

# Northumbria Research Link

Citation: Nguyen, Vinh, Ginige, Kanchana and Greenwood, David (2018) Challenges in integrating disaster risk reduction into the built environment – The Vietnam context. *Procedia Engineering*, 212. pp. 316-323. ISSN 1877-7058

Published by: Elsevier

URL: <https://doi.org/10.1016/j.proeng.2018.01.041>  
<<https://doi.org/10.1016/j.proeng.2018.01.041>>

This version was downloaded from Northumbria Research Link:  
<http://nrl.northumbria.ac.uk/33929/>

Northumbria University has developed Northumbria Research Link (NRL) to enable users to access the University's research output. Copyright © and moral rights for items on NRL are retained by the individual author(s) and/or other copyright owners. Single copies of full items can be reproduced, displayed or performed, and given to third parties in any format or medium for personal research or study, educational, or not-for-profit purposes without prior permission or charge, provided the authors, title and full bibliographic details are given, as well as a hyperlink and/or URL to the original metadata page. The content must not be changed in any way. Full items must not be sold commercially in any format or medium without formal permission of the copyright holder. The full policy is available online: <http://nrl.northumbria.ac.uk/policies.html>

This document may differ from the final, published version of the research and has been made available online in accordance with publisher policies. To read and/or cite from the published version of the research, please visit the publisher's website (a subscription may be required.)

[www.northumbria.ac.uk/nrl](http://www.northumbria.ac.uk/nrl)





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

## Challenges in integrating disaster risk reduction into the built environment – The Vietnam context

Vinh N. Nguyen<sup>a\*</sup>, Kanchana Ginige<sup>a</sup> and David Greenwood<sup>a</sup>

*<sup>a</sup>School of Architecture and Built Environment, Faculty of Engineering and Environment, Northumbria University, Newcastle upon Tyne, United Kingdom*

---

### Abstract

For decades, Vietnam has been recognized as one of the countries most vulnerable to the impact of climate change and its associated phenomena, including natural disasters and extreme weather events (NDEWEs). The increasing pattern of NDEWEs witnessed over recent times underlines the importance of disaster risk management and disaster risk reduction (DRR) in Vietnam. The Vietnamese built environment, which plays a crucial part in the national economy and facilitates the functions of the entire society, is one that is directly exposed and susceptible to disasters. Nonetheless, the achievements of the Vietnamese built environment in integrating DRR has, due to various problems, remained somewhat limited and research on NDEWEs specific to the country's built environment is currently nebulous and sporadic. This paper presents an investigation into the progress and shortcomings in integrating DRR into the construction and maintenance of the built environment in Vietnam. The investigation is based on a comprehensive review of legislative documents and related literature which was conducted as part of a wider research which aims to establish a framework that employs various instruments and strategies to integrate DRR more effectively into the built environment in Vietnam. The challenges identified by the study include lack of capacity and coordination at the national level; gaps in legal frameworks and lack of guidance for implementation; complex institutional arrangements; incompatibility of building codes and lack of enforcement; lack of qualified human resources; and inadequate understanding among the general public. These findings are of special importance to further research into developing a complete collection of measures to overcome the existing challenges in the application of DRR in the built environment and urban infrastructure.

© 2018 The Authors. Published by Elsevier Ltd.

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

*Keywords:* Disaster risk reduction; Disaster management; Disaster resilience; Built environment; Vietnam

---

\*Corresponding author: *Email:* [vinh2.nguyen@northumbria.ac.uk](mailto:vinh2.nguyen@northumbria.ac.uk)  
Tel: (+44) 7397601241

## 1. Introduction

Climate change is one of the major challenges faced by countries worldwide. Recent years have witnessed a noticeable increase in both frequency and intensity of climate change phenomena. Due to specific geographical features that involve a narrow coastal strip territory located in tropical monsoon area, a coastline of 3,440 km and two vast low-lying deltas, Vietnam is prone to a wide range of natural hazards and has been identified as a hotspot for future climate impacts and vulnerability to natural disasters and extreme weather events (NDEWEs) [1, 2]. The most prevalent in Vietnam are storms and floods, which account for 49% and 37% of all events respectively. The impacts of NDEWEs upon different sectors of the economy are so detrimental that the annual loss is recorded as 1-1.5% of GDP [3]. Thus, disaster risk management and disaster risk reduction (DRR) have become a priority issue for Vietnam. The built environment facilitates the functions of society [4] and is directly exposed and most susceptible to natural hazards [5, 6]. Annual average figures for 2005-2015 show a total of 649 NDEWEs resulting in 469,256 destroyed and 174,653 damaged houses [7]. In the 2 months of 2016 saw 317,000 residential properties collapsed in 5 devastating floods, with a total loss of US\$ 1.7 billion [8]. Most civil infrastructure in Vietnam has been conventionally designed and constructed in a way that is inadequate to withstand NDEWEs. Water drainage systems in two major cities of Vietnam - Hanoi and Ho Chi Minh are almost paralyzed during heavy rains, which normally result in serious flooding [9], and the Vietnamese transport system suffers up to US\$ 100 million loss per annum due to floods and landslides [10]. The impact of NDEWEs can be reduced, and a more resilience created, by wholesale adoption of DRR [11, 12]. This includes a combination of systematic development and application of strategies, policies and practices to prevent or mitigate the adverse effects of natural hazards [13]. Over the last ten years, Vietnam has achieved a noticeable progress in integrating DRR into national and provincial socio-economic development planning framework. However, the Vietnamese built environment's achievements have remained limited. This study investigates the integration of DRR into the construction and development of the built environment in Vietnam. The study is of special importance to all public and private sector stakeholders in recognizing and implementing DRR in their practices that contribute to the construction and maintenance of the built environment in Vietnam.

Following a brief exploration of the history and adoption of DRR (including the legal documentation and organizational structure in support of disaster management), an extensive literature review was made of Vietnamese legal documents, academic databases, professional reports, and conference proceedings using keywords (in English and Vietnamese) such as: built environment, construction industry, disaster, resilience, disaster management, disaster risk management, disaster risk reduction, mitigation, prevention, response, and recovery. With an intention to obtain the most precise reflection to the current status of DRR, the majority of selected literature material has the age not exceeding ten years. Noticeably, this includes the most recent building regulations and land use planning laws, which are conventionally used as tools to improve the resilience of the built environment to NDEWEs. The challenges in adopting DRR, its efficacy and residual problems are discussed. Finally, a direction for future work is proposed.

## 2. Disaster risk reduction in national disaster management

### 2.1. Legislation in support of disaster risk reduction: Lack of focus on the built environment

The built environment in Vietnam has a history of accommodating various means of preparing for and actively responding to NDEWEs. This is confirmed by the existence of extensive sea walls and dikes across many regions, reflecting people's awareness on the country's fragility to riverine and coastal floods, typhoons and other tropical storms [14, 15]. Laws and regulations pertaining to DRR in Vietnam have been delivered via numerous instruments which receive updates on regular basis. Before May 2014, there was no stand-alone law on NDEWEs in Vietnam. The majority of laws and regulations dealt with only floods and storms, while other hazards were addressed separately. The legal framework regarding to floods and storms was initiated in 1946 following the establishment of the Central Dyke Protection Committee - the forerunner of the present Central Committee for Flood and Storm Control (CCFSC) [16]. The framework consisted of the Ordinance on Prevention and Control of Floods and Storms of 1993 [17], the decree of 1996 for its implementation [18], the 1996 Decision on the Establishment of the CCFSC [19], and the Amendments to the Ordinance in 2000. Despite the inclusion of DRR, the framework had shown greater focus on defining functions and responsibilities of different agencies for disaster response. In fact, the disaster prevention and

mitigation measures laid down in the aforementioned laws and regulations were largely short-term. However, there existed some measures in support of long-term disaster prevention in the Ordinance of 1993: this mandated prevention plans for each area; construction of flood and storm prevention and mitigation infrastructure; strategy for resettlement; and the promotion of DRR awareness within the community. Additionally, the separate law concerning dikes had more detail regarding infrastructure. The common concern of these ordinances is disaster management in rural rather than urban areas [20]. Since the latter are characterized by a higher density of structures, urban design has an essential role for fostering DRR at the levels of disaster recovery [21], resilience and social capital improvement [22, 23] and through the design of resilient infrastructure [24] involving protective structures and measures. Settlement layouts, number of floors, height of houses, and the design and landscaping of drainage and flood retention areas are integral to flood and surge control [25]. In 2007, the Government of Vietnam (GoV) launched the National Strategy for Natural Disaster Prevention, Response and Mitigation to 2020 (Strategy 2020) [26], presenting the long-term strategic orientations of DRR and its implementation. Strategy 2020 is the first policy in which DRR is strongly promoted and connected to socio-development, including the construction and maintenance of the built environment. Its opening chapter points out that “disaster prevention, response and mitigation shall be integrated in every socio-economic development master plan and planning of every region and sector nationwide” [27], to be achieved through a range of programs introduced in the strategy, including improving legislation and policies, strengthening disaster management capacities, and reinforcing organizational structures. Strategy 2020 is tailored to different geographical regions in Vietnam: the Red River Delta, the Central Coast and Central South, the Mekong River Delta, and the mountainous areas. However, this national strategy does not possess any action plan for adopting DRR in cities, which again reflects the bias of DRR efforts towards rural areas. In addition, the Vietnamese built environment’s achievements under this strategy have remained limited over the first ten years of DRR application due to difficulties driven by the lack of national and local resources [28]. From 2005 to 2014, the GoV made notable progress in integrating DRR into national and provincial socio-economic development planning frameworks by introducing a new Law on Natural Disaster Prevention and Control (New DRM Law) [29] that displaced the 1993 Ordinance and its 2000 Amendment and came into effect in May 2014. It relates to all NDEWEs, both geophysical and hydro-meteorological. Unlike the 1993 Ordinance that mainly coped with NDEWE response and short-term prevention, the New DRM Law offers more provisions on long-term prevention as well as risk management. Although the term ‘DRR’ is not used as such, the adoption of DRR in Vietnam is still implicit in numerous provisions. In parallel to mainstreaming DRR in socio-economic development, the New DRM Law contains a number of provisions in support of development of DRR policies and strategies, as well as assessing physical infrastructure for DRR, and thus is of major significance for DRR and its implementation [20].

## *2.2. Disaster risk reduction committees on floods and storms: Complex institutional arrangements in disaster management and lack of collaboration*

The Ministry of Natural Resource and the Environment (MONRE) has the leading role for climate change coordination in Vietnam, while the Ministry of Agriculture and Rural Development (MARD) has overall responsibility for NDEWE mitigation and response. In terms of the built environment, the Ministry of Construction (MOC) oversees major public works and drainage systems; the Ministry of Planning and Investment issues regarding to land use and master planning; and the Ministry of Science and Technology those related to climate forecasting. The CCFSC is the chief coordinating body responsible for disaster management in the country and its mandate is to translate the strategy into action. MONRE is crucial in the organizational structure and operation of the CCFSC, which also includes representatives from other ministries. The CCFSC chaired by the Minister for Agriculture and Rural Development presides over the implementation of Strategy 2020, which is mandated in all sectoral ministries and localities.

Each sectoral ministry has a sub Committee for Flood and Storm Control, working in cooperation with the national central committee and provincial-level offices. Sectoral ministries and local entities are answerable for ensuring effective implementation of relevant objectives, contents, duties and solutions established in Strategy 2020. However, according to the International Federation of Red Cross and Red Crescent Societies (IFRCRCS) [30] committees at all levels have yet to cooperate satisfactorily in long-term disaster prevention and mitigation, i.e. in DRR. Furthermore, as no single department, sectoral ministry or locality has responsibility for DRR [31] it is not at the top of any priority list. In the built environment, this results in DRR considerations being negligible when building regulations and planning policies are introduced [20]. Additionally, Nguyen [32] reveals that as of 2015 (i.e. 7 years from the commencement of Strategy 2020) there has been very limited activity in urban areas, with a serious lack of collaboration between MONRE and MARD on DRR and also climate change adaption. At the provincial level, the disaster management organizational structure is consistent with the national level. Under the New DRM Law, each province maintains a Steering Committee for Flood and Storm Control (CFSC), chaired by the vice-chairman of the People’s Committee and involving representatives from all associated sectoral departments. Vietnam has 63 provinces so there is a total of 63 CFSCs. Most activities of provincial CFSCs focus on setting up plans for NDEWE preparedness, response and recovery. However, DRR at provincial level has not been implemented sufficiently in an active mode. The IFRCRCS [30] reports that only the CFSC of Da Nang city undertakes additional DRR activities (e.g. building resilience and awareness-raising by improving early-warning systems).

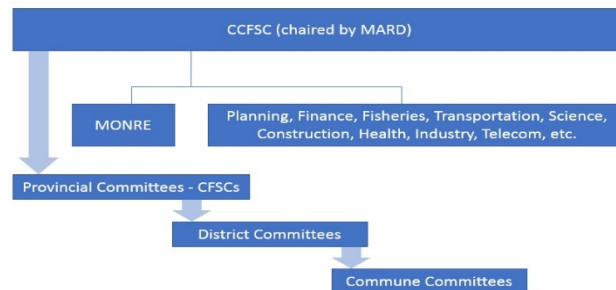


Figure 1: Institutional arrangement for disaster management in Vietnam

### 3. Planning and regulations for disaster risk reduction in the built environment

Building standards can be used as a tool to mitigate damage and destruction to houses, public buildings and infrastructure, and therefore improve the resilience of a community to NDEWEs [25]. In parallel, responsible land use planning can prevent or reduce the severity of impact that NDEWEs have upon the built environment [33]. The combination of these two approaches contributes to the creation and maintenance of safer and more sustainable living conditions.

#### 3.1. Building codes

The Law on Construction of 2014 [34] imposes regulations on building and civil engineering design and construction in Vietnam through a set of general requirements, with no direct reference to DRR and no provision to ensure the resilience of buildings to natural hazards. Its aim for a ‘safe and sustainable living environment’ could be interpreted as necessitating NDEWE-resilient buildings and infrastructure, but this is not explicitly stated in the Law. In Vietnam, there are detailed building codes, produced by MOC, which include the resilience of high rise buildings to typhoons, but not specifically for flood-resilience. In principle, a primary objective of any building code is safety and protection of life; this explains why it is extremely important to ensure that each building code needs to be context-specific [35]. The DRR approach is to reduce the risks associated with physical development close to hazards [36]. Thus, structures situated in risky areas need to be designed and engineered to resist NDEWEs. Building codes in Vietnam - a country that is prone to storms and floods - have been inadequate in such fundamental principles. In practice, there remain challenges in implementing building codes to achieve the effective integration of DRR. A key

requirement for a building permit is the submission of a construction design. Nonetheless, upon the release of construction permit, MOC has limited capacity to carry out compliance inspections and to supervise and control construction sites effectively [20, 30] and non-conformity is commonplace. Based on the HFA report 2011-2013, the IFRCRCS [30] reveals that MOC has developed a number of NDEWE-resilient housing and building models, but there remains a need for adequate resources in order to enable their promotion and uptake. In the case of housing, this is often due to lack of awareness, or to the higher costs of appropriate materials and construction [37].

In Vietnam a number of flood-prone flat coastal areas, in which flood levels can rise rapidly up to several meters after heavy rains, have no higher ground for evacuation purposes: an ideal solution would be multi-storey buildings. According to IFRCRCS [30], apart from several public buildings identified in flood-prone areas in Dien Chau district of Nghe An province, most houses are single-storey, with multi-storey building uncommon. Although the dike system in the district accommodates a degree of protection, should the dikes collapse or become overflowed, floodwater could descend rapidly. This highlights the importance of higher building for residents to shelter in. The New DRM Law promotes legal requirements for this, but, although the obligation is understood, its enforcement has been weak. and there is little incentive to conform.

### 3.2. Land use planning

DRR encompasses a variety of measures, including land use planning provisions in support of identifying hazards and vulnerability, developing NDEWE mitigation plans that avoid disaster-prone areas by directing new houses, public buildings and infrastructure away from such areas, and relocating land uses and susceptible structures to less risky places [38]. Although a combination of approaches is needed for effective application of DRR, land use planning and management processes play a significantly important role in enabling communities to produce the optimal collection of disaster mitigation measures that are well-matched with their particular situation [36].

The Law on Land of 2013 [39] provides regulations on the use and management of land, whereby the public authority issues and registers land use rights to land users and private landowners. However, its implementation has remained problematic, with many examples, particularly in rural areas, where individuals have not received land use certificates. In Dien Ngoc and Dien Bich districts in Nghe An province, for example, numerous exemptions from land use certificates were given to families if the land had been used for generations [30]. Although this may be considered reasonable, it still represents a constraint in natural hazard planning and disaster management, as land use certificates are an important feature in post-disaster recovery programmes, and their absence can lead to delays in providing support for reconstructing damaged property.

In Article 33 [39], the Law indicates MONRE's responsibility to undertake and publish (every 5 years) surveys, measurement, drawing and management of land use status quo maps and land use planning maps of the entire country. Article 35 [39] lays down a number of principles in support of land use planning, such as compatibility with strategies, socio-economic development plans, defence and security; the economical and efficient use of land; and rational exploitation of natural resources and environmental protection. Articles 38, 39 and 40 introduce more detailed requirements concerning the content of land use plans at all levels, in that land will be reserved for construction, infrastructure, industrial development, urban and residential development, defence and security [39].

Thus, Vietnamese land legislation does not, in itself, present barriers for the implementation of DRR. Nonetheless, the New DRM Law does not explicitly mention the need to integrate DRR into land use planning, which, in turn has not yet been exploited for its potential to promote DRR. While concerns remain with the fact that urbanization in Vietnam will lead to the increased risk of local floods [20, 30], there are provinces (e.g. An Giang and Nghe An) where locally-made risk maps are applied as a solution to assist land use planning. Examples are province, where risk mapping is adopted for planning of infrastructure and identification of high flood risk areas.

## 4. Challenges to obtaining effective integration of disaster risk reduction in the built environment

The response to Strategy 2020 has been limited, and there exist a number of common issues that may influence the effectiveness of the laws and regulations, and the extent to which DRR will be integrated into development of the built environment. These include:

#### *4.1. Lack of capacity and coordination at the national level*

In reality, DRR is not implemented effectively in the built environment due to lack of capacity and human resources of the Government in general, and MOC in particular. There is a lack of awareness of NDEWE risks amongst the governmental bodies and their willingness to collaborate, while the CCFSC and CFSCs have yet to play a more active role in the coordination between ministries and between provinces for long-term prevention and mitigation. The lack of cooperation is further increased by the lack of effective involvement of construction stakeholders [40]. There is also an absence of legislation to stipulate responsibility and involvement for investors and construction enterprises.

#### *4.2. Gaps in legal framework and lack of guidance for implementation*

Despite observable progress, current regulatory frameworks on planning, design and construction do not adequately consider NDEWE impacts and resilience [10, 28] despite examples (in An Giang and Nghe An provinces) where initiatives have been made in support of designing NDEWE risk maps, resilience planning and construction guidelines at local levels [30]. However, these have not been mainstreamed into construction planning and approval process of the local governments [37], and the awareness of such potential instruments has remained relatively low across local level staff engaged in planning and construction.

#### *4.3. Lack of focus on cities and urbanization*

Strategy 2020 and existing legal frameworks, including the New DRM Law, do not promote DRR in urban development in an effective manner. There is rapid urbanization (reaching 56% by 2050 [20]), and yet, in cities, such as Hanoi and Ho Chi Minh most drainage systems, servicing infrastructure and protective structures are not sufficient to meet population demands. Additionally, many small and medium-sized cities at present do not have rational development plans and have complicated procedures for regulating urban development [10]. The causal factors encompass land acquisitions, ownership issues and relocation requirements.

#### *4.4. Complex institutional arrangements*

In Vietnam, a number of governmental bodies are accountable for the creation, operation and maintenance of the built environment. Integrating DRR thus requires involvement from different sectoral ministries, supported by the CCFSC and CFSCs. This presents a number of drawbacks, including role-ambiguity and responsibility-overlap, and lack of coordination and of political will and commitment. Processes that involve a large number of stakeholders are by their nature, inherently complicated and lengthy [41].

#### *4.5. Incompatibility of building codes and lack of enforcement*

The current building codes of Vietnam show little consideration of flood-resilient construction. The detailed authorised risk maps and scenarios required for building regulation that pertains to flood resilience are unavailable in Vietnam at present. Further, the application of building codes presents many difficulties for old structures. A large part of the old building stock and infrastructure, in many cities as well as rural areas, have been clearly designed without adequate consideration to the impacts of NDEWEs. Replacing these old buildings and at-risk infrastructure entails substantial funds. In the countryside and coastal areas there are many temporary buildings and temporary structures that are particularly susceptible to NDEWEs: relocating residents from these areas remains a great challenge. Additionally, Vietnam's building codes have conventionally been adapted from those of other countries, making their application unsuitable in the Vietnamese context [30].

#### *4.6. Lack of qualified human resources*

The MOC has inadequate capacity, lack of qualified people and limited awareness of the roles of construction actors, to deal with the booming construction sector in Vietnam and there is a need to proactively engage a broader

range of construction and non-construction stakeholders in DRR initiatives [31]. In Vietnam, very few professionals recognise or acknowledge DRR in their daily decision-making. This is, to some extent, related to the fact that the professional training of planners, architects and civil engineers does not yet consider DRR as a core competency.

#### 4.7. Inadequate understanding among the general public

In Vietnam, whilst the awareness about hazard's occurrence is relatively high, this does not translate into how people proactively prepare for NDEWEs. There is evidence that many people in rural areas take advantage of legal gaps and lack of enforcement to construct houses and buildings without compliance with approved designs. According to one developer "Until there is a legal requirement and a sufficiently strong enforcement, people are going to avoid it. Because economic is such, the budget is such that people will only do what they need to do. And even it might mean loss of life or loss of property in the future, it is all about today, and not necessarily tomorrow" [35]. Additionally, corruption and unlawful activities appear to be common in Vietnam's construction sector, leading to the compromising of safe living conditions by saving money; funds being diverted away from development programmes and their potential beneficiaries [3]; and the evasion of regulations and approval systems [32].

### 5. Conclusions and recommendations for future work

The Government of Vietnam, as witnessed by its commitment to the Hyogo Framework and the recent Sendai Framework, sees DRR as an integral element of national socio-economic development. Over a long period, the application of DRR in the country has been supported by the legal framework, which maintains details of institutional responsibilities, implementation methods and allocation of financial resources. Legislation has contributed to achievements in many different areas, including structural measures against NDEWEs, especially floods and storms.

Nonetheless, the progress of integrating DRR has been limited due to numerous shortcomings. The review of legislative documents and related literature has revealed that these challenges encompass: lack of capacity and coordination at the national level; gaps in legal framework and lack of guidance for implementation; complex institutional arrangements; incompatibility of building codes and lack of enforcement; lack of qualified human resources; and inadequate understanding among the general public.

For a more resilient built environment in Vietnam through effective application of DRR, it is essential to close gaps in the current legal framework, and to tackle the challenges identified above. The measures to overcome such challenges require adequate demonstration using the empirical evidence of further research. Importantly, as emphasized in the Sendai Framework and the Global Assessment Report on Disaster Risk Reduction 2015, these measures need to be implemented in a way that involves all built environment stakeholders in proactively integrating DRR activities and resilience considerations into their current practices.

### References

- [1] World Bank, Vietnam: Disaster Risk Management Project, 2013. Retrieved May 2nd, 2017, from <http://www.worldbank.org/en/results/2013/04/09/vietnam-disaster-risk-management-project>
- [2] D.T. Nguyen, T. Hiroshi, E. Miguel, Introduction: Coastal Disasters and Climate Change in Vietnam, *Engineering and Planning Perspectives*, 2014.
- [3] Give2Asia, Disaster Preparedness and Resilience: Vietnam, 2015. Retrieved May 2nd, 2017, from <http://www.give2asia.org/disaster-preparedness-and-resilience-myanmar-1-1/#Introduction>
- [4] L.S. Boshier, *Hazards and the built environment: Attaining built-in resilience*, Taylor and Francis, London, 2008.
- [5] J.A. Vanegas, Road map and principles for built environment sustainability, *Environmental Science and Technology*, 37 (23), 2003, pp. 5363-5372.
- [6] J.E. Anderson, G. Woldhurst, W. Lang, Energy analysis of the built environment – a review and outlook, *Renewable and Sustainable Energy Reviews*, 44, 2015, pp.149-158.
- [7] Tri Thuc Tre, Vietnam's economy suffers a loss of 5.2 billion USD per annum as a consequence of disasters, 2015. Retrieved May 5th, 2017, from <http://vietq.vn/kinh-te-viet-nam-thiet-hai-52-ty-usd-moi-nam-do-thien-tai-d57350.html>
- [8] A. Pham, Disasters caused 235 death cases and a total loss of 1.7 billion USD, 2016. Retrieved May 5th, 2017, from <http://m.tienphong.vn/xahoi/235-nguoi-chet-va-mat-tich-thiet-hai-17-ty-usd-do-thien-tai-1084897>



- [9] H.N. Tran, Water services and drainage system in urban and rural areas in context of climate change, National science report: Impacts of climate change on the built environment, Hanoi, 2011.
- [10] N. Ky, Improving disaster prevention and response measures in the transportation sector, 2016. Retrieved May 6th, 2017, from <http://www.baogiaothong.vn/nganh-gtvt-day-manh-phong-chong-thien-tai-d161163.html>
- [11] L.S. Boshier, A.R.J. Dainty, Disaster risk reduction and ‘built-in’ resilience: Towards overarching principles for construction practice, *Disasters*, 35(1), 2011, pp.1 – 18.
- [12] C. Benson, J. Twigg, J. Tools for mainstreaming disaster risk reduction: Guidance notes for development organisations, International Federation of the Red Cross and Red Crescent Societies/The ProVention Consortium, Geneva, 2007.
- [13] ISDR, Local Governments and Disaster Risk Reduction: Good Practices and Lessons Learned, United Nations Secretariat to the International Strategy for Disaster Reduction (ISDR), Geneva, Switzerland, 2010, 86pp.
- [14] N. Allan, An analysis of water resources management in Hanoi, School of Global Studies and Planning, RMIT University, Melbourne, 2007.
- [15] S. Geertman, The self-organizing city in Vietnam: Processes of change and transformation in housing in Hanoi, Bouwstenen Publicatieburo, Eindhoven, 2007.
- [16] GOV, RCC 5 Report, Fifth Meeting of the ADPC Regional Consultative Committee on Disaster Management, 2005.
- [17] GOV, Ordinance No. O9-L/CTN on Prevention and Control of Floods and Storms, 1993.
- [18] GOV, Decree No. 32-CP of the Government Providing Details for the Implementation of the Ordinance on the Prevention and Control of Floods and Storms, 1996.
- [19] GOV, Decision No. 299-TTg of the Prime Minister on the Establishment of the Central Committee for the Prevention and Control of Floods and Storms, 1996.
- [20] H. Nguyen, P. Tran, Urban Disaster Risk Reduction in Vietnam: Gaps, Challenges, and Approaches. In *Urban Disasters and Resilience in Asia*, 2016, pp.123–140.
- [21] R.B. Olshansky, L.A. Johnson, J. Horne, B. Nee, Longer view: planning for the rebuilding of New Orleans, *Journal of the American Planning Association*, 74 (3), 2008, pp.273-287.
- [22] D. Godschalk, Urban hazard mitigation: creating resilient cities, *Natural Hazards Review*, 4 (3), 2003, pp.136-143.
- [23] IPCC, Summary for policymakers, in: C.B. Field, V. Barros, T.F. Stocker, D. Qin, D.J. Dokken, K.L. Ebi, M.D. Mastrandrea, K.J. Mach, G.K. Plattner, S.K. Allen, M. Tignor, P.M. Midgley (Eds), *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation - A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change*, Cambridge University Press, Cambridge and New York, 2012, pp.3-21.
- [24] J. Donovan, *Designing to Heal*, CSIRO, Melbourne, 2013.
- [25] D. King, Y. Gurtner, A. Firdaus, S. Harwood, A. Cottrell, Land use planning for disaster risk reduction and climate change adaptation: Operationalizing policy and legislation at local levels, *International Journal of Disaster Resilience in the Built Environment*, 7 (2), 2016, pp.158-172.
- [26] GOV, PM’s Decision No. 173/2007/QĐ-TTg to Approve the National Strategy for Natural Disaster Prevention and Mitigation to 2020, 2007.
- [27] MARD, National Strategy for Natural Disaster Prevention and Mitigation to 2020, 2008.
- [28] T.A. Tran, *Developing disaster resilient housing in Vietnam: Challenges and solutions*, Springer International Publishing, Switzerland, 2016.
- [29] GOV, Law on Natural Disaster Prevention and Control (No. 33/2013/QH13), 2013.
- [30] IFRCRCS, Viet Nam: Country Case Study Report. International Federation of Red Cross and Red Crescent Societies, 2014.
- [31] L.S. Boshier, ‘Built-in resilience’ through disaster risk reduction: operational issues, *Building Resilience Infrastructure*, 42 (2), 2014, pp.240–254
- [32] T.D. Nguyen, T.K.T. Tran, Designing optimization model to decision making on natural disaster mitigation investment in Vietnam. *Khoa Hoc Ky Thuat Thuy Loi va Moi Truong*, 53(6), 2016.
- [33] D. King, Reducing hazard vulnerability through local government engagement and action, *Natural Hazards*. 47 (3), 2008, pp.497-508.
- [34] GOV, Law on Construction (No. 50/2014/QH13), 2014
- [35] K. Chmutina, L.S. Boshier, Disaster risk reduction or disaster risk production: the role of building regulations in mainstreaming DRR, *International journal of disaster risk reduction*, 13, 2015, pp.10-19.
- [36] B.C. Glavovic, *The role of land-use planning in disaster risk reduction: An introduction to perspectives from Australasia*, 2010.
- [37] Tri Thuc va Phat Trien, Climate change: Challenges to be overcome, 2015. Retrieved May 13th, 2017, from <http://www.vusta.vn/vi/news/Thong-tin-Su-kien-Thanh-tuu-KH-CN/Bien-doi-khi-hau-Nhieu-thach-thuc-phai-vuot-qua-59135.html>
- [38] A.J. Schwab, K. Eschelbach, D.J. Brower, *Hazard mitigation and preparedness: Building resilient communities*, Hoboken, Wiley, NJ, 2007.
- [39] GOV, Law on Land (No. 45/2013/QH13), 2013.
- [40] K. Chmutina, L.S. Boshier, Construction in Barbados: keeping natural hazards in mind, *Disaster Prevention Management*, 23 (2), 2014, pp.175 – 196.
- [41] C. Malalgoda, D. Amaratunga, R. Haigh, Challenges in creating a disaster resilient built environment, *Procedia Economics and Finance*, 18, 2014, 736-744.