Resilience of traditional societies in facing natural hazards

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Abstract

Purpose – This article sets out to address the response of traditional societies in facing natural hazards through the lens of the concept of resilience.

Design/methodology/approach – This paper considers that resilient societies are those able to overcome the damage caused by the occurrence of natural hazards, either through maintaining their pre-disaster social fabric, or through accepting marginal or larger change in order to survive. The discussion is based on a review of the corpus of case studies available in the literature.

Findings – The present article suggests that the capacity of resilience of traditional societies and the concurrent degree of cultural change rely on four factors, namely: the nature of the hazard, the pre-disaster socio-cultural context and capacity of resilience of the community, the geographical setting, and the rehabilitation policy set up by the authorities. These factors significantly vary in time and space, from one disaster to another.

Practical implications – It is important to perceive local variations of the foregoing factors to better anticipate the capability of traditional societies to overcome the damage caused by the occurrence of natural hazards and therefore predict eventual cultural change.

Originality/value – This article takes off from the previous vulnerability-driven literature by emphasizing the resilience of traditional societies.

Keywords Natural disasters, Culture, Change management, Changing society

Paper type General review

Natural hazards are those natural phenomena that pose a threat to people, structures and economic assets. Natural hazards include earthquakes, volcanic eruptions, landslides, tsunamis, storms and cyclones, droughts, floods and storm surges among others. The response capacity of people in the face of natural hazards is driven by the concepts of vulnerability and resilience.

Early definitions of vulnerability mostly referred to the quantitative degree of potential loss in the event of the occurrence of a natural hazard. The concept eventually evolved to encompass the wider social context in what is commonly called "social vulnerability". Social vulnerability may be defined as the propensity of a society to suffer from damages in the event of the occurrence of a given hazard. Vulnerability thus stresses the condition of a society which makes it possible for a hazard to become a disaster (Cannon, 1994, p. 13). It basically depends on a large array of factors which interact in systemic and causal directions (Watts and Bohle, 1993; Wisner *et al.*, 2004). These factors are demographic, social, cultural, economic and political in nature. It is further important to recognize that vulnerability reflects the daily conditions of society

(McKnight, 1977; Wisner, 1993). Disasters are therefore viewed as the extension of everyday hardships wherein the victims are marginalized in three ways: geographically because they live in marginal hazard-prone areas, socially because they are poor, and politically because their voice is disregarded (Wisner *et al.*, 2004). Vulnerability further varies according to the nature of the hazard (Wisner, 2004).

Peoples' capability of response in the face of natural hazards also relies on their capacity of resilience. This concept spread widely in the disaster literature in the 1990s and is still the object of a conceptual debate around its sense and application among social scientists (e.g. Klein *et al.*, 2003). Pelling (2003, p. 48) views resilience as a component of vulnerability or the ability of an actor to cope with or adapt to hazard stress. In this regard, it basically includes the planned preparation and the spontaneous or premeditated adjustments undertaken in the face of natural hazards. Other scholars (Folke *et al.*, 2002, p. 13) coin resilience as the "flip" – positive – side of vulnerability or the capacity to resist from damage and change in the event of the occurrence of a natural hazard. A third approach breaks away from the previous two to define resilience as the capacity of a system to absorb and recover from the occurrence of a hazardous event (Timmermann, 1981, p. 21). Dovers and Handmer (1992, p. 270) further distinguish three levels of societal resilience and differentiate:

(1) resilience through resistance to change;
(2) resilience through incremental change at the margins; and
(3) resilience through openness and adaptability.

The United Nations International Strategy for Disaster Reduction recently took over this differentiation in its definition of resilience as:

> [...] the capacity of a system, community or society to resist or change in order that it may obtain an acceptable level of functioning and structure.

Following the same approach, Walker *et al.* (2004) differentiate four crucial aspects of resilience. The first aspect is the latitude or the maximum amount by which a system can be changed before losing its ability to recover. The next dimension is the resistance or the ease or difficulty of changing the system. The precariousness or how close the current state of the system is to a limit or "threshold" is also of importance. The final aspect is the panarchy or the cross-scale interactions and influences from states and dynamics at scales above and below.

Resilience differs from vulnerability by addressing the capability and the ways people deal with crises and disasters. On the other hand, vulnerability only encompasses the susceptibility of individuals to suffer from damage and thus to transform the occurrence of a natural hazard into a disaster. Both concepts may rely on the same factors (demographic, social, cultural, economic, political, etc.) which may however vary on different scales. Resilient societies are able to overcome the damages brought by the occurrence of natural hazards, either through maintaining their pre-disaster social fabric, or through accepting marginal or larger change in order to survive. The concept of resilience is thus intimately linked to the concept of change. Post-disaster changes within the impacted society may be technological, economic, behavioral, social or cultural in nature. The latitude and resistance to change greatly depend on the type of society affected by the disaster. The following paragraphs explore the case of traditional societies.

Traditional societies in the face of natural hazards

Traditional societies, sometimes called folk, tribal, or primitive societies, are those groups characterized by their pre-industrial self-sufficient ways of either hunting/gathering or extensive agriculture. These societies are further identified by the intimate relationship they nurture with their immediate natural environment and the slow level of cultural change they usually experience (Kottak, 2003).

Many researchers have addressed the capacity of industrial societies to overcome the havoc wrought by the occurrence of natural hazards with more or less change in the social fabric (see Bates and Peacock, 1987; Drabek, 1986; Nigg and Tierney, 1993 and Passerini, 2000 for syntheses). Fewer scholars discussed the capability of traditional societies to cope with natural hazards. A review of the scarce literature further denotes a lack of consensus among social scientists. Three different theoretical frameworks may be distinguished from the available corpus of research materials (Figure 1).

The first and dominant framework regards traditional environment-dependent societies as fragile and unable to cope on their own with large-scale fast-onset natural hazards. Destruction of the environment due to extreme natural phenomena deprives these societies of their main resources and pushes them to rely on external resources in order to recover. Natural hazards are therefore viewed as a powerful vector of socio-cultural change (Burton, 1972; Burton *et al.*, 1993; Dynes, 1976; Kates, 1971; Kates *et al.*, 1973; Mileti *et al.*, 1975). Such an argument largely emanates from the "top-down" technocratic and western logic characterizing the dominant paradigm in the hazard and disaster literature. The proponents of this approach find justification for promoting a transfer of experience, knowledge and technology from industrialized countries to developing nations in the poor capacity of traditional societies to respond to natural hazards.
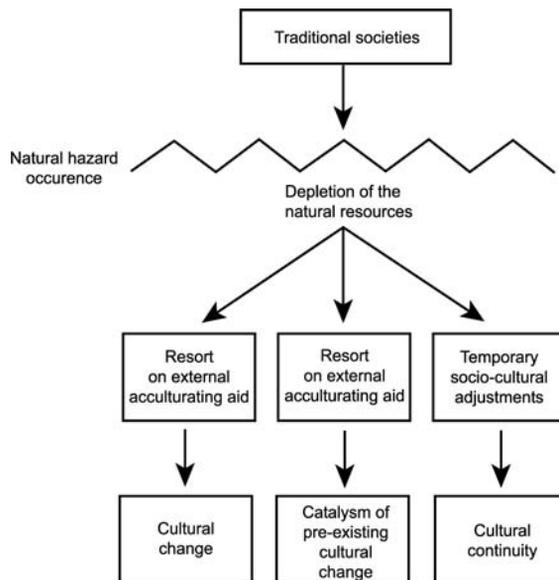

Figure 1.
The different theoretical frameworks regarding the response of traditional societies in facing natural hazards

On the other hand, the second theoretical framework sees traditional societies as capable to recover on their own from the impact of natural phenomena. The environmental modifications resulting from the occurrence of natural hazards forced these societies to make slight adjustments without modifying the fundamentals of their social organization (Holland and VanArsdale, 1986; Sjoberg, 1962; Torry, 1978a, 1979). This framework emerged from the growing anthropological literature on hazards and disasters during the 1960s and 1970s (see Torry, 1979 and Oliver-Smith, 1996 for syntheses). The arguments of this approach have greatly contributed to challenging the aforementioned dominant and technocratic paradigm on disaster management by pointing out the perverse effects of emergency measures and other technological adjustments set up by western governments. For the proponents of this approach, if there is a temporary incapacity of traditional societies to overcome the consequences of natural hazards occurrence, it is due to the foreign relief aid that disrupts indigenous resilience systems rather than to the intrinsic incapability of affected societies (Cijffers, 1987; Newton, 1995; Torry, 1978b; Waddell, 1974, 1983).

Finally, the third approach regarding the responses of traditional societies in the face of natural hazards defends an intermediate viewpoint. It argues that the occurrence of natural hazards rather acts as a catalyst for ongoing cultural changes among traditional societies increasingly pressured by the industrial world (Bates and Peacock, 1987; Blong, 1984; Oliver-Smith, 1996).

The foregoing frameworks are all driven primarily by the concept of vulnerability or the susceptibility of traditional societies to experience disaster following the occurrence of natural hazards. They do not address cultural change as a way of coping with the havoc wrought by the disaster. In this paper, we aim to tackle the capacity of response of traditional societies in the face of natural hazard through the lens of the concept of resilience. Our discussion will be based on the small set of case studies available in the literature. To assess traditional societies' resilience will first require evaluating if the occurrence natural hazards brought about some changes in folk cultures. A critical review of the factors that affected resilience in the said case studies will eventually lead to suggest an alternative approach of the response of traditional societies in the face of the occurrence of natural hazards.

The corpus of available case studies

There is only a small set of detailed case studies on the response of traditional societies in the face of the occurrence of natural hazards available in the disaster literature. The forthcoming sections will focus on 12 major cases.

Case 1: The Tarascan Indians and the Paricutín volcano eruption in Mexico – 1943-1952

From 1943 to 1952, the *Tarascan* communities of Central Mexico were affected by the birth of a volcano, eventually named Paricutín, in their corn field (Nolan, 1972, 1979; Nolan and Nolan, 1993). In 1944, the very traditional and rural village of Paricutín was totally destroyed by the eruption of the eponym volcano. The *Tarascan* Indians of Paricutín were eventually resettled 20 kilometres away from their native village near an urban centre whose dominant population was not Tarascan. Thirty years after the disaster, Tarascan traditions and social organization have been deeply eroded by regular interactions with surrounding ethnic groups and the land speculation that

followed the eruption. The formerly homogenous community has progressively adopted a system of social stratification unknown to the Tarascan culture. On the other hand, the neighbouring village of Angahuan, only partially destroyed by the eruption, has not been totally abandoned and a couple of territorial markers have survived (*Tarascan* language, dress, and housing). However, tourism activities and associated land speculation that occurred following the eruption connected the former isolated community with the outside world. As a consequence, a large number of Angahuan inhabitants gradually became farm employees under the management of land buyers, thus abandoning their traditional land ownership statute (Table I). In other surrounding villages like Zacan, Zirosto and San Juan Parangaricutiro, the eruption of the volcano rather accelerated the process of cultural change which had already been going on for years as part of a programme of modernization of the Mexican Nation. The catalytic process has been facilitated by the resettlement of victims and governmental support programmes, the development of tourism and out-migrations toward Mexican or American urban centres, as an alternative to temporary infertile lands (Nolan, 1972, 1979; Nolan and Nolan, 1993; Rees, 1970).

Case 2: The people of Niuafo'ou in Tonga in facing the island volcano's eruption in 1946
In 1946, the people of Niuafo'ou, in the Tonga archipelago, had to evacuate their tiny island due to the restless activity of the local volcano (Rogers, 1981). After an erratic journey that led them to the neighbouring islands of Nukualofa, and then Eua, the victims were successful in re-establishing their community on Eua with respect to their ethnic traditions. The main Niuafo'ou territorial landmarks (churches, schools, stores) were conscientiously rebuilt despite the initial hostility and cultural antagonism with the Euans (Table I). In 1958, some victims were eventually permitted to go back to their native island where they quickly rebuilt their villages abandoned for more than a decade.

Case 3: The 1951 eruption of Mt Lamington, Papua New Guinea, and the Sangara, Sasembata and Orokaivan people
One of the most studied cases is most probably the 1951 eruption of Mt Lamington in Papua New Guinea. Belshaw (1951), Keesing (1952), Ingleby (1966) and Schwimmer (1969, 1977) have documented deep social and cultural changes among the *Sangara*, *Sasembata* and *Orokaivan* ethnic groups that inhabit the flanks of Mt Lamington. The hardest hit were probably the Orokaivans who had to leave their ancestral lands on the slopes of the volcano and, henceforth, a number of traditional rites attached to these lands fell into abeyance. Eventually, the Orokaivans had to cope with the increasing pressure exerted on their land by neighbouring groups. This situation pressed them to accept sole tenure and to cultivate unfamiliar cash crops, thus, deeply modifying their social organization. In this precise case, post-disaster changes thus concerned cultural, social and economic as well as demographic fundamentals of the community marked by a high mortality rates among elderly (Table I).

Case 4: Ambrymese people's response to Mt Benbow 1950-1951 eruption in the New Hebrides
Tonkinson (1968, 1977, 1985) described the resettlement and adaptation of the Ambrymese people of Maat on the neighboring island of Efate following heavy and

Study cases	Kind of hazard	Year	Kind of change	Extent of change	Duration of change	References
Tarascan Indians, Mexico	Volcanic eruption	1943-1952	Social organization, economic activities, traditions	Large/incremental	Long-term	Nolan (1979)
Niuafo'ou people, Tonga	Volcanic eruption	1946	No	NA	NA	Rogers (1981)
Mt Lamington Sangara, Sasembata and Orokaivan, PNG	Volcanic eruption	1951	Demography, social organization, land tenure, economic activities, rituals	Large	Long-term	Belshaw (1951); Keesing (1952); Ingleby (1966); Schwimmer (1969, 1977)
Ambrymese people of Maat	Volcanic eruption	1950-1951	Relocation but no change	NA	NA	Tonkinson (1968, 1977, 1985)
Tikopia people, Solomon	Typhoons	1952-1953	Agricultural practices, rituals	Adjustment	Short-term	Spillius (1957)
Tristan da Cunha people	Volcanic eruption	1961	Housing, clothing, economic activities, habits	Large	Middle/long-term	Blair (1964); Munch (1964, 1970)
Koniag people, Alaska	Earthquake and tsunami	1964	Housing, facilities, political awareness, identity, dependence on governmental services	Large/incremental	Long-term	Davis (1986)
Nila people, Indonesia	Volcanic eruption	1968	Diet, economic activities, habits, traditions	Large	Long-term	Pannell (1999)
Quechua Indians of Yungai, Peru	Earthquake/debris avalanche	1970	No	NA	NA	Oliver-Smith (1992)
Guatemalan Mayan	Earthquake	1976	Housing, economic activities	Medium	Long-term	Cuny (1983); Bates (1982); Hoover and Bates (1985)
Mt Pinatubo Aetas, Philippines	Volcanic eruption	1991	Settlement, religion, language, medicine, diet, clothing, land tenure, economic activities	Large/incremental	Long-term	Gaillard (2006); Seitz (2004)
Rabaul Tolais, PNG	Volcanic eruption	1994	Social organization, religion, economic activities	Large	Long-term	To Waninara (2000)

Table I.
Post-disaster cultural change among sample traditional societies as highlighted in the relevant literature

consistent ashfalls between 1950 and 1951. The relocation scheme was organized by a coconut planter from Efate who offered to Maat village leaders land and building materials if they would accept to work exclusively in his plantation. The proposal was unanimously approved by the victims who re-established their community on Efate in respect of their traditions and in a roughly similar environment without encroaching on the territory of other ethnic groups. They further maintained sparse regular contacts with their homeland but refused to go back to Ambrym in 1954 when coconut palms were again bearing. Maat people relocated on Efate thus enjoyed a total freedom of choice all along the resettlement process and managed to retain their pattern of social relationships and kinship system.

Case 5: The people of Tikopia in the Solomon archipelago in the face of successive typhoons in 1952 and 1953

Between 1952 and 1953, the small island of Tikopia, in the Solomon archipelago, was devastated by two typhoons and a subsequent famine (Boehm, 1996; Spillius, 1957; Torry, 1978a). Following the destruction of most of the resources of the island, the inhabitants of Tikopia had to make certain adjustments in their traditional way of life to meet their daily needs. The main measures adopted include the temporary abandonment of fallow periods, the redefinition of agricultural rights, stricter crime and thief repression, the omission or abbreviation of agricultural rites of lesser importance, the adjournment of wedding ceremonies, and a reduction in size and eventually diminution in the number of mortuary contributions (Table I). All these adjustments have been agreed upon by the whole community during daily public assemblies.

Case 6: The inhabitants of Tristan da Cunha versus the island volcano eruption in 1961

In 1961-1962, the island of Tristan da Cunha, a small British dominion in the Southern Atlantic, was affected by the eruption of the local volcano (Blair, 1964; Lewis *et al.*, 1972; Munch, 1964, 1970). Evacuated in far-away England, the victims had to abandon their traditional nineteenth-century way of life and adjust to an acculturating urban way of life. The inhabitants of Tristan da Cunha struggled to cope with an unfamiliar lifestyle, which included housing rental, industrial and service jobs, punctuality, modern transport modes, and administrative procedures. Overall, changes following the disaster pertained to culture, society and economy (Table I). Between 1962 and 1963, 264 people out of 278 evacuees managed to come back to Tristan da Cunha and imported those changes in their culture.

Case 7: The 1964 Alaskan earthquake and tsunami and their impact on Koniag communities

On 27 March 1964, a 8.4-magnitude earthquake hit the southwestern coast of Alaska and triggered a devastating tsunami that befelled several native Koniag communities. Davis (1971, 1986) described the US government-sponsored resettlement of Kaguyak and Old Harbor victims. Old Harbor people were resettled at their original site while Kaguyak survivors were relocated at Old Harbor. Both communities eventually suffered from adjustment problems inside their new homes and underwent technical and material changes (especially housing and community facilities) brought by increasing links with the outside world. However, the Koniag social structure was

slightly altered and only attitudinal modifications were noticed. An increase political awareness of the state and nation, an enhanced sense of ethnic identity, a greater knowledge of the availability of social services and an increased dependence on governmental services are the major changes produced by the rehabilitation program.

Case 8: The people of Nila in the Maluku archipelago following the awakening of the local volcano in 1968

Pannell (1999) has documented significant social, cultural and economic changes among the inhabitants of tiny island of Nila in the Maluku archipelago in Indonesia, relocated at the midst of Semar island following the eruption of their volcano in 1968. Subsequent regular contacts with a large number of Sulawesi migrants in the surroundings pressed the people of Nila to evolve from a maritime society to a land society where eating fish is a luxury, and boat making and navigation only a memory (Table I).

Case 9: The 1970 Huascaram debris avalanche and the people of Yungay, Peru

Oliver-Smith (1977, 1979a, b, c, 1992) has vividly described the movement of resistance of the Indians of the town of Yungay, in the eponym province, when faced with the relocation program set up by the government of Lima after the earthquake that struck Peru in 1970 (Table I). Following the total destruction of the town by a debris avalanche triggered by the earthquake, the Peruvian government indeed tried to resettle the victims around 15 km away from their place of origin. But to maintain the links that ancestrally linked them to their territory, the inhabitants of Yungay decided to rebuild their town by themselves in the immediate vicinity of the ruins of their former dwellings.

Case 10: The 1976 Guatemalan earthquake and the Mayas

A series of studies (Bates, 1982; Bates and Peacock, 1987; Cuny, 1983; Hoover and Bates, 1985) have addressed the impact of the 1976 Guatemalan earthquake among Mayan uplanders. Among these communities, damage was particularly severe for traditional infrastructures and housing made of adobe. The reconstruction task was partly led by international non-governmental organizations which introduced aseismic materials and used foreign patterns of construction less dangerous in the event of an earthquake. Besides, the financial aid poured into the affected areas following the disaster led to a sharp increase in the number and variety of small-scale business establishments which was accompanied by a growing complexity of commercial exchanges (Table I).

Case 11: The 1991 Mt Pinatubo eruption and the Aetas of the Philippines

In 1991, the brutal awakening of Mt Pinatubo volcano, in the Philippines, hit the *Aeta* Negrito communities who previously resided on the slopes of the mountain (Gaillard, 2006; Gaillard and Leone, 2000; Seitz, 1998, 2000, 2004; Shimizu, 1992, 2001). The thick and hot pyroclastic and ash deposits blanketing the highest flanks of the volcano prevented the upland Aetas going back to their ancestral lands and forced them to relocate on the foothills of Mt Pinatubo, which were already occupied by lowland ethnic groups. This caused increasing and intense economic, social and political interactions that led the uphill Aetas to integrate foreign socio-economic and cultural

elements, including: settlement pattern; religion; language; medicinal treatments, clothing; diet; land tenure and farming activities (Table I). On the other hand, the Aetas of the foothills of the volcano were already long living in close contacts with lowland groups and American servicemen on duty at the neighbouring Clark Air Base. By further increasing the social, economic and political dependency of those Aetas toward the lowland people, the eruption accelerated the diffusion of Western socio-economic references already widespread before the catastrophe.

Case 12: The Tolais of Papua New Guinea in facing Mt Rabaul eruption in 1994
The 1994 eruption of Mt Rabaul in Papua New Guinea severely impacted the *Tolai* traditional communities living on the volcano (To Waninara, 2000). Relocated several tens of kilometres away from their native villages, Tolai communities had to deal with the depletion of Tambu (traditional shell money with commercial and ritual values used to evaluate wealth) habitually accumulated from agricultural harvests on the slopes of the mountain. The lack of Tambu progressively resulted in the abandonment of the Tolai's traditional leadership system based on the accumulation of this shell money. Post-disaster changes chiefly affected culture, society and economy of the Tolais (Table I).

The works referred in these case studies differed in their objectives and in the methodology used. Furthermore, some researches occurred immediately after the disaster while others took place much later. Despite these evident biases in the level of analysis, the available corpus of case studies may serve as basis for the assessment of the capacity of resilience of traditional societies in the face of natural hazards.

Traditional societies' resilience in the face of natural hazards

Based on the foregoing case studies, most but not all traditional societies turned to changes in their of way of life to cope and recover from the damage brought by the occurrence of natural hazards. Those changes may be small or large and punctual or long-lasting (Table I). The people of Tikopia turned to short-term changes in their lifestyle to be able to reduce consumption of resources and cope with food shortage. On the other hand, the communities living on the flanks of Mt Lamington turned to long-lasting changes in their culture to deal with new environmental and socio-economic contexts. The importance of scaling changes in time has been tackled by Hoffman (1999) and Torrence (2002, 2003a, b) who further mentioned that socio-cultural changes viewed as major transformations a few months, years or even decades after a disaster may, on the other hand, be seen as slight adjustments in the longer run. Those changes in traditional society following disasters brought by natural phenomena should not be seen as the mere consequence of high vulnerability. It should rather be considered as part of the resilience process. Indeed, in all the case studies, cultural change is a way of coping with the changing environmental, social, economic and political environment brought by the disaster. Contextual changes may be short-term, long-term or definitive and imply adapted cultural change in the society. Therefore, if resilient societies are those that are able to overcome the damages brought by the occurrence of natural hazards, either through maintaining their pre-disaster social fabric, or through accepting marginal or larger change in order to survive, then traditional societies are resilient.

The extent and duration of changes undergone by traditional societies to recover from disasters reflect the different latitudes, resistances and states of precariousness of traditional systems. The case of the Mt Pinatubo Aetas in facing the huge eruption of their volcano in 1991 is significant. Aetas from the upper flanks of Mt Pinatubo became resilient through openness and adaptability. The latitude of the social fabric was wide and permeable enough to easily accept large changes but did not allow the loss of some fundamentals of the Aeta society such as the sense of "communalness". Indeed, the system was already in a state of precariousness induced by increasing pressure from lowland groups. On the other hand, the communities formerly situated at the foothills of the mountain and near the old Clark Air Base underwent fewer changes. Among these communities, acculturation was already ongoing before the eruption, which acted as an accelerator of the trend through further cultural adjustments. Therefore, Aeta communities from the lower slopes of Mt Pinatubo have been resilient through incremental and marginal change due to a narrower gap or latitude between lowland and upland cultures.

The differential capacity of responses of traditional societies in the face of natural hazards and the amplitude and duration of cultural change are influenced by the context of the disaster. For the past two decades, considerable attention has been given to this question in the hazard and disaster literature (e.g. Wisner *et al.*, 2004; Cannon, 1994; Hewitt, 1983, 1997; Lavell, 1997; Maskrey, 1993; Susman *et al.*, 1983). Natural hazards such as volcanic eruptions, earthquakes, landslides, typhoons or floods have different inherent characteristics such as diverse speed of onset, temporal spacing and magnitude. Moreover, they occur in very different geographical, social, political and cultural contexts that contribute to shape the responses and adjustments of the victims. It is therefore important to break away from universal patterns of response to natural hazards as those mentioned in the first section of this paper. It rather seems that the capacity of resilience of traditional societies in the face of natural hazards and related cultural changes are commanded by an intricate interrelation of several factors that vary in time and space, from one event to another. These factors are physical, socio-cultural, geographical and political in nature. The following section illustrates each of them as a new approach in understanding the capability of traditional societies to overcome the damage brought by the occurrence of natural hazards. Worth mentioning is that this framework only applies to fast-onset and contemporary events and thus excludes prehistoric and slow-onset hazards phenomena like droughts and climatic changes.

Factors of resilience of traditional societies in facing the occurrence of natural hazards

The nature of the hazard

We have already mentioned that natural hazards have different intrinsic characteristics. The magnitude and the temporal spacing of the event play a great role in shaping the long-term consequences of the occurrence of natural hazards on traditional societies (Table II). A couple of studies have demonstrated the capacity of such communities to deal with moderate-magnitude and recurrent phenomena. The most significant are the investigations by Cijffers (1987) in the Cook Islands in the face of hurricanes, the study of Busset and Schoeneich (1996; Schoeneich and Busset-Henchoz, 1998) among Swiss upland communities regularly hit by

Table II.
Characteristics of natural phenomena and their induced damages among sample traditional societies as highlighted in the relevant literature

Study cases	Kind of hazard	Year	Magnitude	Recurrence/temporal spacing	People killed	% of the group affected	References
Tarascan Indians, Mexico	Volcanic eruption	1943-1952	Large	First time	0	~15	Nolan (1972, 1979)
Niuafo'ou people, Tonga	Volcanic eruption	1946	Small	1929 ad, 1935 ad, 1943 ad	0	100	Rogers (1981)
Mt Lamington Sangara, Sasembata and Orokaivan, PNG	Volcanic eruption	1951	Huge	4,850 ybp	3 to 4,000	100	Belshaw (1951); Keesing (1952); Ingleby (1966); Schwimmer (1969, 1977)
Ambrymese people of Maat	Volcanic eruption	1950-1951	Large	1908, 1909, 1910, 1912, 1913, 1915, 1929, 1935, 1937, 1938, 1942	0	100	Tonkinson (1968, 1977, 1985)
Tikopia people, Solomon	Typhoons	1952-1953	Large	Seasonal	0	100	Spillius (1957)
Tristan de Cunha people	Volcanic eruption	1961	Large	1700 ad	0	100	Blair (1964)
Koniag people, Alaska	Earthquake and tsunami	1964	Large	Rare	2	100	Davis (1971, 1986)
Nila people, Indonesia	Volcanic eruption	1968	Small	Quite common	0	100	Pannell (1999)
Quechua Indians of Yungai, Peru	Earthquake/debris avalanche	1970	Large	First time	4,200	93 per cent of the city population but small percentage of the total Quechua group	Oliver-Smith (1992)
Guatemalan Mayans	Earthquake	1976	Large	Rare	Several thousands	Small percentage of the total Maya group	Bates (1982); Cuny (1983); Bates and Peacock (1987)
Mt Pinatubo Aetas, Philippines	Volcanic eruption	1991	Huge	500	ybp	Several hundreds	Gaillard (2006); Seitz (2004)
Rabaul Tolais, PNG	Volcanic eruption	1994	Large	1943 ad	5	~50	To Waninara (2000)

avalanches, the assessment of coping with floods in northern Canadian aboriginal communities by Newton (1995) Newton *et al.* (2005); and the works of Lewis (1981) and Hurrell (1984) in Tonga in the face of tropical storms and the research of Schneider (1957) among the people of the Pacific island of Yap, who are seasonally struck by tropical cyclones. In the Philippines and Papua New Guinea, several authors have also demonstrated the ability of environment-dependent and upland ethnic groups to cope with recurrent typhoons, frost and other climatic perturbations (Blolong, 1996; Heijmans, 2001; Insauriga, 1999; Philippine Institute of Volcanology and Seismology, Philippine Atmospheric Geophysical and Astronomical Services Administration and Ugnayang Pang-Aghamtao Foundation, 1998; Sillitoe, 1993; Waddell, 1975, 1983). Conversely, the magnitude of the 1991 Mt Pinatubo eruption, which led to significant short and middle-term cultural changes among the Aeta communities, was far greater. Moreover, the Aetas had to deal with a phenomenon they did not know since it occurred after five centuries of volcanic inactivity. The violent and likewise unexpected awakenings of Mt Lamington and Rabaul volcano in Papua New Guinea in 1951 and 1994 also surprised the varying ethnic groups that were living in close intimacy with their mountain for centuries (Table II).

The extent of damages also played a crucial role in the impact of natural hazards on traditional societies. In the case of the 1991 Mt Pinatubo eruption, most of the Aeta villages were buried under several metres of hot pyroclastic and ash fall deposits preventing the immediate reoccupation of the upper slopes of the volcano. Relocation downhill in the immediate vicinity of other ethnic groups, with whom acculturating interactions eventually occurred, was a must and no other alternatives were left to the Aetas. In the same way, Tarascan inhabitants of the village of Paricutín buried by the eruption of the volcano in 1944, had no other choice but to accept the resettlement program set up by the Mexican authorities near an acculturating urban centre. Likewise, thick ashfall deposits prevented the Ambrynese inhabitants of Maat to rely on the harvest of coconuts for three years and convinced them to accept resettlement on the Efate Island in 1951 (Tonkinson, 1968, 1977, 1985). On the other hand, phenomena like typhoons, floods and even tsunamis more easily allow post-disaster reoccupation of the stricken area thus helping the victims to promptly recover. That happened on the small Polynesian island of Tikopia, which was struck by two typhoons between 1952 and 1953 but never abandoned by its inhabitants (Spillius, 1957).

The intrinsic social condition of the particular group exposed to a given hazard
The second factor affecting the capacity of resilience of traditional societies is the intrinsic social condition of the particular group exposed to a given hazard. It seems that the capability of traditional societies to overcome disasters particularly depends on the pre-disaster level of acculturation, the relationships between the affected group and its neighbors, the diversity of pre-disaster livelihood, the cultural attachment to the devastated site, the size of the community affected and the age and the conservatism of the traditional leaders. The most significant case is the eruption of Paricutín volcano and its impact on the different surrounding villages already mentioned in this article. In her long-term study, Nolan (1972, 1979; Nolan and Nolan, 1993) perfectly demonstrated that the dissimilar responses of the different communities are rooted in the pre-disaster socio-cultural characteristics of each village. The Paricutín case illustrates that the deepest cultural changes occurred among the most traditional

communities when the natural hazard strikes. Among the most acculturated communities, the disaster rather acted as catalyst for pre-existing processes. Following the 1991 Mt Pinatubo eruption in the Philippines, the deepest socio-cultural changes similarly occurred among the communities which were the less acculturated before the eruption, while the more acculturated communities in 1990, undertook little adjustments to the new environmental and socio-economic contexts (Gaillard, 2006). The capacity of resilience therefore seems to be directly linked to the pre-disaster level of acculturation. The more traditional the society before the occurrence of the hazard, the more prone it is to cultural change.

Closely related is the amplitude of pre-disaster socio-cultural differences between the affected ethnic group and its neighbors, as well as the intensity of inter-group interactions. It seems that the larger the gap and the slighter the interactions, the more permeable is the society and the deeper the cultural changes. Following the 1991 eruption of Mt Pinatubo, the Aetas from the upper slopes of the volcano, who discovered the way of life of the lowlanders during their stay in the evacuation centres, were the most vulnerable to cultural change. Conversely, changes were much slighter among the communities from the foothills of the mountain which were long interacting with neighbouring groups (Gaillard, 2006). Likewise, Ambrymese people of Maat in the New Hebrides, used to have regular contacts with neighboring communities before their evacuation to Efate after the awakening of Mt Benbow in 1950-1951. Hence, they maintained a similar pattern of relationships with surrounding groups and preserved their social structure (Tonkinson, 1968, 1977, 1985).

The diversity of pre-disaster livelihoods is another factor affecting the capacity of resilience. The societies that are most vulnerable to cultural changes seem to be those relying on a unique livelihood. It is evident that communities relying exclusively on the natural resources available in their immediate environment are much more vulnerable in the event of partial or total destruction of these resources. In the case of the 1991 Mt Pinatubo eruption, uphill communities exclusively dependent on agriculture for their living were rendered harmless by the destruction of their fields by metres of pyroclastic deposits. On the other hand, the communities located on the foothills of the volcano which used to rely on several livelihoods turned out to be less affected by the eruption. This larger spectrum of resources allowed them to rely less on external and acculturating support. Among the rural communities of Belize, Hall (1983) also observed that traditional hunting and gathering activities is a viable alternative when repeated hurricanes sweep farmlands and diminish agricultural resources. In Tonga, Rogers (1981) mentioned that storm-resistant root crops constitute an alternative source of food to other staple crops more vulnerable to typhoons.

The cultural attachment to the site devastated by a natural hazard is also decisive in the capacity of resilience of traditional societies in the face of natural hazards. In the cases of Lamington, Rabaul and Pinatubo volcanoes, the mountain plays a major spiritual role and is the centre of traditional religious beliefs (Blong, 1982; Lubos na Alyansa ng mga Katutubong Ayta ng Sambales, 1991; To Waninara, 2000). The post-disaster relocation away from the slopes of these volcanoes constituted a painful cultural rupture for the traditional societies affected. Among the Orokaivans of Mt Lamington, Schwimmer (1977) showed that alienation from the native land meant separation from the ancestors who are supposed to live in the mountain. Animist mortuary and birth rites usually performed on taro fields on the slopes of the

mountains had to also be stopped following the eruption. The abandonment of such traditional rituals was also observed among Tolai communities affected by the 1994 eruption of Mt Rabaul (To Waninara, 2000). In this last case, the awakening of the volcano led to the depletion of Tambu habitually accumulated with agricultural harvests. On the other hand, the Konyag communities struck by the 1964 Alaskan earthquake and tsunami did not display the same attachment to their natives villages and even indicated no interest in returning to their former site (Davis, 1971, 1986). The social structure of the communities, which was not tightly land-bond, eventually survived the resettlement program set up by the US government.

The age and conservatism of the traditional leader before the disaster is another significant element affecting the capacity of resilience of traditional societies in the face of the occurrence of natural hazards. In the Mt Pinatubo case, preservation of socio-cultural references was hindered by the critical shift in leadership that followed the eruption. The "Apo" or old wise man lost his prerogatives in preserving and transmitting the indigenous traditions because of his incapacity to deal with the new issues the Aetas had to cope with after their relocation downhill. Younger leaders are now emerging from among the different communities due to their ability to communicate with lowlanders (Gaillard, 2006). Likewise, the 1951 eruption of Mt Lamington in Papua New Guinea left a heavy toll among Sangara older people who had the exclusivity of traditional religious education. This caused the rapid abandonment of numerous traditional references because of foreign innovations, whose penetration was facilitated by a lack of control by elderly leaders (Schwimmer, 1977). On the other hand, Ambrymese leaders of Maat were instrumental in the decision of the community to relocate on Efate following the eruption of Mt Benbow in 1950-1951 (Tonkinson, 1968, 1977, 1985).

The extent to which a community is affected seems to have a direct link with the capacity of resilience and post-disaster cultural change as well (Table II). If the whole community is hit by a natural hazard, resistance to cultural changes seems unlikely. The 1991 Mt Pinatubo eruption did not spare any Aeta community (Gaillard, 2006; Gaillard and Leone, 2000; Seitz, 1998, 2000, 2004). All were affected and all the Aetas experienced the evacuation into resettlement centres where contacts with the lowlanders first occurred for the uphill communities. The absence of intact village, which would have taken care of the Aeta traditions, did not allow a retreat toward a preserved socio-cultural environment. Similar experiences were observed at Tristan da Cunha and around Mt Lamington following the brutal eruptions of the local volcanoes in 1951 and 1961-1962, which affected entire communities. On the other hand, the inhabitants of Yungay, Peru, struck by the debris avalanche of 1970, were part of the numerous Quechua communities that occupy the Andes Mountains (Table II). Their culture was not directly endangered by the disaster.

The role of the geographic setting
The third factor affecting the capacity of resilience of traditional societies in the face of natural hazards is the geographic setting which is directly linked to the two previous points. The lack of space in a homeland-like environment for relocation without encroachment on other ethnic groups and cultures is of critical importance. The existence of available space is directly connected to the magnitude of the event and the extent of damage brought among the affected communities. This is evident when

disasters strike small islands. The most remarkable example is probably the eruption of the volcano of Tristan da Cunha between 1961 and 1962. No other alternative was left to the inhabitants of this small island in the southern Atlantic Ocean but to leave their homeland and relocate in distant England. Most of the victims of Tristan da Cunha then discovered very different western habits that deeply penetrated their traditional way of life (Lewis *et al.*, 1972). In the case of the 1991 Mt Pinatubo eruption, there was definitely no space available in homeland-like environment for spontaneous relocation. The resettlement sites selected by the government encroached on lowlander territories and favoured contacts between Aetas and their neighbours. Foothill sites, where other Aeta communities spontaneously resettled, also trespassed on lowlander's lands (Gaillard, 2002; Gaillard and Leone, 2000; Seitz, 2004).

Conversely, the reconstruction of the Peruvian town of Yungay following the 1970 earthquake shows that the availability of enough vacant land in the immediate vicinity of the former settlement enabled the victims to maintain their ancestral links with their territory. The Indians of Yungay have been successful in preserving their social and cultural organization. In this specific case, the land availability was commanded by the limited spatial extent of the hazard (debris avalanche) and by the ethno-linguistic homogeneity of the affected area (*Quechua* Indians). Likewise, there was enough space in similar environment available on Efate, in the New Hebrides, for the resettlement of the Ambrymese community of Maat following the eruption of Mt Benbow in 1951. This was fundamental in the maintenance of Maat social structure and traditions (Tonkinson, 1968, 1977, 1985). The intimate relation between the nature of the hazard, the intrinsic social condition of the particular group and the geographical setting is here evident. A fourth factor has, however, to be added to these three first issues: namely, the rehabilitation policy set up by the authorities.

The policy of rehabilitation of the affected area

The fourth and last factor affecting the capacity of resilience and cultural change among the Aeta communities is the post-disaster rehabilitation policy set up by the authorities. Natural hazards are often used as alibi by authorities to relocate cultural and traditional minorities within the territory of mainstream communities. Such alleged-hazard-compelled relocation programs have been described in Palau in the wake of a typhoon in 1905 (McKnight, 1977) and following the awakening of volcanoes in Nila, Indonesia, and Niuafo'ou, Tonga (Panell, 1999; Rogers, 1981). Several studies have further shown that some cultural changes have been premeditated by the authorities in charge of the rehabilitation of the affected areas. It occurred following the earthquakes that struck Guatemala in 1976 and Yemen in 1982. Following the 1976 Guatemala disaster, several non-governmental organizations taught the *Maya* Indian victims how to build more resistant houses using foreign technologies instead of their traditional adobe homes (Bates, 1982; Bates and Peacock, 1987; Cuny, 1983). Similarly, following the 1982 Yemen earthquake, foreign experts brought new building techniques which accelerated a process of change that had already long been under way among the rural upland communities affected by the disaster (Leslie, 1987). In these precise examples, there was no hidden political purpose behind these cultural changes and it resulted in a lower vulnerability level. Conversely, following the eruption of Paricutín volcano, the Mexican government has been accused of using the resettlement policy and the associated social services program to "civilize" the Indians

(Nolan, 1972, 1979). Subsequently, to the awakening of Rabaul volcano in 1994, the Papuan authorities have similarly gathered the Tolai victims within resettlement centres where the traditional pre-eruption clannish organization disappeared at the benefit of Christian values (To Waninara, 2000).

Attempts at political manipulations following disasters are not always successful. We have already mentioned the immediate and total refusal of the inhabitants of the Peruvian town of Yungay to be relocated 15 kilometres away from their hometown buried by a debris avalanche in 1970 (Oliver-Smith, 1992). Following the 1991 Mt Pinatubo disaster some government officials were also boasting of trying to "civilize" the Aeta through the rehabilitation program set up following the disaster, especially through the resettlement policy and social programmes. If it is true that education within the resettlement centres contributed to enlarge the cultural references of the youth, major socio-cultural changes among the Aeta communities did not occur by direct inputs of the government, but rather as a progressive process due to geographic proximity, which led to increasing interactions with external lowland culture. This is particularly evident because a large number of Aetas chose to leave the relocation centres spontaneously to settle on available lands in the surrounding foothills (Gaillard and Leone, 2000; Seitz, 2004). In 1946, the Tongan authorities ordered the early and unjustified evacuation of Niuafo'ou Island, and the eventual relocation of its inhabitants on the neighbouring island of Eua among culturally different Euan people. Nevertheless, 30 years after the event, the residents of Niuafo'ou have maintained their social organization and their former cultural references (Rogers, 1981).

A third set of examples illustrates the role of the authorities in cultural changes that may occur among traditional societies following disasters. Subsequent to the 1951 Mt Lamington eruption, Sasembata people were evacuated by village groups under the leadership of village constables. The constables were also in charge of dealing with the central government for the distribution of food supplies and house building matters. The authority of government constables, henceforth, quickly overcame the leadership of ethnic traditional leaders, thus deeply modifying Sasembata social organization (Schwimmer, 1977). Likewise, the resettlement program set up by the US Bureau of Indian Affairs following the great 1964 Alaskan earthquake was directly responsible for the changes in Konyag housing type and settlement pattern as well as in the spread of community facilities (water and sewage systems, electricity) (Davis, 1971, 1986).

On the other hand, the people of Tikopia swept by two typhoons and a subsequent famine between 1952 and 1953 have themselves organized the rehabilitation of their island in respect of their traditions. The adjustments undertaken to surmount the crises were temporary and the normalization of rituals and customs was decreed as soon as possible (Spillius, 1957; Torry, 1978a). Likewise, the Ambrymese community of Maat had a total control on their relocation process on the island of Efate in the New Hebrides following the awakening of Mt Benbow in 1951. This freedom of choice enabled them to retain their social structure (Tonkinson, 1968, 1977, 1985).

Finally, the post-disaster rehabilitation program cannot be detached from the global national government policy toward ethnic and cultural minorities. In most of the developing countries, which are the most severely affected by disasters, the recognition of traditional societies is often inexistent. For example, at the time of the 1991 Mt Pinatubo eruption, there were no specific governmental guidelines to protect and defend ethnic minority rights in the Philippines. Hence, it was most unlikely that the

Figure 2.
Factors of resilience of traditional societies in facing natural hazards

Philippine government had appropriate measures for the preservation of the Aeta culture at this time.

Conclusions

The occurrence of natural hazards has often brought much damage to the physical and socio-economic environment that traditional societies have had to modify their lifestyle to recover. Changes in traditional societies way of life may be large, incremental or slight. Changes may be temporary, or they may last longer. In every case, however, those changes among traditional societies should be seen as a mode of coping and recovery from the havoc brought by natural hazards rather than as the consequence of different levels of vulnerability.

The previous paragraphs identified several factors influencing the capacity of resilience of traditional societies when facing brutal and contemporary natural hazards (Figure 2). It is evident that the nature of the hazard, the intrinsic social condition of the particular group exposed to a given hazard, the geographic setting and the rehabilitation policy set up by the authorities greatly vary in time and space, from one disaster to another. Given the great diversity of natural hazards and the multiplicity of their local geographical contexts of occurrence, the quest for a unique and universal theoretical framework assessing the capacity of resilience of traditional societies therefore becomes secondary. More important is to perceive the local variations of the factors detailed in this paper to better anticipate the capability of traditional societies to overcome the damage brought by the occurrence of natural hazards and therefore predict eventual cultural change. This framework is in line with the new approach of hazards and disaster management programs which enhance a local consideration of the problems rather than being limited to a transfer of technology from industrialised to developing countries.

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