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Professional education in disaster resilience in the built environment

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Abstract: Disasters continue to take a heavy toll on many communities around the world. It is critical to anticipate, plan for and reduce disaster risk in order to more effectively protect people, communities, their livelihoods, health, cultural heritage, socioeconomic assets and ecosystems, and thus strengthen their resilience. Professionals responsible for the built environment have a vital role to play in developing societal resilience to disasters. The protective characteristics of the built environment offer an important means by which humanity can reduce the risk posed by hazards, thereby preventing a disaster. Conversely, post-disaster, the loss of critical buildings and infrastructure can greatly increase a community's vulnerability to hazards in the future. The consequences outlined above serve to underline and support the growing recognition that those responsible for the built environment (BE) have a vital role to play in developing societal resilience to disasters. With the increase in occurrence of high impact disasters, the role of Higher Education Institutes (HEIs) in enhancing the disaster related knowledge and skills of BE professionals is highly recognised. Doctoral education is identified as one of the methods in upgrading the knowledge of the BE professionals in this regard. Due to the shortcomings of the traditional doctoral programmes in addressing the needs of the industry and professionals, professional doctorates have become increasingly recognised. Most of the professional doctorates target practicing professionals and aim to integrate professional and academic knowledge in the selected discipline. However, professional doctoral concept is not popular in some parts of the world and not integrated within their higher education system. In recognition of these challenges, a EU funded project, CADRE (Collaborative Action towards Disaster Resilience Education) identifies knowledge gaps and develops an innovative professional doctoral programme (DProf) that integrates professional and academic knowledge in the construction industry to develop societal resilience to disasters. Accordingly, the aim of the paper is to present the DProf framework developed as part of this study and to investigate its applicability to developing societal resilience to disasters.

Keywords: Built environment, Disaster resilience, Doctorates, DProf framework, Professional education,

1. Introduction

Disasters either natural or man-made pose significant concerns and challenges. With growing population and infrastructures, the world's exposure to hazards is increasingthan ever before [21]. Therefore, it is critical to anticipate, plan for and reduce disaster risk in order to more effectively protect people, communities, their livelihoods, health, cultural heritage, socioeconomic assets and ecosystems, and thus strengthen their resilience[24]. Accordingly, the importance of tackling disaster risk is highlighted in all three of the major global agreements that were finalised in 2015: Sendai Framework for Disaster Risk Reduction 2015 - 2030, Climate Change (COP21), and the Sustainable Development Goals.

With the increase in risks of high impact disasters, the role of Higher Education Institutes (HEIs) in enhancing the disaster related knowledge and skills of Built Environment (BE) professionals is highly recognised [14, 15, 16, 22].Doctoral education is identified as one of the methods in upgrading the knowledge of the BE professionals in this regard [16, 22]. Due to the shortcomings of the traditional doctoral programmes in addressing the needs of the industry and professionals, professional doctorates have become increasingly recognised [16, 22]. Most of the professional doctorates target practicing professionals and aim to integrate professional and academic knowledge in the selected discipline. However, professional doctoral concept is not popular in some parts of the world and not integrated within the higher education systems. In recognition of these challenges, a EU funded project, CADRE (Collaborative Action towards Disaster

Resilience Education) identifies knowledge gaps and develops an innovative professional doctoral programme (DProf) that integrates professional and academic knowledge in the construction industry to develop societal resilience to disasters. Accordingly, the aim of the paper is to present the DProf framework developed as part of this study and to investigate its applicability to developing societal resilience to disasters.

The paper first synthesises the literature in relation to the need of professional education in disaster resilience in the built environment. Paper then provides an introduction to the concept of professional doctorates. The DProf development process is explained and the key features of the programme are highlighted.

2. Professional education in disaster resilience in the built environment

Construction industry is of strategic importance for many countries, as it delivers buildings and infrastructure, which are needed by the rest of the economy and society [23]. Buildings and infrastructure is severely disrupted by disasters and the construction industry and the built environment practitioners are expected to play a predominant role in reducing the disaster risks and recovering from natural and manmade disasters. Accordingly, the importance of engaging built environment professionals more widely in disaster risk reduction, response and recovery is widely recognised [10,11,25]. More importantly, early attention is needed to engage right expertise to address problems of buildings, infrastructure and land in reducing disaster risks and strengthening resilience [25]. Moreover, construction sector has a direct impact on energy and resource efficiency and is responsible for promoting sustainability to combat climate change [23]. It is therefore important to improve the knowledgebase ofbuilt environment practitioners to successfully tackle these global challenges.

2.1 Divers, trends and the changing role of the profession

Accelerating urbanisation, changing demographics, inequality and instability, resource scarcity and sustainability are some of the trends reshaping the worldthat we live in [1].Out of these, urbanisation is one of the most critical global issues[1,2,3,4,5]. Urbanisation generally means a shift of population from rural to urban areas, which put pressure on land and resources. More than half of the world's population is now live in urban areas [5] or cities.The high concentration of populations and economic and cultural capital in cities threatens the sustainable development and increases the susceptibility to natural disasters [1,4,5].All of theseprompt the need to promote sustainable and resilient cities [3] and demands new knowledge and skills to rethink the land use planning, manage cities and connect urban and rural [1].

Moreover, the world's population is growing and getting older [1,6,9]. As a result a larger population will need more homes, schools and infrastructure [9]. Due to the change in age demographics, complex and long term planning is required to cater the social and economic needs of different age groups [1]. For an example, the older population will require, increased hospitals, short and long term care facilities and protection services [8]. Additionally, some will need specially designed buildings and more attention is needed in terms of accessibility and health issues in designs, build and retrofit [9].

As a result of the increased population, an increased pressure is placed on land and resources. Construction being a resource intensive sector, resources that the construction is relied upon is becoming more difficult to extract and their use has cause environmental problems such as, climate change, waste production and pollution [1]. Increasing concerns about global warming and the concepts such as sustainability, energy efficiency, zero waste and 'green' building have gained growing recognition among the built environment professions [6,9]. As such, increased need for sustainability in the built environment is another area of concern where much effort is still needed to promote the environmental agendas in the built environment [1]. In light of the new developments in the global environmental agendas, the time has come for the built environment professions to incorporate sustainable development more intensely into its practice [6,7].

Besides, increase occurrences of geological and climate related hazards demands built environment professions to plan, design, build and retrofit buildings and infrastructure which can adapt and withstand to the threats posed by natural disasters [10,11,12]. Cities need to be

developed in such a way that it can adapt to the threatsposed by urbanisation, changing demographics, inequality and instability, environmental changes, inadequate infrastructure and resource shortages [1] all of which aggravate the risk of natural disasters.As discussed, land and built environment sectors face immense challenges as a result of these social and economic trends [1]. In overcoming the challenges, it is important that we continuously improve the skill base of the built environment practitioners. The next section highlights the available mechanisms of improving the knowledgebase of built environment practitioners.

2.2 Improving the knowledgebase

As a result of prominent gaps in knowledge, Sendai Framework for Disaster Risk Reduction (2015-2030) has identified the need of enhancing the capacities of relevant stakeholders and industries. Accordingly, the framework suggested to "build the knowledge of government officials at all levels, civil society, communities and volunteers, as well as the private sector, through sharing experiences, lessons learned, good practices and training and education on disaster risk reduction, including the use of existing training and education mechanisms and peer learning" [24]. As highlighted, built environment practitioners play an important role in disaster resilience and management and it is therefore important to design educational and training courses to enable them to successfully fulfil this role. Therefore, risk and hazard awareness training needs to be integrated systematically into the professional training of architects, planners, engineers and developers [11].

Education and training for built environmentpractitioners are usually provided by HEIs; vocational education and training providers; built environment professional bodies; construction organisations, and training and development authorities [14]. Out of all, higher educational institutes play a predominant role in developing capacities of built environment professionals in contributing to disaster resilience [14]. Studies such as Siriwardena et al. (2013), highlights that providing disaster management education as a degree programme is ineffective due to the complexity and multi-disciplinary nature of the subject [15]. Furthermore, the study highlights, lack of industry involvement and the lack of research and development activities on disaster management by built environmentpractitioners as a hindrance [14, 16]. Accordingly, it has suggested the need of continuously updating the knowledgebase of built environmentpractitioners, in order to contribute effectively to disaster resilience [15]. Thus, in overcoming the challenges of existing approaches of disaster management education, lifelong-learning has been identified as the most appropriate approach to educate built environment practitioners in the context of disaster resilience and management [14,15].

In supporting the concept of lifelong learning and in overcoming the identified challenges of existing approaches to disaster resilience education, it is proposed to develop a professional doctorate in disaster resilience in the built environment [16]. By developing a professional doctorate, it is expected that challenges such as, complexity and multi-disciplinary nature of the subject; lack of industry involvement; and lack of research and development activities on disaster management by built environment practitioners, could tackle successfully [16]. The next section introduces the concept of professional doctorates.

3. PhD vs. DProf

For many decades PhD is considered as the most prestigious academic award in a variety of disciplines, including professional disciplines [17]. However, during first half of the 20th century PhD tradition has been challenged and many countries and institutions started improving PhD programmes to make them more efficient [17]. As part of the diversification of doctorates, new forms of PhD programmes were introduced, some of which to name are, professional doctorates, applied doctorates, practitioner doctorates, clinical doctorates in various disciplines [17]. Out of all the above, professional doctorates were more popular in countries like, USA, UK and Australia [17].Professional doctorates usuallyinclude structured elements such as lectures, seminars, and workshops, helping the candidates to acquire skills relevant to their professional practice, in addition to producing original research [20].

According to Bourner et al. neither, professional doctorates or PhDs are homogeneous [18]. As a result, there are variations between, countries,

institutions and subjects.However, Bourner et al. claimed that most of the professional doctorates have been designed to develop a research based career development for experienced practitioners in the profession whereas traditional PhDs intend to develop professional researchers [18]. Accordingly, professional doctorates have certain characteristics that distinguish from a traditional PhD. According to McGraw-Hill Education (2014), "professional practice, the development and/or application of expertise directly in the practice setting and practitioner research are central to professional doctorates" [19]. As such most professional doctorates expect the candidates to research on a topic, which relates to their own working lives [18].Next section highlights the DProf development process.

4. DProf development process

Development of the programme involves a substantial level of research activities to study and analyse market needs in order to capture the labour market requirements for disaster resilience and its interface with the construction industry and its professionals. Accordingly, the first phase of research involved, capturing the needs of 5 stakeholder groups associated in disaster resilience and management as well as current and emerging skills and ultimately knowledge gaps, associated with built environment professionals towards enhancing societal resilience to disasters.

The data collection and analysis framework of the study is a three dimensional framework consisting the following parameters [22].

Built environment stakeholders: National and local government organisations; Community; NGOs, INGOs and other international agencies; Academia and research organisations; and Private sector.

Dimensions of resilience: Economic Resilience; Environmental Resilience; Institutional Resilience; Social Resilience and Technological Resilience

Stages of property lifecycle: Preparation Stage; Design Stage; Pre-Construction Stage; Construction Stage and Use Stage

The data collection and analysis framework was developed through an extensive consultation process with project partners and was refined throughout the first year of the project with the emerging literature findings and with the opinion of stakeholders who have been interviewed to capture the labour market demands in construction industry to increase societal resilience to disasters.

Semi-structured interviews were employed as the main technique for data collection. During the interviews, there was special interest and focus on the needs of 5 stakeholder groups, namely the local and national governments; community; NGOs, INGOs and other international agencies; academia and research organisations; and private sector, and the skills required from construction industry professionals serving these stakeholders. Separate interview guidelines were prepared for each stakeholder to match their circumstances. The interview guidelines were prepared to capture the above issues and the guidelines and a study brief was sent to the interviewees prior to the interview. At the start of the interview the interviewer explained the research topic and the aims and objectives of the study in order to give a clear picture of what is expected from the interviewee. This allowed the interviewees to answer the questions more appropriately. During the interview the interviewer asked questions based on the interview guidelines, however the process allowed the interviewee to elaborate on anyissues, which were relevant to the study. This process allowed interviews to progress in a more proactive manner where the interviewer was able to capture the data, which were more relevant to the study. The interviews lasted for between 15-80 minutes. Most of the interviews were audio recorded using a digital voice recorder with the consent of the interviewees. Audio recording helped the researcher to transcribe interviews accurately and provided the opportunity to fully concentrate on the interviewee during the process. In addition, all key points were written down during the interview in order to avoid any issues arising from technology failures. All the interviews were then transcribed using MS word and this process allowed researcher to use direct quotations from the interviewees when presenting the data; all of which increased the reliability and validity of the research findings.

The interviews were conducted by CADRE project partners and Table 1 presents the number of interviews conducted for each stakeholder group. As shown in Table 1, semi-structured

interviews were conducted with a total of 87 respondents across different countries and continents.

Table 1: Stakeholder interviews

Stakeholder	No
National and local government	20
HEIs and research organisations	21
Private sector	19
Community	15
NGOs/INGOs and international organisations	12

The data gathered from respective interviews were subsequently analysed by the CADRE project partners. The analysis was done using NVivo (version 10) data analysis software. The themes were presented under two main headings i.e. Needs and Skills. The category "Needs" covers the stakeholder requirements that emerged from the interviews as well as the demands specifically made by the interviewees. Also, what the interviewees believe should be in place while professionals relate with them to enhance societal resilience were categorized under the heading "Needs" in the analysis. During the interviews, some set of skills, that were displayed by professionals while serving to reduce the threats posed by natural and human induced hazards and some that are desired by interviewees emerged. These set of skills were categorized under the heading "Skills".

The interviews generated a long list of needs and skills with respect to the property lifecycle stages under the respective dimensions of resilience. Finally, the identified needs and skills were combined 'like-for-like' to produce broader level of knowledge gaps. In parallel an extensive literature review and a policy analysis was conducted to capture the emerging needs in the disaster resilience in the built environment. The findings were then validated using focus group discussions that were conducted as part of two organised stakeholder workshops.These involved a total of 25 respondents.

Some of the key knowledge gaps identified are, Governance, legal frameworks and compliance; Business continuity management; Disaster response; Contracts and procurement; Resilience technologies, engineering and infrastructure; Knowledge management; Social and cultural awareness; Sustainability and resilience; Ethics and human rights; Innovative financing mechanisms; Multi stakeholder approach, inclusion and empowerment; Post disaster project management; and Multi hazard risk assessment. These will form the basis for the initial programme specification for the proposed DProf. Based on these a structured doctoral programme is developed in order to reflect how the construction sector and its professionals can contribute to achieving resilience in the case of increasing threats from natural and human induced hazards.

5. Key features of the proposed DProfframework

The broader title of the programme is defined as "Professional doctoral programme in disaster resilience in the built environment". It is important that the title reflect institutional and country specific regulations and other requirements. Various DProf models are available where DProfs are popular in some regions than others. Therefore in countries like UK or Australia, the award can be a professional doctorate in disaster resilience in the built environment. However, for countries like Estonia and Lithuania, where there are no 'professional doctorate' programmes available at any higher education institution, indeed, would require legislative amendments before such programmes could be offered. Therefore, in such instances, the award can be named as "PhD in disaster resilience in the built environment".

The programme is offered in the context of disaster resilience in the built environment and therefore the aims of the programme should reflect the scope of the programme. Accordingly, some broader aims were developed, linking with the QAA doctoral degree characteristics [20]. They are:

- Provide students with a critical understanding of developing approaches to systematic inquiry reflecting theoretical, and philosophical approaches to generation of new knowledge and its application within the professional context of disaster resilience in the built environment
- Provide students with the ability to create new knowledge through practice based research, contributing to the professional knowledge in disaster resilience in the built environment

- Appraise and synthesise a substantial body of knowledge at the forefront of disaster resilience in the built environment practice and its application

Any adopting institution will need to check and refine these aims to reflect institutional and country specific regulations and other requirements.The next section highlights the key features of the DProfframework.

5.1 A generic framework

CADRE project offers a generic DProf framework, which allows wide range of professionals associated with different built environment sectors in disaster resilience and management to negotiate programmes that are applicable to their own circumstances. In other words, having a generic framework allows the prospective candidates to customise the programme to suit their own professional practice. Furthermore, CADRE being a multi-partner project, developing a generic framework provides the opportunity for different institutions to alter the programme to match their individual institutional and country specific demands, capabilities and regulatory frameworks. Accordingly, the framework suggests various options for the entry requirements, duration, course structure, assessment structure, themes, skills needs and training needs. Apart from the commonalities of the contents across the partner institutions, the specification will be customisable so as to be compatible with the individual institutional standards.

5.2 Address the knowledge gaps in disaster resilience in the built environment

As explained earlier, the DProfframework was developed based on asystematic and extensive analysis of knowledge gaps in disaster resilience in the built environment. Furthermore, the findings were validated using focus group discussions that were conducted as part of two organised stakeholder workshops. All these enabled developing a DProf framework that directly addresses the current and emerging knowledge gaps in disaster resilience in the built environment. As a result, the education and training delivered will be more relevant to the demands in candidate's professional practices, which is vital for the labour market and for people's employability [16]. Accordingly proposed programme will attract learners, from the construction industry, to develop solutions to their labour market demands through doctoral studies.

5.3 Contribution to professional practice

In terms of disaster resilience and management, more applied research is required in order to develop the construction industry with necessary capacities to plan, design, build and operate resilient structures to increase societal resilience to disasters [16]. Accordingly, the proposed programme will provide opportunities to the candidates to undertake research aimed at making a contribution to the knowledge of professional practice and will involve applied rather than pure research. It will therefore strengthen not only the academic knowledge and cooperation between the universities and industries, but also the concerns, capabilities and expectations of the relevant stakeholders related to disaster resilience and management. Accordingly, it will make a research-based contribution to practice within the context of upselling construction professionals with disaster resilience expertise.

5.4Integration of practice, community and university

Teaching disaster resilience and management requires, multi-sectoral and multi-stakeholder engagement [14] and thus, designing and delivery of education programmes catering the built environment practitioners require collaboration between all disaster related stakeholders, BE practice and the university. In order to promote the collaboration, the proposed DProf framework encompasses a Practice, Community and University (PCU) framework [12] to ensure continuous monitoring of market demands and to tailor the contents to meet the demands. Accordingly, appropriate mechanisms were built to integrate all disaster related stakeholders, BE practice and the university in order to ensure success in the DProf programme development and delivery.

5.5Cross-institutional supervisory teams

The proposed DProf framework enables cross-institutional supervisory teams, as well as supervisors from the industry. Due to the multi-disciplinary nature of the subjects, having cross-institutional supervisory teams will enhance the quality and relevance of the research and having supervisors from the industries can significantly add value to the research [16]. Accordingly, the research phase of the programme will be supervised by a panel of supervisors, usually

comprising an academic member of the staff and a practice-based specialist.

5.6Flexible study modes

In order to meet the needs of practising professionals and their employers, it is recommended to offer flexible study modes (such as part –time attendance or distance learning) allowing candidates to spend the rest of the time in industry or a professional organisation. However, when looking at the available programmes, different models of DProf programmes are available, spanning from, full time to part time and some institutions even offer, distance learning and blended courses. As such when looking at the existing DProfs, there is no commonly accepted mode of study and even within the UK, some institutions offer full time and part time courses while others offer part time only courses. Therefore, the study mode needs to be defined by the individual institutions according to the individual institutional standards and regulations and the available modes are full time; part time; distance learning; and blended.

5.7Intermediate exit routes

Intermediate exit points can be defined based on partner's discretion and depending on the individual institutional standards and regulations.Available options include, PGCert at the end of 1st year and MRes/ MProf at the end of 2nd year. As explained earlier, the DProf is offered for practicing professionals and therefore having intermediate exit points will provide flexibility for the candidates to exit from the programme at different points with an appropriate award.

5.8 A taught and a research component

Framework includes two main components: Taught and research. Taught component is essential – preferably at the beginning of the programme (year 1 and year 2). Taught component includes some generic modules on research methodology, critical professional reflection in disaster resilience in the built environment and literature review and synthesis. Based on the knowledge gaps identified, a pool of modules is being developed as part of the DProf framework and will be available in the CADRE Open Education Resource (OER) platform.

In addition, candidates are expected to start a research with a problem in professional practice and to make original contribution to knowledge of professional practice through research. Accordingly, the proposed programme structure will include a taught and a research component with various assessment techniques.

5.9OER

The taught elements of the DProf framework will draw on a variety of teaching and learning methods. Teaching takes the form of face-to-face or online units, with a combination of e-learning support and supervision. All course materials are available through the OER platform developed as part of the CADRE project, which is accessible to students across all regions. Part time/ distance learning programmes are usually supplemented by occasional intensive study days. The recorded sessions will also be available through the OER platform for students who are unable to attend.

7. Conclusions

With the increase in population and infrastructures, world's susceptibility to threats posed by natural hazards is increasing ever before. As a result, built environment professionals are expected to play a key role to reduce disaster risks and to protect communities and built assets from adverse impact of disasters. Accelerating urbanisation, changing demographics, inequality and instability, resource scarcity and sustainability are some of the global trends faced by the industry. In light of these challenges and with the global advances in technology, it is important that the professionals associated with built environment sector continuously improve their knowledgebase to better integrate with the changing world. In facilitating the knowledgebase of built environment practitioners in face of disastrous events, higher education institutions have to play a predominant role. Lifelong learning is, one approach that can address the continuous educational needs of built environment professionals dealing with disaster resilience. In supporting the concept of lifelong learning and in overcoming the challenges of traditional approaches to disaster resilience education, an EU funded project CADRE, seek to develop a professional doctorate in disaster resilience in the built environment.DProf framework was developed based on an extensive analysis of knowledge gaps prevail among built environment practitioners. Paper elaborates the

development process of the DProf framework and highlights the key features of the proposed programme.

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