



MAPPING BUILT ENVIRONMENT PROFESSIONALS' EDUCATIONAL NEEDS TO INTERNATIONAL POLICY FRAMEWORKS FOR DISASTER RISK REDUCTION – COMMUNITY STAKEHOLDER PERSPECTIVE

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Abstract

Purpose – Disaster risk reduction is prominent in the international policy agenda and the year 2015 brought together three international policy frameworks which contribute to disaster risk reduction (i.e. the Sendai framework for disaster risk reduction, the sustainable development goals, and Paris climate change agreement – COP21). However, there is a dearth of effort at identifying and aligning the specific educational needs of built environment professionals with the three policy frameworks. This is needed to facilitate the incorporation of the contents of the policy frameworks into built environment professionals' training. Therefore, this study maps the educational needs of built environment professionals with the core areas of the three international policy frameworks.

Design/methodology/approach – This study utilised CADRE (Collaborative Action towards Disaster Resilience Education) research project outcomes alongside the earlier mentioned three international policy frameworks. A comprehensive desk review was done to map the educational needs identified in the CADRE project with the core priority areas of the three policy frameworks.

Findings –The study revealed the educational needs that are significant towards an effective implementation of the core priority areas of the three international policy frameworks.

Practical implications – This study would be beneficial to the built environment professionals involved in disaster risk reduction. They will be aware of the specific knowledge areas that would aid the successful implementation of the aforementioned three international policy frameworks.

Originality/value – The outcomes of the study would be beneficial to higher education providers in disaster risk reduction and sustainable development. It has identified the knowledge and competency gaps needed to be bridged in the curricula in order to meet the demands created by the international policy frameworks.

Keywords: Built environment, disaster resilience, disaster risk reduction, policy frameworks, professionals

Paper type Research paper

1. INTRODUCTION

Since the adoption of the Hyogo Framework for Action (HFA) in 2005, progress has been made in reducing disaster risk at local, national, regional and global levels (UNISDR, 2015a). This progress is evident in the decrease in mortality rate from hazards (UNISDR, 2015a). However, although there has been progress, disasters have continued to exact a heavy toll on

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3 people, properties, communities and countries. For instance, the January 2010 earthquake in
4 Haiti, the earthquake in New Zealand in September 2010 and February 2011, the July 2010
5 floods in Pakistan and in Australia in December 2010 among other catastrophes resulted in
6 heavy toll (UNISDR, 2011). This is affirmed by the Emergency Events Database (EM-DAT)
7 (2016), it recorded that in 2015, 346 disasters were reported and 22,773 people died, about
8 98.6 million people were affected with a US\$66.5 billion economic damage. Thus, 10 years
9 after the adoption of the HFA (2005 – 2015), the magnitude of loss from disasters remains
10 significant and this is a threat to sustainable development. Notwithstanding, the HFA has
11 provided a critical guidance for disaster risk reduction efforts (UNISDR, 2015a).

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18 The implementation of HFA has also revealed some gaps in tackling disaster risk factors,
19 formulation of goals and drafting priorities, promoting disaster resilience at all levels, and
20 effective implementation (UNISDR, 2015a). These gaps emphasise the need for a
21 development on Hyogo framework, the new framework should help identify disaster risks,
22 guide investments in disaster resilience and as well bridge all other gaps (UNISDR, 2015a).
23 Towards bridging these gaps and addressing other related issues, the Sendai framework for
24 disaster risk reduction (2015 – 2030) was developed. The Sendai framework was endorsed in
25 March 2015 by the UN General Assembly in Sendai City, Japan, it is the first major post-
26 2015 disaster risk reduction agreement (UNISDR, 2015). The framework is directed at
27 reducing disaster risk across multiple sectors. By adopting the Sendai framework, a
28 substantial reduction is expected in disaster risk and loss of lives, livelihood, as well as all
29 other social, economic, physical, cultural and environmental impacts of disasters (UNISDR,
30 2015).

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41 Sendai framework highlighted the importance of incorporating disaster risk knowledge in all
42 forms of education and training, including civic education at all levels (UNISDR, 2015a).
43 Similar to the Sendai framework (2015-2030) are the United Nations Framework Convention
44 on Climate Change Agreement 2015 (Paris Climate Change Agreement – COP21) and the
45 United Nations Sustainable Development Goals 2015. The frameworks were born out of the
46 need for an action-oriented framework for managing disaster risks and promoting sustainable
47 development (UNISDR, 2015; UNDESA, 2015). Thus, there is urgent need to leverage the
48 understanding of disaster risk reduction and sustainable development in all its dimensions
49 among the stakeholders working towards enhancing disaster resilience and sustainable
50 development.

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3 In the light of the above, the research community including professional bodies and
4 international organisations were triggered to identify the key roles and responsibilities of the
5 built environment professionals in disaster management (Max Lock Centre 2009;
6 Amaratunga, 2014; Witt et al., 2014). Earlier researchers have also identified the skills that
7 built environment professionals could contribute to disaster resilience (Bosher *et al.*, 2007;
8 Thayaparan et al., 2010; Siriwardena et al., 2013; Perera *et al.*, 2015; Thayaparan et al.,
9 2015). Others advocated for the education of built environment professionals and proactive
10 multi-stakeholder approach that involves construction professionals in their studies (Bosher,
11 2009 and Gencer, 2013) However, there is a dearth of effort at identifying and aligning the
12 specific educational needs of built environment professionals with the three international
13 policy frameworks. This is needed to facilitate the incorporation of the contents of the policy
14 frameworks into built environment professionals' educational needs. As a result, this study
15 was guided by the following objectives: identify the educational needs of the built
16 environment professionals serving disaster-affected communities; and map the identified
17 educational needs with the core areas of international policy frameworks for disaster risk
18 reduction and sustainable development. In this study, the term 'educational needs' refer to the
19 key built environment professionals' knowledge areas needed to be utilised in the context of
20 natural disasters. The list of educational needs in Table 1 is the summary of the general
21 submissions of the community stakeholder group.

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35 The community group is one of the key stakeholder groups relevant to the disaster resilience
36 theme; others are the private sector, local and national governments, non-governmental
37 organisations (NGOs) and international agencies, and academic and research organisations.
38 According to Twigg (2009) 'in conventional emergency management, communities are
39 viewed in spatial terms: groups of people living in the same area or close to the same risks'.
40 The definition above is adequate for this research but it is acknowledged that a community
41 can be described based on interests, occupation, and religious inclination, these are excluded
42 in the definition above. Ideally, the people exposed to disaster risks should be involved in risk
43 reduction and disaster resilience efforts; the community should hugely contribute to all social
44 wellbeing and capacity development efforts (Sastry, 2001, p. 2 cited in (Hossain, 2013). This
45 submission underlines the importance of presenting community's perspective on the
46 educational needs of built environment professionals in the light of international policy
47 frameworks on disaster risk reduction and sustainable development. It should also be noted
48 that all other stakeholders belong to one community or the other.

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3 The findings of this study would guide the built environment professionals on what is needed
4 to upgrade their capacity in line with the priority areas of the Sendai framework 2015 – 2030,
5 Climate change agreement 2015 (Paris Agreement – COP21) and the United Nations
6 Sustainable Development Goals 2015. Similarly, the study findings will be useful for non-
7 governmental organisations (NGOs), governments: national, regional and local, and the
8 private sector in drawing policy recommendations as well as monitoring and assessing the
9 skills required by built environment professionals for an effective implementation of the
10 international policy frameworks. This study will also be a valuable addition to studies that
11 have called for capacity enhancement for disaster risk reduction in the built environment such
12 as Ginige, Amaratunga and Haigh (2010).
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19 20 **2. INTERNATIONAL POLICY FRAMEWORKS FOR DISASTER RISK** 21 **REDUCTION** 22

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24 Disaster risk reduction, disaster resilience and sustainable development are prominent in
25 international policy agenda and the year 2015 brought together three international policy
26 frameworks relating to disaster risk reduction and sustainable development (i.e. the Sendai
27 framework for disaster risk reduction, the sustainable development goals, and the Paris
28 climate change agreements 2015 – COP21). Therefore, it becomes imperative to understand
29 these frameworks and thereafter consider how they can be effectively implemented. It is on
30 this premise that Hyogo framework for action 2005 – 2015 and the three aforementioned
31 policy frameworks introduced in 2015 are briefly discussed as follows:
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38 **2.1 Hyogo Framework for Action (HFA) 2005–2015** 39 40

41 In January 2005, the 168 member states of the United Nations adopted the Hyogo Framework
42 for Action (HFA) 2005–2015 at the World Conference on Disaster Reduction in Kobe, Japan
43 (UNISDR, 2007), it was an ambitious effort to reduce all forms of losses from disasters. The
44 HFA's expected outcomes, strategic goals, and priorities were meant to guide disaster risk
45 reduction efforts from 2005 to 2015 (UNISDR, 2009). From the accounts of UNISDR (2011),
46 the HFA strengthened and actually guided international cooperation efforts, aided the
47 generation of necessary political momentum for disaster risk reduction and stood as a solid
48 foundation for national and international development agendas. It was credited to have given
49 a common language and a blueprint of critical actions to governments (UNISDR, 2011). As a
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3 result, since 2005, substantial progress has been made in raising the profile of disaster risk
4 reduction across the globe (UNISDR, 2011).
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7 It was indicated in the HFA that its implementation “will be appropriately reviewed”, the
8 United Nations International Strategy for Disaster Reduction (UNISDR) was tasked to
9 “prepare periodic reviews on progress towards achieving HFA’s objectives and priorities”
10 (UNISDR, 2011). As a result, the HFA implementation was monitored, particularly by the
11 World Bank and the UNISDR via a stakeholder participatory approach at national, regional,
12 and international levels. Progress was monitored and the challenges remaining in the
13 implementation of the HFA were identified. The findings made include, the HFA goals that
14 were yet to be achieved, necessary inclusions in future disaster risk reduction frameworks,
15 suggested improvements on the HFA and some other findings that were utilised in the Post-
16 2015 framework for disaster risk reduction, which is Sendai framework.
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24 **2.2 The Sendai Framework 2015-2030**

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27 As mentioned in the introduction, the Sendai framework was endorsed in March 2015 by the
28 UN General Assembly. The Sendai framework is a development on the Hyogo Framework
29 for Action, it was developed to build on and ensure continuity with the progress made by
30 stakeholders on disaster risk reduction during the implementation of the Hyogo Framework
31 for Action and other documents such as the International Strategy for Disaster Reduction of
32 1999, the Yokohama Strategy for a Safer World of 1994, and the International Framework of
33 Action for the International Decade for Natural Disaster Reduction of 1989 (UNISDR,
34 2015b). The Sendai framework aims to ensure a risk-informed and disaster resilient future
35 (COP21, 2015). The framework address climate change and climate actions, it provides
36 measures, guiding principles, and suggests implementation approach. In a submission,
37 COP21 (2015) stated that the Sendai framework highlighted the need to ensure credible links
38 between climate change, disaster risk reduction, the sustainable development goals,
39 development financing, and improved coherence of policies, collaboration among
40 institutions, reporting methodologies and performance measurement. Sendai framework has
41 seven targets and four priorities for action which are directly connected to a goal and an
42 expected outcome (UNISDR, 2015). The priorities for action of Sendai framework are
43 “understanding disaster risk, strengthening disaster risk governance to manage disaster risk,
44 investing in disaster risk reduction for resilience, and enhancing disaster preparedness for
45 effective response, and to build back better in recovery, rehabilitation and reconstruction”
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(UNISDR, 2015). Each of the four priorities for action have sub-actions divided into local and national levels, and regional and global levels. Each of the main and sub actions relevant to the built environment professionals were studied, interpreted and labelled for use in this study (see Section 3 and the legend accompanying Table 3). The Sendai framework is expected to guide all disaster risk reduction activities at all levels of governance within a 15-year period, the framework is to be implemented under thirteen (13) guiding principles (UNISDR, 2015). Summarily, the Sendai framework aims to achieve the following outcome from 2015 – 2030:

“The substantial reduction of disaster risk and losses in lives, livelihoods, and health and in the economic, physical, social, cultural and environmental assets of persons, businesses, communities, and countries” (UNISDR, 2015a).

2.3 Paris Climate Change Agreement 2015 (COP21)

The COP 21 which is a parent treaty of the 1997 Kyoto Protocol was born out of the need to achieve resilient and sustainable development, the agreement targets the strengthening of the ability of stakeholders to tackle the impacts of climate change (UNFCCC, 2015). The COP21 was agreed to by 195 nations in December 2015, the agreement allows the implementation of its contents in line with national and global objectives towards reducing emission and strengthen resilience (UNFCCC, 2015; United Nations 2015). The COP21 covers core areas referred to as landmark essentials or crucial areas, the areas are mitigation, transparency and global stock-taking, adaptation, loss and damage (recovery from climate impacts) and supports for achieving clean and resilient world (UNFCCC, 2015; United Nations, 2015). The COP21 largely recognise the importance of businesses, investors, other private sector players, cities and regions to the achievement of a low-carbon, sustainable and resilient future (UNFCCC, 2015). The stocktaking aimed at evaluating countries’ progress towards the goal of the agreement is scheduled to start in 2023 even as activities are monitored by a compliance team of experts (UNFCCC, 2015). The crucial areas include mitigation i.e. reduction of emission towards achieving the agreed targets and temperature goals, transparency of action, system and support, adaptation i.e. strengthening of stakeholders’ ability to deal with or manage climate impacts, loss and damage i.e. loss from climate impact, risk transfer and the strengthening of recovery abilities, finance i.e. provision of financial resources and supports to build a clean, sustainable and disaster resilient future and four other

crucial areas (UNFCCC, 2015; United Nations, 2015). The nine landmark essentials or crucial areas are outlined and briefly described in the legend that accompanies Table 3.

It is important to note that achieving the landmark essentials outlined by the agreement requires the contributions of several stakeholders in the respective nations and globally. The specific recognition of the importance of businesses, investors, cities and regions is commendable. The place of the built environment in sustainable development and disaster resilient future cannot be overemphasised (UNDP, 2013), it should be recalled that the term 'built environment' describes the products of human building activities, it includes all physical alteration to the natural environment (Lawrence and Low, 1990). As a result, achieving a sustainable and disaster resilient future requires significant appropriate contribution from the built environment professionals (Haigh and Amaratunga, 2010; Thayaparan et al., 2010; Siriwardena et al., 2013; Perera *et al.*, 2015; Thayaparan et al., 2015).

2.4 Sustainable Development Goals

The Sustainable Development Goals(SDG) is the product of a United Nations summit held in 2015, the SDG for the agenda 2030 has 17 goals (United Nations, 2016). A platform was launched to seek partnership and initiatives aimed at supporting the newly adopted SDG, the platform recorded about 1800 partnerships and 40 initiatives (UNDESA, 2015). The call for partnership and initiatives that focus on advancing sustainable development underlines the importance of the need for all stakeholders to support and embed the relevant part of the goals in their activities, actions and services. UNDESA (2015) presented examples of initiatives aimed at promoting the sustainable development goals. The sustainable development goals include among others "ensure availability and sustainable management of water and sanitation for all, ensure access to affordable, reliable, sustainable and modern energy for all, build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation" (UNDESA, 2015). Each of the goals also have sub goals, all the main and sub-goals were reviewed, labelled and utilised in the mapping exercise done to achieve the aim of this study. The process and the outcome are presented in section 3, section 4 and Table 4. Presented in the next section is the research methodology for this study.

3. RESEARCH METHODOLOGY

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3 Creswell (2013) described research design as the research process; it consists of the plans and
4 procedures, data collection methods and the method of analysis adopted in a research. This
5 research is a qualitative study, the word qualitative refers to the attributes of entities,
6 processes, and meanings that are not experimentally measured (Denzin & Lincoln, 2008).
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8 Qualitative research is interpretive, naturalistic, and qualitative researchers objectively
9 interpret a phenomenon of interest based on valid accounts (Denzin & Lincoln, 2008). A
10 number of methods were adopted in this study, this includes semi-structured interviews, desk
11 review, and a mapping exercise. A semi-structured interview does not limit the depth of
12 probe of an interviewer but rather prevents the interviewee from roving or digressing
13 excessively (Flick, 2014). Creswell (2013) submitted that researchers purposively select
14 participants, therefore, a large number of participants or cases are not actually required in an
15 interview-based research. Thus, a total of fifteen semi-structured interviews were conducted
16 with carefully selected respondents from the “community” stakeholder group across different
17 locations.
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27 Each of the respondents have either experienced disaster events as a member of a disaster-
28 affected community or have been deeply involved in the recovery and reconstruction of
29 disaster-affected communities. The selection criteria were necessary to ensure that only the
30 respondents with valid information were engaged. The selection approach is consistent with
31 judgement sampling (Sekaran, 1992). The interview focused on the needs of communities
32 and the skills required from construction industry professionals to meet the needs while
33 serving communities in the context of disasters. The semi-structured questions used during
34 the interviews served as a guide and a good check for the discussion. The data gathered were
35 analysed using thematic coding (Flick, 2014), the themes that emerged from the interviews
36 were collated and similar themes were merged. Eventually, twenty-nine educational needs
37 (i.e. knowledge gaps) were identified (Table 1), this aspect of the study is reported in more
38 details in Perera *et al.* (2017) (Part of CADRE research outputs).
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47 This research progressed with a comprehensive desk review involving four researchers and
48 academics in the built environment. The review was carried out on Sendai framework, the
49 sustainable development goals and the Paris Climate Change Agreement (COP21). The
50 review resulted in the identification of areas relevant to the built environment professionals in
51 all the policy frameworks. In the Sendai framework, the priorities for action and guiding
52 principles were read, interpreted and labelled (See the legend under Table 2). Also, the nine
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3 crucial areas outlined in the Paris Climate Change Agreement (COP21) (See the legend under
4 Table 3), and the 17 goals in the Sustainable Development Goals were read, interpreted and
5 labelled (See the legend under Table 4). The labels served as references for each of the items
6 during the mapping exercise that followed.
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10 The mapping process involved the alignment of the priorities for action and guiding
11 principles (see the Sendai framework), crucial areas (see the COP21), and goals (see the
12 Sustainable Development Goals) with the identified educational needs (Table 1). This
13 mapping approach was employed by Macgillivray *et al.* (2007), the study abstracted core
14 principles from maturity literature, aligned and tailored it to risk management for
15 benchmarking and maturity improvement purpose. Similarly, Udeaja *et al.* (2015)
16 qualitatively mapped sustainability-related features within Quantity Surveying (QS) degree
17 programmes curriculum, to identify sustainability-related educational needs within the
18 curriculum. The qualitative mapping method was also utilized by Perera *et al.* (2016) to
19 produce a framework for regulating professionally oriented higher degree programmes.
20 Sarshar *et al.* (2000) submitted that the qualitative mapping exercise is tedious. However, the
21 method has been successfully adopted for various purposes in previous studies. It was used in
22 the study to identify the educational needs of built environment professionals in the context
23 of disaster risk reduction, disaster resilience and sustainable development. Presented in the
24 next section is the outcome of the identification of the educational needs and the mapping
25 exercise.
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36 37 38 **4. RESULTS AND DISCUSSION** 39

40 Table 1 reveals the identified 29 educational needs with the respective sample components,
41 the educational needs are the consolidated themes from the interview. Among the educational
42 needs that were identified to be important for built environment professionals and perhaps not
43 the core of their trainings are qualitative leadership and people management, supply chain
44 management, team working, multi-stakeholder management, communication and
45 negotiation/information systems, business planning, and governance. The study finding
46 affirmed some existing literature, particularly Jo da Silva, Lubkowski, Batchelor, and Kabir
47 (2010) that described post-disaster reconstruction or recovery as a complex process, it
48 requires a range of skills, multi-sectoral involvement, and consumes huge resources. This
49 claim is underscored by the number of times that issues relating to community participation
50 and mobilization, use of local skills and local knowledge, empowering and engaging
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3 in the policy frameworks. Clearly, the built environment professionals' educational needs and
4 their links with the policy frameworks have been greatly established in this study.
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7 **5. CONCLUSION**

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10 The Sendai framework emphasised the importance of all forms of education and training i.e.
11 formal and non-formal education, civic education, as well as professional education and
12 training at all levels in reducing disaster risk (UNISDR, 2015). The need to clearly
13 understand the educational needs required for the implementation and adequate entrenchment
14 of the Sendai framework and other international policy frameworks in educational curricula
15 cannot be overemphasised. Thus, this study identified 29 educational needs of the built
16 environment professionals serving disaster affected communities and mapped the needs with
17 the core priority areas of Sendai framework, the Sustainable Development Goals, and the
18 Paris Climate Change Agreement (COP 21). All the needs were directly mapped to the policy
19 frameworks except for one (out of 29) that could not be mapped with any priorities for action
20 in the Sendai framework.
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29 This study has presented the educational needs that are significant towards the effective
30 implementation of the four core priorities of Sendai framework on the respective areas of
31 priorities for actions at the Global & Regional level and National & Local levels. This was
32 also done for the two other international policy frameworks considered in this study. The
33 findings of the study affirmed the existing literature such as Jo da Silva *et al.* (2010) that
34 described post-disaster reconstruction or recovery as a complex and resource consuming
35 process. The study revealed that team working, budgeting & financial planning, quality
36 leadership & people management, communication & negotiation/information systems,
37 insurance, project audit & reporting, business planning, multi-stakeholder management,
38 among others are knowledge areas that built environment professionals could bring to
39 leverage the disaster management and the sustainable development process. These skills were
40 requested to be entrenched further in the trainings of built environment professionals,
41 especially in the context of disaster risk reduction.
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51 The study would be beneficial to the built environment professionals involved in disaster risk
52 reduction. The professionals will be aware of the specific knowledge areas required to
53 successfully implement the three international policy frameworks and therefore improve their
54 capability accordingly. In addition, the findings of the study would be highly beneficial to
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3 higher education providers in disaster risk reduction and sustainable development. It has
4 identified the specific knowledge and competency gaps needed to be bridged in the curricula
5 to meet the demands created by the international policy frameworks. This study is part of
6 CADRE EU research that aims to develop a professional doctorate programme crafted on
7 clear demands, needs, knowledge gaps with adequate input from communities and other
8 stakeholders in the society.
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Table 1: Descriptions of the identified educational needs with the sample portion of their components

1. Budgeting & financial planning - Fund sourcing and financial management skills -Funding or financing to address disaster resilience -Financing flood adaptation strategies	10. Quality leadership & people management -Objective consideration of issues- Flexibility -Understanding the community needs -Leadership skills	19. Communication & negotiation/Information systems - Language (familiarity with local language) and communication skills - Effective communication links - Negotiation skills
2. Quantification & costing of construction works -Budgeting and estimating construction costs -Pricing and estimating-Construction works	11. Team working -Effective use of community groups & individuals -Engaging community - Relationship with other agencies and communities	20. Project audit & reporting - Knowledge of loss assessment and loss adjustment - Auditing skills
3. Supply chain management -Alternative utility supplies after disaster	12. Governance -Transparency and accountability in adopted processes - Minimising political interferences	21. Conflict management & dispute resolution procedures - Knowledge of dispute resolution
4. Consultancy services -Assistance from external parties (i.e. government; NGOs; Private sector, etc.) -Providing property advice to community	13. Multi-stakeholder management - Clarity on roles and responsibilities of different parties - Multi-stakeholder engagement	22. Cross-cultural awareness in global resilience - Familiarity with local language - Use of local skills and local knowledge

5. Procurement & contract administration/practice -Advice to community on selection of contractors and consultants -Selection of consultants and contractors - pre-qualifications	14. Business planning - Temporary business area - Business continuity strategies/plans - Business protection - Needs assessment and prioritisation of resources	23. Project management - Project management skills
6. Building regulation & planning -Resilience planning, designing and construction -Knowledge on land-use planning	15. Environmental assessment - Weather changes monitoring - Awareness of potential disaster threats - Forecasting and warnings	24. Asset/Resource management -Use of local skills and resources - Prioritisation of resources
7. Legal/Regulatory compliance -Knowledge of prevailing laws needs for the flexibility of laws and policies	16. Management of the built environment - Development of preventive structures and methods	25. Disaster management - Management of disaster relief
8. Health & safety -Temporary housing provision -Availability and identification of suitable alternative place to relocate	17. Insurance - Financial compensation for damages - Knowledge and awareness of insurance - Property insurance - Adequacy of insurance cover	26. Risk management - Disaster risk assessments
9. Work progress & quality management -Rapid restoration of damaged infrastructure -Better infrastructure needs	18. Time management - Time management	27. Continuing professional development -Awareness & education on disaster resilience
		28. Emergency management - Rapid recovery after an onset of a disaster - Management of emergency shelters
		29. Construction technology & environmental services - Knowledge on resilient construction practices

Table 2: Mapping of the identified educational needs with the Sendai framework

No.	Identified educational needs	Sendai framework		
		Priorities for action (PA) (With details)	Priorities for action (PA)	Guiding principles (GP)
1	Budgeting & financial planning	PA1NLk, PA2NLc, PA3NLm	PA1, PA2, PA3	GPj, Gpm
2	Quantification & costing of construction works	PA3NLc	PA3	GPj
3	Supply chain management	PA4NLe	PA4	
4	Consultancy services	PA4GRg	PA4	GPj, Gpm
5	Procurement & contract administration/practice	PA3NLc	PA3	
6	Building regulation & planning	PA2NLd, PA3NLf, PA3NLh, PA4NLj, PA4NLk, PA4NLI	PA1, PA2, PA3, PA4	
7	Legal/Regulatory compliance	PA1NLn, PA2NLa, PA2NLb, PA2NLd, PA2NLf, PA2NLk, PA3NLj, PA4NLa, PA4NLb, PA4NLp	PA1, PA2, PA3, PA4	GPa, GPh
8	Health & safety	PA4NLj, PA4NLo	PA4	
9	Work progress & quality management	PA3NLc,	PA3	Gpk
10	Quality leadership & people management	PA2NLc, PA4NLo	PA2, PA4	Gpb, Gpd
11	Team working	PA1NLh, PA1NLo, PA1GRe, PA2NLf, PA2NLh, PA2GRa, PA2GRb, PA2GRc, PA2GRd, PA2GRe, PA2GRf, PA3GRc, PA3GRf, PA4GRa, PA4GRf,	PA1, PA2, PA3, PA4	GPa, Gpd, GPe, GPf
12	Governance	PA2NLa, PA3GRg	PA2, PA3	GPa, Gpb
13	Multi-stakeholder management	PA1GRa, PA1GRg, PA2NLg, PA2NLI, PA2GRa, PA2GRb, PA2GRc, PA2GRd, PA2GRE, PA3GRd, PA4NLI, PA4NLI, PA4GRa, PA4GRf	PA1, PA2, PA3, PA4	GPa, GPe, GPI
14	Business planning	PA3NLo, PA3GRi, PA4NLg,	PA3, PA4	
15	Environmental assessment	PA3NLg, PA4NLb	PA3, PA4	
16	Management of the built environment	PA3NLn, PA3GRa	PA3	Gpc
17	Insurance	PA3NLb, PA3GRb	PA3	
18	Time management	Relevant to all		Gpm

No.	Identified educational needs	Sendai framework		
		Priorities for action (PA) (With details)	Priorities for action (PA)	Guiding principles (GP)
19	Communication & negotiation/Information systems	PA1NLa, PA1NLc, PA1NLe, PA1NLf, PA1GRa, PA1GRc, PA1GRg, PA1GRh, PA1GRi, PA2GRf, PA4NLb, PA4GRb, PA4GRd	PA1, PA2, PA4	GPg, GPm
20	Project audit & reporting	PA2NLe	PA2	
21	Conflict management & dispute resolution procedures			
22	Cross cultural awareness in global resilience	PA1NLc, PA1NLi, PA1NLo, PA3NLd	PA1, PA3	GPa, GPi, GPm
23	Project management	Relevant to all		
24	Asset/Resource management	PA3NLa, PA3NLn, PA3NLp, PA3NLq, PA3GRf,	P3	GPc, GPm
25	Disaster management	PA4NLh	PA4	
26	Risk management	PA1NLb, PA1NLaj, PA1GRb, PA1GRg, PA2GRf	PA1, PA2	GPa, GPc, GPI
27	Continuing professional development	PA1NLg, PA1NLI, PA1NLm, PA1GRe, PA1GRf, PA1GRg, PA1GRi, PA2NLj, PA4NLm, PA4GRf	PA1, PA2, PA4	GPk, GPm
28	Emergency management	PA4NLd, PA4NLm	PA4	
29	Construction technology & environmental services	PA1NLj, PA2NLc, PA3NLc, PA3NLe, PA3GRc, PA4NLc, PA4NLk,	PA1, PA2, PA3, PA4	GPk, GPm

Table 3: Mapping of the identified educational needs with the Paris Climate Change Agreement (COP21)

No.	Identified educational needs	Paris Climate Change Agreement (COP21) Crucial Areas
1	Budgeting & financial planning	CA2, CA3, CA4, CA5, CA8
2	Quantification & costing of construction works	CA2, CA4, CA5, CA8
3	Supply chain management	CA4, CA8, CA9
4	Consultancy services	CA7, CA9
5	Procurement & contract administration/practice	CA2, CA4, CA5
6	Building regulation & planning	CA1, CA2, CA3, CA8
7	Legal/Regulatory compliance	CA2, CA9
8	Health & safety	CA1, CA3, CA4
9	Work progress & quality management	CA2, CA9
10	Quality leadership & people management	CA2, CA9
11	Team working	CA2, CA3, CA4, CA8
12	Governance	CA2, CA3, CA4, CA8, CA9
13	Multi-stakeholder management	CA2, CA3, CA4, CA9
14	Business planning	CA4, CA5, CA8
15	Environmental assessment	CA1
16	Management of the built environment	CA1, CA9
17	Insurance	CA4, CA5
18	Time management	CA1, CA2, CA3, CA4
19	Communication & negotiation/Information systems	CA2, CA6
20	Project audit & reporting	CA2, CA4, CA5, CA8, CA9
21	Conflict management & dispute resolution procedures	CA2
22	Cross cultural awareness in global resilience	CA2
23	Project management	CA2, CA4, CA5
24	Asset/Resource management	CA4
25	Disaster management	CA3, CA4, CA7
26	Risk management	CA3
27	Continuing professional development	CA3, CA4, CA6, CA7
28	Emergency management	CA3, CA4, CA9
29	Construction technology & environmental services	CA1, CA3, CA4, CA6

Table 4: Mapping of the identified educational needs with Sustainable Development Goals

No.	Identified educational needs	Sustainable Development Goals
1	Budgeting & financial planning	9.1, 9.4, 11.1, 11.2, 17.3, 17.8
2	Quantification & costing of construction works	9.1, 9.4, 11.1, 11.2
3	Supply chain management	9.1, 9.4, 11.1, 11.2
4	Consultancy services	9.1, 9.4, 11.1, 11.2
5	Procurement & contract administration/practice	7.2, 9.4, 11.1, 11.2
6	Building regulation & planning	9.4, 11.1, 11.3, 11.7, 13.2, 17.13, 17.14
7	Legal/Regulatory compliance	9.4, 13.2, 17.4, 17.14, 17.15
8	Health & safety	9.1, 9.4, 11.1, 11.2, 11.6
9	Work progress & quality management	9.1, 9.4, 11.1, 17.19
10	Quality leadership & people management	9.1, 9.4, 17.1, 17.10, 17.17
11	Team working	9.1, 17.16, 17.17
12	Governance	17.1, 17.2, 17.4, 17.5, 17.6, 17.9
13	Multi-stakeholder management	9.1, 17.1, 17.16, 17.17
14	Business planning	9.3
15	Environmental assessment	6.1-6.6, 7.3, 9.4, 11.3, 11.6, 11.7
16	Management of the built environment	7.1, 7.3, 9.4, 11.3, 13.1
17	Insurance	17.3, 17.4
18	Time management	Relevant to all
19	Communication & negotiation/Information systems	17.8
20	Project audit & reporting	9.4
21	Conflict management & dispute resolution procedures	Not specifically mentioned
22	Cross cultural awareness in global resilience	9.1, 11.4, 17.9, 17.10, 17.15, 17.18
23	Project management	9.1, 9.4, 11.2, 17.6
24	Asset/Resource management	6.1-6.6, 9.3, 17.1, 17.6
25	Disaster management	11.5, 13.1
26	Risk management	11.5
27	Continuing professional development	9.5, 13.3, 17.7, 17.9, 17.18
28	Emergency management	11.5, 13.1
29	Construction technology & environmental services	7.2, 7.3, 9.1, 9.4, 11.1, 11.2, 13.1