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DISASTER RISK REDUCTION THROUGH LOCAL KNOWLEDGE AND CAPACITIES ENHANCEMENT

Local resources and multilevel cooperation: towards long-term prevention strategies

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Ancient/Historic and Innovative Solutions for Damage Prevention and Performance Improvement in the event of Natural Disasters

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Abstract:
In disaster prone areas, local communities have always faced natural hazards and, over time, have managed to develop different strategies to prevent and/or reduce their impact. Local builders have often integrated natural risks into their daily practices, developing in many cases singular techniques, building details or devices aiming at reducing the vulnerability of the built environment. Such indigenous knowledge can contribute to the development of disaster-resistant engineering through the analysis of vernacular building practices and the potentials offered by locally available resources (materials, knowledge and know-how).
The aim of this article is to illustrate a number of practices based on an action-research process, integrating elements of local building cultures, and proposing a methodology for the enhancement of local capacities and know-how through technology transfer and knowledge sharing

1. INTRODUCTION

Around 75% of the world's population lives in areas that were affected by earthquakes, hurricanes or floods between 1980 and 2000 (UNDP 2004). Since then, social, political and environmental factors have led to an increased number of people having to deal with the impact of major natural phenomena (UN / ISDR 2009). Major disasters mobilize humanitarian aid to support the recovery of affected populations.
Since the 1990s, risk reduction principles have been integrated as part of the support policies to assist affected populations, including the implementation of preventive measures designed to alleviate the existing separation between emergency and development measures (1). Since then, the post-disaster reconstruction phase has become a valuable opportunity to implement measures aiming at reducing the vulnerability of people and their built environment, in the long-term (Abhas et al 2010).

But it is only in the past ten years that some of the actors involved in reconstruction practices have started to implement approaches oriented towards the active involvement of beneficiary communities in the decision-making process and the management of reconstruction, with technical financial support provided by aid agencies (Arshad and Rasheed 2011) (2). However, if the involvement of beneficiaries can encourage the reactivation and strengthening of social dynamics, very often the technologies offered by aid agencies do not guarantee the autonomy and capacity of the populations to deal with the management and prevention of risks associated with housing in the long run (Davindson et al 2007).

In areas prone to natural hazards, many of the buildings that make up the built environment are constructed almost exclusively through the experience and direct observation of builders (masons, artisans or local populations) without the support from an engineer or an architect. In relation to the frequency and intensity of natural hazards, some societies have managed to develop constructive and morphological features to provide solutions so as to reduce their impact, revealing a level of mastery in terms of architectural design and risk management (Ferrigni et al 2005).

Although the reproduction of such constructions is in itself proof of the relevance and reliability of these techniques, socio-cultural and environmental factors have lead to a loss of interest on the part of people to continue implementing traditional constructions. Also, difficulties in the application of validation methods to prove the relevance of such traditional knowledge by the scientific community make it difficult for experts and technicians to teach and implement these techniques in the field, hindering the development of norms and technical documentation.

2. CASE STUDY: A MULTILEVEL APPROACH

Over the course of 30 years, the French association CRAterre has developed an approach dynamically linking analysis, research, experimentation and the implementation of projects, between field practice and academic research. The cases below illustrate two specific principles defining CRAterre's processes:

- Bringing technical support to strengthen the knowledge and skills in the field of construction, based on local practices and know-how. The analysis of architectures, resources and potentials existing on the site is the starting point for the development, in consultation with local communities, of improvements and / or new building solutions, through training and educational approaches.

- Linking various stakeholders around a common issue (local communities, universities, aid agencies and donors) to establish a synergy of skills and knowledge. The exchange between various institutional entities (universities, organizations) and scopes of action (local, regional, international) represent an important factor, allowing for the implemented strategies to adapt to local capacities, availabilities and potentials.

2.1. Haiti: valorization of local resources and skills

On January 12th, 2010 an earthquake of magnitude 7.0 struck Haiti. The farmers' organization Vive l'Espoir pour le Développement Kapwouj (VEDEK), working around Cap Rouge, sought support from Secours Catholique / Caritas France (SC/CF), for the repair of 100 houses on the basis of a financial aid adapted to the needs and capacities of each beneficiary. Aid was thus based on the damage caused to the houses and to the owners' abilities to contribute to their reconstruction, which allowed as many families as possible to benefit from the project.

Through this proposal, VEDEK aims to implement a longer-term vision regarding the identification of necessary technical improvements to reduce the vulnerability of buildings at risk in earthquake and hurricane prone areas, so that it may be integrated as part of current construction practices. SC/CF requested the assistance of CRAterre to support local partners in the process of evaluating needs, monitoring and determining constructive principles based on solutions adapted to local risks, potentials and capacities.

Fig.1 – Haiti, Cap Rouge: local architecture (credits: Annalisa Caimi, 2011).

A first on-site evaluation showed the relevance of vernacular building systems in relation to hazards affecting the area. The building systems implemented do take into account the impact of recurrent cyclones. Also, during the earthquake, they allowed the main structure of the buildings to resist, reducing the damage on the structures and greatly reducing the risks faced by the people inside the buildings.

To enable the reproducibility of the proposed improvements, two criteria are decisive: the access to materials and the availability of skills to implement constructive principles locally.

The use of materials available on the site, and commonly used for construction, has been privileged. The repair of houses was thus based on the recycling of debris and elements present as part of the existing structures, for rehabilitation purposes but also for the implementation of future constructions.

The development of local expertise in the field of construction in risk-prone areas was provided through training sessions aimed at local craftsmen from all over the region of Cap Rouge, making their new skills available to the whole population. Damaged houses were used as support for the explanation of the techniques that the artisans then put into practice on their own. Meanwhile, a sensitization campaign aimed at building professionals and the general public was conducted through radio broadcasts, site visits and meetings with project stakeholders.

Fig.2 – Haiti, Cap Rouge: training of local masons for housing repair (credits: CRAterre, 2010).

Fig.3 – Haiti, Cap Rouge: creating public awareness (credits: CRAterre, 2010).

In this project, external interventions, both technical and financial, were calibrated to allow the local population to continue to integrate the new architectural proposals and gain access to the skills acquired by the artisans during training. Repairing housing structures while explaining their shortcomings to owners, enhancing and improving the existing building methods, suggesting technical solutions adapted to local capacities and resources, training and informing beneficiaries and stakeholders within the local construction sector are factors that can contribute to build capacities in local communities and foster the process of reducing vulnerability, in sustainable and accessible ways.

2.2. Bangladesh: synergy of knowledges

On November 15th, 2007, Bangladesh was hit by cyclone Sidr, a large cyclone which caused great devastation. Secours Catholique/Caritas France (SC/CF) and its partner Caritas Bangladesh (CB) became quickly involved in a project to rebuild homes. The first models available were the result of studies conducted by engineers and technicians, based on solutions and technical features which, although scientifically validated, did not include formal and constructive elements already present in the local architecture. The lack of integration of local building practices on the part of academic experts has sometimes led people to discredit and mistrust the solutions they themselves had developed against risk.

With technical support from CRAterre, a collaboration was then established between stakeholders working directly on the site and the Bangladesh University of Engineering and Technology (BUET), with the intention of improving the proposed solutions by deepening the study of local building cultures, associating them with some of the latest scientific results conducted on housing structures.

Fig.4 – Bangladesh: local architecture presenting features (pitched roof, natural wind breakers, high plinth) allowing for a better resistance to cyclones and floods (credits: CRAterre, 2009

In May 2009, a second cyclone, Aila, hit the areas previously affected, encouraging all partners to work together to develop a national emergency preparedness plan. A second project was launched, aimed at both strengthening the capacities of communities to cope with potential crises though their active involvement in all the stages of the project and the

improvement of housing, and enhancing the actions implemented by CB in terms of speed and adequacy of response.

Bangladesh is affected by many natural hazards (cyclones, floods, earthquakes), but it also offers great diversity in terms of building materials (bamboo, earth, wood), and the ways of life of its people. Standard solutions, both methodological and technical, would not lead to appropriate results adaptable to different contexts and populations.

Fig.5 – Bangladesh: assessment of local constructions (credits: CRAterre, 2009).

Through the contribution of local disaster management committees, CB proceeds to the definition and analysis of different homogenous territories, according to local risks, building practices, resources and social customs. For each of these defined areas, prevention strategies will be implemented and reconstruction programs will be reviewed by BUET and CB, with the design of low cost housing adapted local conditions.

Fig.6 – Bangladesh: shelter provided by CB after cyclone Sidr, integrating features from the local building culture (credits: CRAterre, 2009).

The gathering of between different levels of research and action (local communities, universities, grassroots organizations, donors) and the synergy between the various

stakeholders can benefit from the knowledge and skills specific to each group, and help create databases of sustainable strategies ,technically and scientifically validated, truly adapted to local contexts and building practices.

Awareness on the part of technicians and academic experts of the relevance of some of the solutions present in vernacular architecture adds value to the knowledge developed by local populations, but also pave the way for research to make technical improvements including the understanding and validation of scientific principles developed empirically, locally.

3. LINKING KNOWLEDGE, EXCHANGING KNOW-HOW

First, by taking local potentials into account (materials, skills, knowledge, technical and financial means) allows local populations to build, maintain, repair and extend any building in a sustainable way, while reinforcing the skills of local builders.

Second, by creating opportunities for cooperation between different institutional structures (universities, laboratories, NGOs and government structures, other entities...), which may encourage the scientific study of techniques and local knowledge, promote their integration as part of vocational and academic programmes, allow their use in the definition of building norms and technical support available to different targeted groups (local populations, artisans, technicians, policy makers).

The development of an approach based on the creation of links between research, experimentation and practice in the field has the potential to promote a consistent process of enrichment of the different dynamics that can lead to reducing the vulnerability of communities the long term, contributing in their evolution towards self-determination.

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Notes :
(1) " *We must, above all, shift from a culture of reaction to a culture of prevention*." (K. Annan). International Decade for Natural Disasters Reduction 1990-1999 (United Nations) ; Hyogo Framework for Action 2005-2015; Disaster Preparedness Programme - DIPECHO (European Commission Humanitarian Aid).

(2) Owner Driver Reconstruction Approach, some examples : Post-earthquake reconstruction in Gujarat, India (2001) ; Post-tsunami reconstruction in India and Sri Lanka (2004) ; Post-earthquake reconstruction in Northern Pakistan (2005) ; Post-earthquake reconstruction in Haiti (2010).

Curriculum :

Oliver Moles, associate research professor, CRATerre-ENSAG laboratory (France). Since 1990, Oliver Moles has initiated monitored and evaluated programmes for the promotion and upgrading of local building cultures constructive in over 30 countries, under the aegis of various organizations (UNESCO, UNIDO, FAO, UNDP, UN Habitat, MISEREOR, CARITAS, IFRC…).

Annalisa Caimi, architect EPFL (Switzerland). Between 2005-2007, she developed a research on bamboo construction in India. In 2010, she obtained a post-master's degree on Earth Architecture at CRAterre-ENSAG (France). She is currently doing a PhD, at the National School of Architecture in Grenoble on indigenous building technologies related to natural hazards.