



7th International Conference on Building Resilience; Using scientific knowledge to inform policy and practice in disaster risk reduction, ICBR2017, 27 – 29 November 2017, Bangkok, Thailand

## "Built Environment Flood Resilience Capability Maturity Model"

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### Abstract

Capabilities are required for managing the impact of disasters on the built environment. These capabilities need to be continually improved and there should be a way of assessing them. This paper focuses on the development of a built environment flood resilience capability maturity model for micro, small and medium-sized enterprises (MSMEs). The study utilised the concept of capability maturity modelling to achieve its aim. The model developed identifies the built environment flood resilience capabilities of MSMEs. This was achieved by identifying relevant capabilities from the literature and mapping accordingly with maturity level characteristics prior to verification and refinement. This paper is limited to the development of the conceptual version of the model. The flood resilience capability maturity model is aimed at providing an assessment, improvement and benchmarking methodology for built environment flood resilience capabilities.

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Peer-review under responsibility of the scientific committee of the 7th International Conference on Building Resilience.

*Keywords:* "Built environment, business, capabilities, flood, resilience"

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### 1. Introduction

Towards achieving organisational goals which include managing and surviving crises [1, 2], Yen-Tsang, Csillag [3] described the need for capabilities and its importance in coordinating a set of activities to achieve particular goals. The capability of a firm is a combination of competencies, skills, resources, strengths, societal network used to coordinate a set of activities to achieve particular goals [3, 4], this includes disaster resilience. UNISDR [4] submitted that capacity can also be referred to as capability. The effective deployment of capabilities is still very low, flooding is still causing significant physical damage to business premises [5]. Previously, Boshier [6] declared the need to build capabilities for property resilience beyond physical attributes of the property, a similar need was identified by UN ESCAP and AIT [7]. It should be noted that the ability of the built environment to withstand, resist and absorb the impact of flood affects the speed of recovery of the business. Despite the call for the building and enhancement of capabilities, no study has developed a methodology for assessing the maturity of capabilities for enhancing built environment flood resilience and none has presented the specific capabilities for enhancing the flood resilience of the built environment. Although, studies have been conducted on flood mitigation measures generally

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(Asgary *et al.*, 2012; Bhattacharya-Mis & Lamond, 2014; CIRIA, 2010), this study is significant because it focuses specifically on capabilities for flood resilience in the context of built environment.

## 2. Literature review

### 2.1. Flooding and business organisations

The Royal Institute of British Architects identified six mechanisms of flooding [8], the mechanisms are tidal, fluvial, ground water, pluvial, flooding from sewers, and flooding from human-made infrastructures. The magnitude of damage from whichever type of flood is dependent on some factors, among these are the depth of inundation, duration of inundation, the rate of rising, the velocity of flow, flooding frequency, the presence of debris, property type, age, construction material and building use [9-18]. The possession of relevant capabilities by an organisation will help the management of some of the factors and simply control the damage influence of some. Technically, flood water is controlled at the source, pathway and the receptor points [19]. The focus of this study is the receptor, business organisations fall in this category. Business organisations are classified based on turnover and number of employees, this study focuses on micro, small and medium-sized enterprises (MSME) i.e organisations with 1 – 249 employees [20]. The focus on MSMEs is simply because of the significance of this class of business to the economy of a nation. Currently, MSMEs are also highly vulnerable to disruptions basically because of the limited human and financial resources and limited risk management capability [21, 22].

### 2.2. Flood resilience capabilities

UNISDR [4] submitted that capacity can also be described as capability and capacity refers to infrastructure, physical facilities, institutions, societal coping mechanisms, human knowledge, skills, social relationships, as well as leadership and management. Similarly, [3] described the capability of a firm as a combination of competencies, skills and abilities used to coordinate a set of tasks or activities to achieve a goal. Capabilities determine the preparatory strength, coping response, absorptive ability, and adaptive ability; these abilities influence the disaster resilience of a system in a disaster situation. Towards achieving the aim of this study, twenty-six capabilities were identified from the literature. The capabilities extracted are presented in Table 1.

Table 1 Key Capability Areas and brief descriptions

SN	Key Capability Areas and brief descriptions	Literature source
1	Understanding of flood risk to property - This is expected to lead to a detailed mitigation survey.	[19, 23]
2	Planning or review for a flood resilience scheme - This is expected to lead to a clear, workable plan and schedule for a flood mitigation/resilience scheme.	[19, 23]
3	Survey of property - This is expected to result to a detailed design specification for the property.	[19, 23]
4	Acquisition of relevant facilities - Understanding of the purpose and function of flood resilience facilities.	[23]
5	Installation and Post-flood management scheme relationships - Management of installation period and preparations for potential disruption. Post installation relationship management with supplier and installer.	[23]
6	Operation and Maintenance - Operation, storage and maintenance requirement. Effective response readiness.	[23]
7	Organisation of disaster scenario simulations - Participation in drills and flood scenario simulations. It creates physical and mental alertness.	[19, 24]
8	Built environment related safety precautions – Switch-off power or power banks, fastening water tank and external furniture etc. To prevent complications.	[19]

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