PLANNING FOR POST-DISASTER RECONSTRUCTION

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INTRODUCTION

At least 250 natural disasters and 125 human-made catastrophes occur each year in the modern world.[1] In recent decades, the number of disasters has increased steadily and so has their toll of losses, damage, destruction and casualties.[2] Recovery after disaster is thus a perennial problem of growing complexity. The traditional view of reconstruction is a rather uninventive one of picking up the pieces after a devastating event and thus restoring the *status quo ante*. However, as one leading expert (the late Frederick Cuny) noted, by creating sustainable disaster mitigation, reconstruction can be used as a catalyst to improve people's lives and make communities safer.[3]

This paper will consider seven issues associated with post-disaster reconstruction, all of which are significant to communities that have had to rebuild after catastrophe or that will face such a need in the future. The issues are as follows:-

(1) What are the strengths and weaknesses of post-disaster reconstruction in the modern age?

(2) What is the role of reconstruction planning in the wider field of urban and regional planning?

(3) How can reconstruction work around the problem of "geographical inertia", the persistent occupation of hazardous locations?

(4) How necessary is it to preserve the spirit of a place, its *genius loci*, in reconstruction, and how can this best be done? Furthermore, what is the symbolic value of reconstruction?

(5) What constitutes sustainable disaster mitigation and how can it be incorporated into reconstruction programmes?

(6) Can reconstruction planning be carried out *before* disaster strikes in order to anticipate future needs and reduce the time required to set reconstruction in motion after disaster strikes?

(7) What makes a reconstruction programme efficient and effective?

Before seeking answers to these questions, let us delve into some of the historical background of reconstruction planning.

A little history

The village of Senerchia lies in the Sele Valley of central-southern Italy, an area subject to considerable seismic activity. The settlement was founded at least 1000 years ago and occupies a site crossed by the master-fault of a graben and subject to seismically-induced compaction subsidence, landsliding, mudflows and normal faulting. On 23 November 1980 Senerchia was devastated by a magnitude 6.8 earthquake. Sixty-four people lost their lives and virtually all of the older buildings at the centre of the village were knocked down or damaged beyond repair. Yet in some respects this was hardly an exceptional event, as the village still bears the scars of ten earthquakes that have occurred since the major seismic event of AD 1456.[4] Perhaps what is remarkable about this is not the repetitiveness and persistence of the damage but the lack of any mitigation of future earthquake devastation until the arrival of reinforced concrete construction after about 1950.

In fact, the history of disasters is distinguished by an extraordinary lack of "architectural Darwinism", or survival of the fittest building. True, a style of housing in the highly seismic Pattan Valley of Pakistan evolved based on the use of tree-trunks to brace the buildings against lateral shear, but this was hardly enough to be able to say that the lessons of disaster have routinely been incorporated into reconstructed buildings.[5] The ruins of the Palace of Knossos in Crete show signs of a wooden ring-beam to strengthen the walls against collapse, but it took six devastating earthquakes in fairly close succession before such a design emerged, and it was not perpetuated in later public buildings (the temples of Selinunte in Sicily, the most massive in Magna Graecia, were progressively reduced to rubble by earthquakes).[6]

One of the most remarkable examples of post-seismic reconstruction in history was that directed by the Marquis do Pombal after the earthquake, fires and tsunamis of 1 November 1755 in Lisbon, Portugal. A large area from the River Tagus to Praça Rossio was levelled and its surrounds were graded. Street widths were standardised at 20 metres, 17 m for roadways and 3 m for pavements. A rectilinear plan was used and the façades of new buildings were standardised. So were architectural elements, which were mass-produced to save time and guarantee integration. All new buildings had to have a fire-resistant shear wall and a wooden frame, called a *gaiola*, which was flexible enough to resist earthquake loading.[7] Yet although the Lisbon earthquake was very much a high profile event in its time, Pombal's designs and edicts, which were formulated entirely after the disaster, were seldom replicated in other seismic areas, and no general model of post-disaster reconstruction emerged.[8] It all adds up to a failure to consider disasters in continuity terms, as cyclical or repetitive events which must be prepared for.

Despite these not very encouraging antecedents, in the modern age reconstruction planning has become a more serious discipline and has benefited from the accumulation of knowledge and experience derived from successive events and from half a century of research.[9]

The strengths and weaknesses of modern reconstruction programmes

Students of disaster tend to characterise the process of reconstruction according to the model of disaster propounded by Kates and Pijawka, in which there are four phases: emergency action, recovery of basic services, replacement reconstruction and developmental reconstruction.[10] Kates and his colleagues suggested that there is a logarithmic relationship between the respective durations of the phases, such that reconstruction may take something like one thousand times longer than the phase of emergency intervention. Whether or not this is so, it can take 10-25 years to rebuild a community after a major disaster. Hence, conditions may be very different at the conclusion of the process with respect to what they were at its beginning.

Researchers who have sought to apply the Kates and Pijawka model in the field have qualified it in significant ways. In a 12-year study of reconstruction after the Friuli (northern Italy) earthquakes of 1976, Robert Geipel found that although the process was ultimately successful, it was achieved at the expense of high levels of debt among participants.[11] Sarah Jane Hogg also studied the situation in Friuli and observed that reconstruction was quickest in the settlements that were geographically and politically best connected with the outside world of capital and assistance. In those towns that did not enjoy such status the process tended to stagnate.[12] This ties in with Kates's and Pijawka's observation that the first parties to reconstruct are those that have the easiest access to capital--e.g. financial institutions. In general, reconstruction is space extensive and, irrespective of the magnitude of losses, it is closely correlated with the financial status of individuals and organisations before the disaster, in that the richer people are, the more resilient to disaster that they prove to be.

Various researchers have noted that reconstruction can lead to a "boom-and-bust" economy in which the process of rebuilding fuels temporary economic growth, but this is achieved at the expense of the long-term sustainability of the local area's economy. In the USA, after both Hurricane Andrew (1992) and the Northridge, California, earthquake (1994), indebtedness reduced both household spending and the ability of local government to borrow money, while the Federal government increased its debt levels by providing assistance.[13]

Given these problems, it is axiomatic that reconstruction would be more effective and less onerous if it were well planned. Planning needs to be holistic, in that it is not merely a question of replacing damaged building stock and infrastructure, but also one of reconstructing communities, ensuring equity, access to resources and equality of opportunity for the most disadvantaged members of those communities, and reducing community vulnerability to hazards.[14]

Over the last 25 years, there have been periodic attempts to encourage communities that are seriously at risk of hazards to plan reconstruction before disaster strikes--i.e., to foresee the destruction and formulate a draft plan to tackle it when it occurs.[15] The US Federal Emergency Management Agency claims to have induced communities to write such plans, and the state of North Carolina has inaugurated similar initiatives for coastal hazards. Nevertheless, pre-disaster reconstruction planning has not proved popular, especially as most communities have scarce resources and many other pressing demands to attend to. There are thus few data on how effective such planning is in reducing the delays in reconstruction.

Reconstruction programmes in the context of urban and regional planning

Only a small minority of US states has incorporated hazard prevention schemes into urban planning instruments.[16] Worldwide, it is much less common to find disaster prevention tackled as part of urban and regional planning than through building codes. Nevertheless, there is both ample scope to consider disaster prevention in planning and every reason to do so. It is thus paradoxical that planners are seldom taught about hazard mitigation, even though the have many of the tools to achieve it. In fact, land-use control is one of the most effective ways of reducing vulnerability to any of those hazards that can be mapped and foreseen, especially during the "window of opportunity" after disaster has struck, when the public and the politicians demand greater safety.

The process of urban and regional planning involves ensuring the orderly, mutually compatible and safe development of housing, infrastructure, other land uses, economic development, capital improvements, historical preservation and environmental protection. All this cannot be achieved without full consideration of the complex relationship between the natural and built environments. This involves mitigating hazards, in which mitigation is defined as "any action taken to reduce or eliminate the long-term risk to human life and property from hazards".[17] It requires assessment of vulnerabilities and risks, as well as formulation and implementation of policies for their reduction or containment. Hazard mitigation is a crucial element of the long-term stability of communities, as it can ensure that the destruction caused by disasters does not cause businesses to fail, the local property market to collapse and major losses that must be sustained over long periods of recovery time.

In the aftermath of disaster, planners will have to consider how to promote timely, safe and effective reconstruction. This will be a period in which there is much emphasis on restriction of non-conforming land uses. These are those functions that are incompatible, either with uses of the surrounding land or with the local hazards situation and which therefore require to be phased out and directed elsewhere. Other planning needs include the provision of evacuation routes and assembly areas, the exclusion of land uses from zones of high risk, and the application of mandatory hazard-proofing to buildings (e.g. flood barriers, fire-resistant roofs or anti-seismic bracing).[18]

In synthesis, there is considerable scope for hazard reduction through the normal urban and regional planning process, but at the moment it is very significantly underutilised.

Geographical inertia and the need to preserve a "spirit of place"

No community that has been devastated by disaster is ever reconstructed exactly as it was before the event. Indeed, reconstruction tends to demand more space than the original land-uses that it supplants, especially where these predated the use of the private automobile as a means of mass transport. Should reconstruction aim to replace what has been lost or develop the area towards a new future? What balance should be struck between replacement-reconstruction and developmental reconstruction?

Few communities are abandoned completely after disaster or relocated entirely to new sites. Apart from any failure of the reconstruction process to reduce the prevailing risks, there are various other reasons why geographical inertia prevails. First, the existing pattern of land ownership usually remains after the disaster, which encourages reconstruction *in situ* by individual land owners. Secondly, the local population is usually keen to restore the pre-existing pattern of economic activities and social relations in order to regenerate the sense of community. Thirdly, there has probably been a process of gradual adaptation to hazards, which may have reduced some of the risks. This may increase during the reconstruction phase, but not necessarily by virtue of relocation. Fourthly, historical preservation may require some buildings or artefacts to be reconstructed as close to their original form as possible. Finally, people's sense of attachment to place is a function of its *genius loci*. This quality is hard to define, but it is essentially determined by the historical character of a place, by physical and natural site characteristics, and by symbolic references that express some aspect of local, regional or national culture in the form of monuments or facilities. [19]

The degree of emotional or ideological attachment to place varies from one culture to another but is usually high. Hence, reconstruction normally involves devoting resources en masse to rebuilding those elements of a place that embody its *genius loci*, and the older and more historic a place, the more complex and demanding this process will be. For example, the city of Bam in southern Iran suffered a devastating earthquake in December 2003, with the loss of a remarkable monumental complex of mudbrick buildings that were classified by UNESCO as a major world heritage site. One presumes that they will be rebuilt, as although they had no economic or housing value (other than as a magnet for tourism), the complex defines the very essence of Bam. Elsewhere, failure to reconstitute the *genius loci* of Lima, Peru, after devastating earthquakes has undoubtedly diminished the city and reduced its ability to define a character that people can relate to in positive ways.

There is always an exception that proves the rule, and one such case is the town of Noto, in Sicily, which was devastated by earthquake in 1693-4. It was reconstructed (on a green-field site 9 km from the original location) in a monumental style that essentially created a *genius loci* from scratch.[20] However, such an approach tends to be riotously expensive and risks alienating many of the participants. Elsewhere in Sicily, reconstruction of the town of Santa Ninfa after it had been destroyed by a swarm of 14 earthquakes in 1968 did not occur for 20 years, thanks to shortages of funds, but when it finally came to pass it scrupulously respected the existing pattern of land ownership. Planners were thus the guardians of the cadastre.

The lesson of this situation is clear: the process of planning reconstruction must necessarily take account of people's physical, emotional and economic attachment to place. This usually does not lead to the most efficient forms of reconstruction, but it does increase the chances of success compared to more radical solutions that attempt to sweep away the past but are likely to be rendered inoperable by public hostility.

Sustainable disaster mitigation for effective reconstruction planning

Perhaps the first way to consider the question of how to incorporate sustainable mitigation of disasters into reconstruction planning should be to analyse some of the mistakes that are commonly made in directing the reconstruction process.

Reconstruction that occurs very rapidly or indeed instantaneously should be treated with suspicion, for it implies that there has been a failure to consult adequately with interested parties. Time is socially necessary in order to make reconstruction democratic (*but it is not limitless*). The worst cases are either those in which planners ride roughshod over local interests or those in which conflict of interests leads to stalemate. At the latter end of the scale temporary shelter can outlive its design life, as permanent reconstruction falters. At the other end restorable buildings are hastily demolished, useful rubble (including potentially reusable architectural material) is cleared away, trees are uprooted, historical and archaeological sites are upset, and hasty and inappropriate repairs are carried out. In order to speed up reconstruction, normal regulations, design procedures and building permit processes are suspended, leading to laxity, which is usually compounded by a poor quality building inspection system run by too few inspectors facing a hopelessly large workload. Finally, government agencies fail to co-ordinate their strategies, which conflict with one another, sowing confusion in the reconstruction process.[21]

Although the literature on post-disaster reconstruction is replete with examples of failings such as these, they need not occur. Essentially, post-disaster planning has three main aims: the timely restoration of normal activities and living conditions, protecting the community against the future impact of hazards, and the formulation and achievement of common objectives between the parties involved. Successful strategies will have many of the following attributes:-

$	they will be adaptable to the need for change, which is particularly important given the length of time that major post-disaster reconstruction is likely to last;
$	they will be efficient in terms of using capital and resources wisely;

$ collaboration will ensure broad participation and enhanced objectives;
$ diversity and multiple approaches (i.e. redundancy) will protect the strategies against failure through overemphasis of single objectives or methods
$ they will be self-sufficient in terms of their ability to operate independently of outside control;
$ the strategies of different organisations will be mutually supportive;
$ and finally, they will be resistant to attack by outside forces.[22]

As the number of government agencies that participate in post-disaster work can vary from 25 to 100, strategies that fulfil many of these criteria require complex negotiation and many hours of meetings and discussions among the stakeholders.[23]

As reconstruction will only succeed in the long term it if builds resilience into communities, it must involve the mitigation or abatement of hazards. When drawing up the plan, risks must be identified, described and evaluated. Goals and objectives for their mitigation must be defined and strategies formulated to achieve them. Plans must be drawn up, implemented, monitored, evaluated and constantly updated. Among natural hazards, hurricanes and floods can both be combated with a battery of structural and non-structural measures (in which strength and resilience are achieved through the diversity of approaches adopted). Tornadoes are less easy to devise cost-effective mitigation for and earthquakes involve a function in which initial investment in structural retrofitting is excellent value for money, but cost-effectiveness declines with each new step of marginal investment. Industrial and technological hazards mostly involve limiting the proximity of incompatible land uses. For example, the explosion of a fertiliser factory at Toulouse on 21 September 2001 killed 12 people, injured 180 and caused serious damage up to 5 km from the site. The factory was located next to another plant that manufactured fuel for Ariane space-rockets, and although the latter did not explode as well, this was a clear example of hazards compounded by failure to separate them in land-use planning. On the other hand, intentional hazards such as terrorism are difficult to mitigate as the process relies on predictions of behaviour that may prove invalid and, often, massive investment in structural defences and technology, including sophisticated surveillance systems, blast-proof buildings and measures to limit access to sites.[24]

The solution to the problem of how to incorporate sustainable mitigation into reconstruction planning lies in information flow, collaboration and wise use of planning precepts. Research indicates that the higher the quality of basic information, the more it is likely that it will be used to inform hazard abatement measures.[25] In this context, risks should be assessed in terms of the pattern of hazards, the configuration of sites (topographically and, where appropriate, geologically), the design and construction of buildings and structural defences against hazards, and the provision of assistance and sanctuary (through evacuation). The measures need to be implemented at several levels, including the neighbourhood (detailed planning), the local authority area (general planning) and the level of regional and national plans, strategies, norms and codes. Like emergency plans, reconstruction plans must be updated and re-evaluated periodically.

Critical factors in this process include the economic trends that prevailed in any given settlement before disaster struck. Extra effort is required to turn endemic decline into a post-disaster renaissance. In the case of the 27 March 1964 earthquake in Alaska, the village of Old Harbor exhibited a trend of growth prior to the disaster and showed flexibility and adaptability after it. As a result, it recovered well, in contrast to the neighbouring village of Kagayak, which had been in decline before the event. The decline became terminal after it as Kagayak failed to recover.[26]

Much depends on whether the local administrative culture is fundamentally sensitive to the question of hazard abatement. In one community, which will not be identified here, the local government had learnt enough to make some elementary provisions to tackle the considerable seismic risk that afflicted the housing stock of the area. However, both the planning office and the municipal emergency operations centre were located in the town hall. Although this would normally be the most logical and appropriate place to house them, the town hall was situated in the local castle, which was the one building most likely to collapse in an earthquake. The situation did not bode well for post-disaster resilience.

Conclusions

Urban and regional planning is about ensuring public health, welfare and safety while guiding the process of economic development. These processes need not be unduly intrusive, but they must provide sufficient guidance to ensure that hazards are abated or mitigated to a satisfactory degree. This can involve both prohibition, for example on certain land uses at particular sites, or incentives, such as offering economic advantages to those who take action on mitigation.

Microzonation, the local evaluation of risk at specific sites, is an expensive process but a necessary one, in that good factual detail is the essential basis of hazard mitigation. If progress in risk reduction is too slow during times of quiescence, careful preparation during such periods can help it to accelerate during the "window of opportunity" provided by post-disaster reconstruction. At other times, great efforts may need to be made to promote awareness of hazards. In a study of landslide perception in Cincinnati, Jerry Green found that residents were not only largely unaware of the hazards, they were also unaware of the planning provisions that had been implemented to reduce them.[27] Disaster would, of course, increase such awareness dramatically, but it would obviously be better to achieve better understanding by more peaceful and less destructive means.

Endnotes

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