to measure a particular phenomenon or attribute. ...it provides a sign or a signal that something exists or is true. It is used to show the presence or state of a situation or condition.</p>
Outcomes	<p>Outcomes are observed and measurable changes that relate to a particular variable of interest. But it is not always the case that the changes that we can see and observe are causal consequences. Outcomes relate therefore to changes that we can see and are measurable, but those changes could have happened for many reasons, including but not limited to how we have manipulated the environment.</p>
Outcome evaluation	<p>Outcome Evaluation measures program effects in the target population by assessing the progress in the outcomes that the program is to address.</p> <p>Can focus on short, immediate, or long-term program/intervention objectives.</p>
Outcomes indicators	<p>Outcome indicators measure the consequence of a project, program, or policy such as increased risk awareness following attendance at Community Fireguard meetings.</p>
Risk reduction	<p>Disaster risk reduction comprises a range of activities undertaken to minimise vulnerabilities and disaster risk throughout a society, to avoid or to limit the adverse impact of hazards.</p>

	Agencies engage individuals and communities to reduce the risk they face from hazards through interventions to enhance their resilience and preparedness.
Summative evaluation	Any combination of measurements and judgements that permit conclusions to be drawn about the impact, outcomes or benefits of a program or intervention.
Types of impacts	<p>Impacts may be intended or unintended and include preventing negative or positive change.</p> <p>Possible types of impact include an effect on, change or benefit to an activity, attitude, awareness, behaviour, capacity, opportunity, performance, policy, practice, process or understanding of an audience, beneficiary, community, constituency, organisation or individuals in any geographic location whether locally, regionally, nationally or internationally.</p>

## **Appendices**

<i>Intended use</i>	<i>Typical evaluation question</i>	<i>Conditions</i>	<i>Relevant methods and designs</i>
Attribution	Did the intervention cause the impact(s)?	Requires a single cause and a small number of effects. Needs either a homogenous effect (it works the same for everyone) or knowledge about the contextual factors that influence impacts	RCTs, regression discontinuity, propensity scores
Apportioning	To what extent can a specific impact be attributed to the intervention?	Requires a single effect, large data sets on relevant contributing factors.	Regression, econometrics, structural equation modelling
Contribution	Did the intervention make a difference?	Requires an understanding of the different configurations that could produce the results (which can include contextual factors, variations of the programme and other programmes).	Contribution analysis, comparative case studies, process tracing, Bradford Hill criteria
Explanation	How has the intervention made a difference?	Requires the development of a clear programme theory which sets out a change theory (how change is understood to come about) and an action theory (what activities will be undertaken to trigger this). This can be informed by exploring how actors in the intervention attribute cause and investigate these for plausibility, as well as drawing on research literature and theoretical frameworks.	Actor attribution, theory-based evaluation, realist evaluation, process tracing.
		Where it is possible to identify potential 'active ingredients' in the programme and develop different combinations of what is delivered and test their relative effectiveness. Requires homogeneity of effects as it only provides information about average effects.	Multi-arm RCTs with 2-way or 3-way interactions designed to identify the 'active ingredient'
Generalisability or transportability	Is the intervention likely to work elsewhere? What is needed to make it work elsewhere?	Need an understanding of contextual factors that have affected the implementation and results. Need to identify alternative action theories which might be more suitable in different contexts, or even alternative change theories.	Realist evaluation

Appendix 1

<i>Causal inference strategy</i>	<i>Possible methods 2</i>
<b>Compare results to the counterfactual</b>	
Experimental research designs	Control group; Randomised controlled trial (RCT)
Quasi-experimental research designs	Difference-in-difference (or double difference); instrumental variables; judgemental matching; matched comparisons; propensity scores; sequential allocation; statistically created counterfactual; regression discontinuity
Non-experimental options	Key informant interviews (hypothetical counterfactual); Logically constructed counterfactual
<b>Check results support causal attribution</b>	
Gathering additional data	Actor attribution; modus operandi; process tracing
Analysis	Bradford-Hill criteria (dose-response patterns; intermediate outcomes check timing of outcomes); compare to expert predictions; comparative case studies; qualitative comparative analysis (QCA); realist analysis of testable hypothesis.  Contribution analysis; collaborative outcomes reporting; multiple lines and levels of evidence (MLLE); rapid outcomes assessment.
<b>Investigate possible alternative explanations</b>	Force field analysis; general elimination methodology; key informant interviews; process tracing; ruling out technical explanations; searching for disconfirming evidence / following up exceptions; statistically controlling for extraneous variables

Appendix 2

<i>Task</i>	<i>Options</i>
<b>Sampling</b>	
Probability samples	Multi-stage; simple random sample; stratified random sample
Purposeful samples	Confirming and disconfirming; criterion sample; critical case; homogenous; intensity; maximum variation; outlier; snowball; theory-based; typical case, extreme case
Convenience samples	Convenience sample; volunteer sample
<b>Use measures and indicators (develop or use existing)</b>	Targets; indexes; standards
<b>Collect and/or retrieve data</b>	
From individuals	Interviews; opinion polls; questionnaires and surveys; assessment scales or rubrics; goal attainment scales; logs and diaries; mobile phone logging; expert reviews; polling booth; postcards; projective techniques; seasonal calendars; mapping; stories and anecdotes
From groups	After action review; brainstorming; concept mapping; Delphi study; dotmocracy; fishbowl technique; focus groups; future search conference; hierarchical card sorting; keypad technology; mural; ORID technique; Q-methodology; SWOT analysis; world cafe; writeshop
Observation	Field trips; participant observation; non-participant observation; photography and video; transect walks
Physical measurements	Biophysical; geographical
Existing data	Big data; official statistics; previous evaluations and research; project records; reputational monitoring dashboard
<b>Combine qualitative and quantitative data</b>	
In terms of when qualitative and quantitative data are gathered	Parallel data gathering; sequential data gathering
In terms of when qualitative and quantitative data are combined	Component design; integrated design
In terms of the purpose of combining data	<p>Enriching: using qualitative work to identify issues or obtain information on variables not obtained by quantitative surveys.</p> <p>Examining: generating hypotheses from qualitative work to be tested through the quantitative approach.</p> <p>Explaining: using qualitative data to understand unanticipated results from quantitative data.</p> <p>Triangulation (confirming/reinforcing; rejecting): verifying or rejecting results from quantitative data using qualitative data (or vice versa)</p>



<b>Analyse data</b>	
Numeric analysis	Correlation; cross-tabulations; data mining; exploratory techniques; frequency tables; measures of central tendency; measures of dispersion; multivariate descriptive; non-parametric inferential statistics; parametric inferential statistics; summary statistics; time series analysis
Textual analysis	Content analysis; thematic coding; framework matrices; timelines and time-ordered matrices
<b>Visualise data</b>	
See relationships among data points	Scatterplot; matrix chart; network diagram
Compare a set of values	Bar chart; block histogram; bubble chart
Track rises and falls over time	Line graph; stacked graph
See the parts of a whole	Pie chart; treemap; icon array
Analyse a text	Word tree; phrase net; word cloud
See the world	Demographic mapping; geotagging; GIS Mapping; interactive mapping; social mapping

### Appendix 3

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