International Journal of Disaster Risk Reduction 8 (2014) 32–49

Contents lists available at ScienceDirect

International Journal of Disaster Risk Reduction

journal homepage: www.elsevier.com/locate/ijdrr

The socioeconomic vulnerability index: A pragmatic approach for assessing climate change led risks–A case study in the south-western coastal Bangladesh

Md. Nasif Ahsan [a,*], Jeroen Warner [b]

[a] Economics Discipline, Khulna University-9208, Bangladesh
[b] Disaster Studies Group, Wageningen University, The Netherlands

ARTICLE INFO

Article history:
Received 7 April 2013
Received in revised form
17 December 2013
Accepted 20 December 2013
Available online 2 January 2014

Keywords:
Vulnerability
Index
Climate change
Domain
Coastal area
Contributing indicator
Bangladesh

ABSTRACT

We develop a Socioeconomic Vulnerability Index (SeVI) for climate change affected communities in seven unions[1] of *Koyra* upazilla[2] in south-western coastal Bangladesh. We survey 60 households from each union to collect data on various vulnerability domains and socioeconomic indicators. The SeVI aggregate these collected data using a composite indicator index, where a relative weight is assigned to each indicator with a view of obtaining weighted average index scores for different vulnerability domains in different unions. Results suggest that southern and south-eastern unions are relatively more vulnerable, which are the most exposed to natural hazards and mostly surrounded by the mangrove forest *Sundarbans*. Furthermore, social, economic and disaster frequency are found as more influential indicators to adaptive capacity, sensitivity and exposure respectively in *Koyra*. This pragmatic approach is useful to figure out and monitor socioeconomic vulnerability and/or assess potential adaptation-policy effectiveness in data scarce regions by incorporating scenarios into the SeVI for baseline comparison.

1. Background

Over the last few years, the importance of vulnerability and adaptive capacity has been frequently cited in explaining the societal aspects of climate change [1]. Therefore, development of vulnerability research and consequent adaptation policy has become top priority [2]. Various climate change assessment studies explore the vulnerability status for the poor whose livelihood is natural resource dependent [3], which often leads to socioeconomic discrimination in the society [4,5]. However, some scholars opined that effects of environmental change might have catalysed the latent adaptive capacity of rural communities [6,7]. Therefore, policies addressing climate change adaptation put focus on coping capacity in convergence of increasing climatic catastrophes [8].

Since vulnerability possesses the site-specificity, many scholars urge for more local-level analyses for grabbing a better understanding of fundamental features underlying vulnerability along with appropriate targeting of adaptation policies for concerned agencies at local, national and international premises [9–11]. Vincent [12] and Hinkel [2] opined for development of vulnerability or adaptive capacity indices for narrowly defined systems where both deductive and inductive approaches could be endorsed for selecting and aggregating main variables. To show society-nature nexus while dealing with vulnerability, an inductive approach is preferred as it can be devised to suggest effective adaptive options for rural marginal poor [13–17]. For assessing vulnerability, Ostrom [18] and Wisner [19] also urged for an inductive approach where adaptive capacity and flexible governance structure were suggested to include.

* Corresponding author. Tel.: +880 19 1406 6224.
E-mail addresses: nasif.ahsan@yahoo.com, nasif.ahsan@econ.ku.ac.bd (Md. N. Ahsan).

[1] Lowest tier of Local Government in Bangladesh.
[2] Sub-district.

2212-4209/$ - see front matter © 2013 Elsevier Ltd. All rights reserved.
http://dx.doi.org/10.1016/j.ijdrr.2013.12.009

Starting from the fourth assessment report of the Intergovernmental Panel on Climate Change (IPCC), there have been a good number of research endeavours targeting the vulnerability assessment and adaptive capacity of communities through the development of indices [20–24]. These studies are conducted at various spatial levels having main objectives as quantifying climate-change impacts and revealing who adapts, why and how. However, all these studies have encountered conceptual as well as data-related problems while selecting and aggregating concerned variables in respective indices.

Generally, an index deals with the aggregation of a series of observable contributing variables into a scalar variable [2]. Hence, the main aim of a vulnerability index is making a theoretical concept operational. Since vulnerability is a multidimensional phenomenon, the index generally consists of several subcomponents that aggregate the contributing variables [9]. Constructions of such index distinguish between two major ontological approaches: data-driven and theory-driven approaches [12]. The former approach deductively applies expert judgment and correlates with previous disaster records for the selection and aggregation of contributing indicators [25,26]. Whereas the latter approach applies insights from the literature to select and aggregate contributing indicators [12,27]. The weakness of the former approach revolves around the limited objectivity of experts and assessment of contributing indicators against a benchmark of vulnerability. For latter approach, the weakness is about the normative selection of contributing indicators those may be associated with uncertainty [9]. Considering the said limitations, a third group of scholars adopts both empirical and theoretical aspects to select and aggregate the contributing indicators for concerned index. Table 1 shows pros and cons of some of the recently developed vulnerability indices addressing different set of parameters, where a good number of indices encountered the question of weighing the contributing (sub)components. Furthermore, the conceptual work on vulnerability and its related theme has not resolved the methodological and terminological confusion until recently [2]. At the same time vulnerability conceptualisations are competing and vulnerability is place- and context- specific [33]. Therefore, developing a more focused vulnerability index, especially for coastal area, the IPCC Vulnerability Framework [34] and Coastal Specificities Framework [35] in terms of exposure, sensitivity and adaptive capacity [36] can be recommended. It is because such an index obtains aggregated as well as individual scores of various vulnerability dimensions at spatial context; and prescribes appropriate adaptation and coping options for coastal communities [37].

Considering the above-mentioned facets, in this study we propose an index-based vulnerability measurement which differs from previous methods since we explore vulnerability with a weighted quantitative assessment of observed events. Hence, the aim of this study is- to develop a Socioeconomic Vulnerability Index (SeVI) for coastal communities in Bangladesh, to assess the relative magnitude of domains (types) of vulnerability in different locations of study region and finally to assess the relative magnitude of contributing indicators within concerned vulnerability-dimension. Like some previous studies, we also adopt relative weight (Likert scale proposed by Wyatt and Meyers [38]) for our proposed vulnerability index. However, unlike those studies, we assign weight to each contributing indicator rather than to any of the domain/dimension as a whole. We assign weight to concerned indicators by utilising knowledge-base of local experts and scholars with an emphasis on inductive approach. Previous studies carried out on coastal Bangladesh mainly focused on hazard warning and evacuation system [39], health security due to disaster [40], physical injuries during cyclones [41]; and coastal hazards and community-coping method [42]. Thus, most of these studies dealt with the coastal coping and adaptation mechanisms. However, we hardly find any study that focused on index-based socioeconomic vulnerability measurement through any weighted index, especially in the South-western coastal Bangladesh. Therefore, applying the proposed methodological framework of determining socioeconomic vulnerability, we intend to bridge the gap between community necessity and priority at the micro level and policy variable at the meso level.

To realise the study objectives, we introduce theoretical framework in Section 2, study method including description of the study region and development of the socioeconomic vulnerability index in Section 3. The results are explored in Section 4 along with relevant discussions and usefulness of SeVI, and finally, we make concluding remarks in Section 5.

2. Theoretical conceptualisation

A comprehensive and varied theoretical-support exists on the vulnerability concept [43–52]. IPCC explores vulnerability through three core concepts: firstly, 'exposure magnitude' to which a system is physically in harm's way; secondly, 'sensitivity' of a system i.e. its likelihood to be affected by a shock; and thirdly, the 'adaptive capacity' of a system to cope or adjust with the negative impacts of a shock [53–55]. Again Adger [56] defines 'vulnerability' as exposure of a group or individual stress due to social and environmental change that disrupts livelihoods. He also defines *'Social Vulnerability'* as exposure of individual or group stress from exogenous risks, especially from climatic shocks [13,57]. For such shocks, Ibarraran et al. [58] shows that concerned community's vulnerability depends on its resilience capacity. This capacity of individual and social groups, during responding towards any external shocks is likely to affect their livelihood [59,60].

Since vulnerability is driven by a number of factors, Adger and Vincent [61] suggested a context-specific method for assessing and measuring vulnerability. Sustainable livelihood framework in terms of 'capital asset' is also suggested for measuring vulnerability [62–65]. A distinctive feature of vulnerability measuring concept is the level or scale of analysis which ends with an index construction. Variation in social and economic vulnerability to environmental risk, for instance, can be explained at individual household or community level. Sometimes biophysical indicators are incorporated in vulnerability index [32]. Such index is, furthermore, enriched by incorporating location, settlement pattern and land-use management [66].