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Disaster recovery processes: Analysing the interplay between communities and authorities in Chennai, India

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Abstract

This paper analyses the underlying factors of a disaster 'recovery process'. Based on a household survey, conducted ten months after the 2015 South Indian floods in two affected constituencies (Mylapore and Velachery) of Chennai, residents were asked how long they took to recover from the floods and whether they took actively part in the recovery process. The results highlight that residents from the more affected constituency (Velachery) took significantly longer to restore physical aspects (e.g. energy, water, roads, etc.), but only partially longer for social and economic aspects. Aspects of social capital (leadership, communication, ownership and trust) were rated equally low in both communities. However, individual actions to help others or participate in volunteer groups increased more significantly in the constituency that was more affected. The findings from this case study point-out that flood disaster events trigger residents to become more solidary and active to help others, but have little impact on triggering a more active interplay between communities and authorities. This highlights that flood disaster events do not change inherent structural and institutional relationships between key actors (local government, communities, private sector, academia and NGOs) involved in disaster recovery processes.

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Keywords: disaster recovery process, community-authority interplay, floods, Chennai

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1. Introduction

The aftermath of a disaster often poses great challenges to communities to recover from the damages and losses [1]. Public and private infrastructure need to be restored and communities rebuilt. This process is commonly referred as 'recovery'. Within the disaster theory, the aspect of 'recovery' is widely seen as the least understood [1-4]. So far little is known about what is needed to achieve successful recovery outcomes [3, 5] and whether people and authorities in affected areas respond to such an event with increased interplay and coordination. Thus, the underlying factors of what enables recovery is still controversially discussed [6], and few quantitative approaches exist to identify possible linkages [3, 5, 7, 8].

A key reason which is considered to be responsible for failed or unsatisfactory recovery processes is a missing or distorted interaction between communities and authorities [9]. Thus, a failed community-authority interplay may result in disaster recovery activities to either not occur at all, to be slow or to be not adequate for the particular context [10-14]. For example, in a comparative analysis about post-disaster housing projects in Colombia, El Salvador and Turkey, [15] highlight the need to involve communities from the beginning into the process of designing new housing concepts. Another study about the 1994 Northridge Earthquake revealed that needs of communities were not sufficiently addressed in the provision of adequate relief and required NGOs to provide support [16]. According to [17], the interplay between communities and authorities during a disaster recovery is characterised by joint leadership, communication, ownership and trust. These factors are considered to be essential in triggering participatory- and community-based disaster recovery activities. Thus, an active community-authority interaction is considered [18] to be beneficial for triggering sustainable recovery processes [19].

This paper analyses whether the underlying factors of 'recovery processes' vary among areas located in the same context. More concretely, we conducted a comparative study in two coastal-urban communities (Mylapore and Velachery) in Chennai, India, following the 2015 South Indian floods, to assess through a household survey whether the recovery process was perceived differently in those two areas. The wider objective of this study is to understand if this disaster opened a 'window of opportunity' [20-22] and thus, increased the interplay between communities and authorities, or whether the social setting remains the same after this event [6].

2. Underlying factors of 'recovery processes'

'Disaster recovery' is defined as "restoring or improving of livelihoods and health, as well as economic, physical, social, cultural and environmental assets, systems and activities, of a disaster-affected community or society, aligning with the principles of sustainable development and "build back better", to avoid or reduce future disaster risk" [23]. This definition highlights the complexity of which aspects recovery includes. It also points-out that the local context needs to be considered and thus, differences exist between disaster affected areas on how the recovery processes takes place [8, 24]. It also stipulates that not only physical (e.g. electricity, water, roads, sanitation, etc.) items need to be restored after a disaster, but as well social (e.g. health [25, 26], nutrition, education, culture [27, 28], etc.) and economic (e.g. employment, household assets, etc.) aspects [8, 29, 30]. Post-disaster needs assessments highlight the multi-dimensional range of items and aspects that may need to be 'build back' and ideally 'built better' to avoid that future hazards cause disasters [30].

In the search of the underlying factors that trigger recovery processes, the concept of social capital serves to understand the interactions within communities and their relationships to authorities and other actors [21]. Trust, social norms and networks are considered to be crucial in triggering successful outcomes in rebuilding disaster affected areas [4, 21, 27, 31]. Strengthened information channels and exchanges within members of families and communities create human capital that is of equal importance to the availability of physical and financial capital [32, 33]. Considering that disasters are socially constructed the interaction of humans with each other and their participation [34] in disaster recovery activities is a decisive factor in delivering sustainable recovery outcomes [2].

In an attempt to put emphasis on the 'place' where disasters occur, and where ultimately recovery is needed, the concept of social capital is linked to a geographically defined entity [27]. Hence, people express a sense of belonging (ownership) to where they live and thus, identify themselves with their neighbourhood/community [35]. People's satisfaction on the recovery process therefore depends on whether they are integrated into the planning and shaping of their affected community [36]. In order to effectively make use of the social capital in a community, roles and

leadership of different members of a community need to be considered in the disaster recovery process [37]. Thus, leaders of communities may interact directly with the authorities and integrate their members' needs and expectations into the planning of the recovery process [11, 37, 38].

Finally, flexible approaches are needed to ensure communities and authorities interact effectively with each other in the recovery process [38]. Thus, 'top-down' and 'command-and-control' approaches may rather create conflicts between communities and authorities than support the recovery process [38]. Thus, a common understanding of how to engage and conduct 'recovery' requires open communication channels and trust between communities, authorities and other actors involved in the recovery process [39-41].

3. Methods

3.1. Case study location: Chennai

Chennai was badly affected by the 2015 South Indian floods. An estimated 301 people died and damages of around USD 3 billion were recorded. During an extensive period of heavy rainfall in November and December 2015 water catchment bodies outside of Chennai gradually filled-up until the water had to be released to avoid breaching of the dams. Ineffective communication to warn residents during the night about an upcoming flood wave after the dams were opened caused this disaster. The city stopped functioning for several days including the operation of the main airport of the city. Many people were stranded and left on their own until the Indian Army, community and voluntary groups provided relief. We selected two adjacent constituencies (Figure 1) because they are having defined jurisdictions, are both coastal and are located along the same river. However, unlike Mylapore, Velachery is more flood prone (located in a marshland) and has only recently been developed.

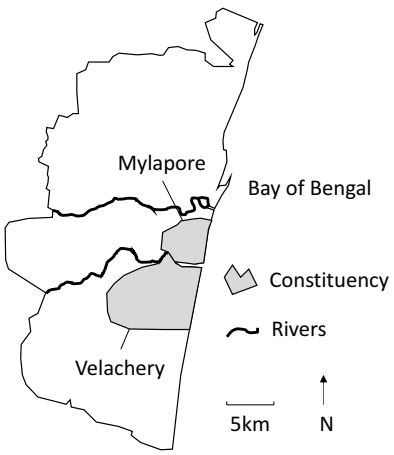

Figure 1. Location of constituencies in Chennai

3.2. Household survey data collection and analysis

For the purpose of our study, we selected two affected communities (Figure 1) to assess whether they were equally affected, recovered in the same time and differed in their availability of the underlying factors for recovery. The household data was collected between October and November 2016 in Mylapore and Velachery through a stratified random sampling technique. The data was analysed through the R Studio computer programme. As data were slightly skewed, comparisons between the two constituencies (Mylapore and Velachery) were calculated with Mann-Whitney-Wilcoxon and Kruskal-Wallis tests. Alpha levels for significance was set at 0.05.

4. Results

The overall results (Table 1) show that Velachery was significantly more affected by the 2015 South Indian floods. The total damages, damages to physical health and money spent for flood proof measures in the aftermath of the disaster were recorded significantly higher in Velachery compared to Mylapore. The level of education and type of gender do not correlate with the variable 'Total damage costs'. In contrast, households with a higher annual income tend to have higher education (p = <2.42e-14, tau = 0.298) and recorded slightly higher 'Total damage costs' (p = 0.006, r = 0.136). Thus, higher income and education does not necessarily result in less exposure to flood risk.

Table 1. Disaster profile of Mylapore and Velachery

Variable	Mylapore (n=257)	Velachery (n=264)	p-value
Gender			***0.01896****
Women:	*29.96%*	*60.23%*	
Men:	*70.04%*	*39.77%*	
Age (mean)	46.58	47.12	0.847*
Size of household (mean)	4.23	4.32	0.7001*
Disaster training before event (1 no training – 5 extensive training), mean	1.35	1.10 (n=258)	***0.00294***
Education			***1.325e-06****
No education:	*32.27%*	*16.87%*	
Primary school:	*15.54%*	*11.65%*	
Secondary school:	*27.88%*	*31.33%*	
College/university:	*24.30%*	*40.16%*	
State of employment			0.3238**
None:	32.68%	33.33%	
Freelancer:	2.72%	8.33%	
Part-time:	6.61%	7.56%	
Full time:	57.97%	50.76%	
Annual income (Indian Rupees)			
Median; mean:	92,000; 152,600	100,000; 247,000	0.3064*
Damage to housing (Indian Rupees)			
Median; mean:	10,000; 32,521	20,000; 56,545	0.09861*
Damage to assets (Indian Rupees)			
Median; mean:	7,000; 20,298	10,000; 47,587	0.05133*
Damage to physical health (Indian Rupees)			
Affected	*26.84%*	*34.85%*	
Affected, median; mean:	*0; 2,704*	*0; 3,042*	***0.0229****
Damage to mental health (Indian Rupees)			
Affected:	0.78%	2.65%	
Median; mean:	0; 19.45	0; 833	0.1003*
Total damage costs (Indian Rupees)			
Median; mean:	*30,000; 55,540*	*50,000; 108,400*	***2.949e-06****
INR spent for flood proof measures			
Spent money on flood proof measures:	*1.56%*	*15.16%*	
Median; mean:	*0; 101*	*0; 12,358*	***2.203e-08****

* Calculated with Mann-Whitney-Wilcoxon Test, ** Calculated with Kruskal-Wallis test

For the physical recovery (Table 2), we can see that Mylapore and Velachery were equally affected by the floods, but Velachery took significantly longer to restore electricity, water, roads, sanitation, solid waste management, communication and housing. The physical items electricity, water, communication and housing were perceived to be significantly better built back in Velachery compared to Mylapore.

Table 2. Physical recovery of Mylapore and Velachery

Variable	Mylapore	Velachery	p-value*
Electricity (affected in %)	99.61% (n=256)	99.62% (n=263)	
Recovery outcomes (0 no recovery – 3 better):	*2.59*	*2.72*	***0.0003317***
Days of recovery: median; mean; standard deviation	*7; 7.16; 5.77*	*7; 12.75; 16.08*	***9.183e-12***

Water (affected in %)	98.44% (n=253)	92.80% (n=245)	
Recovery outcomes (0 no recovery – 3 better):	*2.60*	*2.71*	***0.0001794***
Days of recovery: median; mean; standard deviation	*7; 6.89; 6.35*	*7; 16.74; 31.08*	***1.058e-13***
Roads (affected in %)	99.61% (n=256)	96.97% (n=259)	
Recovery outcomes (0 no recovery – 3 better):	2.56	2.58	0.05281
Days of recovery: median; mean; standard deviation	*7; 12.23; 32.69*	*10; 20.22; 39.21*	***4.307e-15***
Sanitation (affected in %)	99.61% (n=256)	90.53% (n=239)	
Recovery outcomes (0 no recovery – 3 better):	2.55	2.60	0.05159
Days of recovery: median; mean; standard deviation	*7; 7.74; 6.19*	*7; 18.08; 33.11*	***2.669e-11***
Solid waste management (affected in %)	98.44% (n=253)	93.93% (n=248)	
Recovery outcomes (0 no recovery – 3 better):	2.59	2.57	0.3994
Days of recovery: median; mean; standard deviation	*7; 7.84; 6.42*	*7; 21.25; 44.55*	***1.347e-14***
Communication (affected in %)	99.61% (n=256)	98.48% (n=260)	
Recovery outcomes (0 no recovery – 3 better):	*2.57*	*2.69*	***0.001434***
Days of recovery: median; mean; standard deviation	*7; 7.46; 5.79*	*7; 12.57; 16.12*	***5.379e-07***
Housing (affected in %)	80.93% (n=208)	82.95% (n=219)	
Recovery outcomes (0 no recovery – 3 better):	*2.38*	*2.56*	***0.001277***
Days of recovery: median; mean; standard deviation	*7; 22.44; 49.84*	*14; 33; 59.28*	***0.0001369***

* Calculated with Mann-Whitney-Wilcoxon Test

For the social recovery (Table 3), we can see that more health (physical and mental) cases were recorded in Velachery, but only the recovery of physical health took significantly longer in Velachery. A lack of food provision was equally high in both constituencies, but Velachery took significantly longer to fully restore the food supply. Access to school (education) was the same for both constituencies. Access to cultural places took a bit longer to be restored in Velachery compared to Mylapore. The social aspects nutrition, education and culture were perceived to be significantly better built back in Velachery compared to Mylapore.

Table 3. Social recovery of Mylapore and Velachery

Variable	Mylapore	Velachery	p-value*
Physical health (affected in %)	28.40% (n=73)	42.04% (n=111)	
Recovery outcomes (0 no recovery – 3 better):	*2.51*	*2.56*	0.1554
Days of recovery: median; mean; standard deviation	*7; 24.79; 61.26*	*7; 25.43; 32.62*	***0.04445***
Mental health (affected in %)	1.17% (n=3)	10.60% (n=28)	
Recovery outcomes (0 no recovery – 3 better):	2.33	1.67	0.3297
Days of recovery: median; mean; standard deviation	10; 106.70; 167.43	30; 111.40; 132.33	0.6083
Nutrition (affected in %)	60.31% (n=155)	59.47% (n=157)	
Recovery outcomes (0 no recovery – 3 better):	*2.53*	*2.61*	**0.04494**
Days of recovery: median; mean; standard deviation	*5; 5.74; 5.01*	*7; 14.73; 24.95*	***7.791e-12***
Education (affected in %)	41.25% (n=106)	57.56% (n=152)	
Recovery outcomes (0 no recovery – 3 better):	*2.34*	*2.44*	**0.00152**
Days of recovery: median; mean; standard deviation	30; 28..74; 5.74	30; 29.09; 15.81	0.1257
Culture (affected in %)	14.01% (n=36)	26.89% (n=71)	
Recovery outcomes (0 no recovery – 3 better):	*2.06*	*2.23*	***0.01325***
Days of recovery: median; mean; standard deviation	*30; 30.28; 6.17*	*30; 36.55; 53.46*	***0.04745***

* Calculated with Wilcoxon signed-rank sum test

For the economic recovery (Table 4), more households were affected in Velachery by income and employment losses, but not significantly. Surprisingly, more households in Mylapore had to replace household assets, but households in Velachery again took significantly longer to do so. Access to credits was a minor issue and thus, indicating that it is not a key factor of economic recovery. The recovery outcomes were the same for all aspects in both constituencies.

Table 4. Economic recovery of Mylapore and Velachery

Variable	Mylapore	Velachery	p-value*
Income (affected in %)	12.06% (n=31)	30.68% (n=81)	
Recovery outcomes (0 no recovery – 3 better):	2.29	2.14	0.375
Days of recovery: median; mean; standard deviation	30; 107.60; 132.9	30; 89.12; 113.55	0.3312

Employment (affected in %)	0.78% (n=2)	10.60% (n=28)	
Recovery outcomes (0 no recovery – 3 better):	2.86	2.71	0.6571
Days of recovery: median; mean; standard deviation	93.5; 93.5; 122.33	22.5; 29.89; 32.82	0.7321
Credits (affected in %)	0%	3.03% (n=8)	
Recovery outcomes (0 no recovery – 3 better):	NA	1.5	NA
Days of recovery: median; mean; standard deviation	NA; NA; NA	165; 159.90; 149.88	NA
Household assets (affected in %)	89.11% (n=229)	77.27% (n=204)	
Recovery outcomes (0 no recovery – 3 better):	2.12	2.13	0.3785
Days of recovery: median; mean; standard deviation	*30; 38.03; 64.87*	*30; 68.44; 90.68*	***3.005e-08***

* Calculated with Mann-Whitney-Wilcoxon Test

When looking at the underlying factors of recovery processes (Table 5), the results are mixed. On one hand, households in Velachery, after ten to eleven months, became more active in making their home flood proof, stock emergency supply and getting informed about flood mitigation options. Furthermore, households in Velachery became more solidary in terms of interacting with other members of their community, participating in volunteer groups and requesting assistance from neighbours. However, for the solidarity aspect, they do not offer actively more help to their neighbours in form of general assistance, materials and money. The satisfaction in the recovery process (home, health of family and neighbourhood) was perceived moderate and equally high in both constituencies. This highlights that despite the fact that the recovery efforts took longer in Velachery, people were patient and not less satisfied in the recovery process. Ownership to protect their home and the neighbourhood against future floods, was equally low in both constituencies.

The ability of all actors (local authority, community, private sector, academia, NGOs) to lead, trust and communicate with each other was perceived low to very low during the recovery process. The results do not differ for these aspects between the two constituencies. The household respondents perceived in both constituencies that they were hardly involved by the local authorities to shape the recovery process. Similarly, very few, and the same for both constituencies, households were asked about their needs after this event.

Although, the underlying factors of recovery processes are overall rather low and are only partially higher in Velachery, households in both constituencies express high interest and willingness to become part of the recovery (planning) process. Correlation tests between either one of the underlying factors with the recovery outcomes and speed of recovery were only for some few connections weakly significant.

Table 5. Underlying factors of 'recovery processes'

Variable	Mylapore	Velachery	p-value*
Satisfaction of recovery process			
Home: (1 very dissatisfied – 5 very satisfied)	3.51 (n=257)	3.43 (n=263)	0.9422
Health of family: (1 v. dissatisfied – 5 v. satisfied)	3.56 (n=257)	3.57 (n=263)	0.1418
Neighbourhood: (1 v. dissatisfied – 5 v. satisfied)	3.54 (n=257)	3.38 (n=263)	0.2341
Ownership in recovery process			
To protect home against floods: (1 no responsibility – 5 full responsibility)	2.44 (n=257)	2.51 (n=257)	0.2919
To protect community against floods (1 no responsibility – 5 full responsibility)	2.40 (n=257)	2.45 (n=257)	0.3497
Action (after the disaster)			
To make home flood proof: (yes)	*4.38% (n=251)*	*12.17% (n=263)*	***3.782e-09***
To stock emergency supply: (yes)	*23.51% (n=251)*	*41.83% (n=263)*	***1.156e-05***
To insure household assets: (yes)	21.51% (n=251)	20.91% (n=263)	0.8073
Get informed about flood mitigation options: (yes)	*9.16% (n=251)*	*20.91% (n=263)*	***0.0004141***
Solidarity (after the disaster)			
Talk more to other members of community: (yes)	*45.82% (n=251)*	*68.06% (n=263)*	***3.454e-07***
Participate in a volunteer group: (yes)	*52.99% (n=251)*	*64.64% (n=263)*	***0.006673***
Offer assistance to neighbours: (yes)	58.96% (n=251)	67.30% (n=263)	0.06618
Offer materials to neighbours: (yes)	58.96% (n=251)	62.74% (n=263)	0.4211
Offer money to neighbours: (yes)	50.10% (n=251)	50.19% (n=263)	0.7221
Request assistance from neighbours: (yes)	*33.47% (n=251)*	*52.47% (n=263)*	***1.865e-05***

Leadership in recovery process			
Local authority: (1 very bad – 5 very good)	2.06 (n=257)	2.12 (n=261)	0.4173
Community: (1 very bad – 5 very good)	2.23 (n=257)	2.05 (n=261)	0.5323
Private sector: (1 very bad – 5 very good)	2.28 (n=257)	2.08 (n=260)	0.1739
Academia: (1 very bad – 5 very good)	1.25 (n=257)	1.14 (n=261)	0.111
NGOs: (1 very bad – 5 very good)	1.50 (n=257)	1.68 (n=261)	0.1073
Trust in recovery process			
Local authority: (1 very bad – 5 very good)	2.05 (n=257)	2.01 (n=261)	0.9369
Community: (1 very bad – 5 very good)	2.31 (n=257)	2.07 (n=261)	0.382
Private sector: (1 very bad – 5 very good)	2.26 (n=257)	2.02 (n=260)	0.04056
Academia: (1 very bad – 5 very good)	1.26 (n=257)	1.13 (n=261)	0.02629
NGOs: (1 very bad – 5 very good)	1.50 (n=257)	1.71 (n=261)	0.1154
Communication in recovery process			
Local authority: (1 very bad – 5 very good)	1.65 (n=257)	1.68 (n=261)	0.6465
Community: (1 very bad – 5 very good)	1.69 (n=257)	1.68 (n=260)	0.913
Private sector: (1 very bad – 5 very good)	*1.71 (n=257)*	*1.60 (n=261)*	***0.04463***
Academia: (1 very bad – 5 very good)	*1.20 (n=257)*	*1.13 (n=261)*	***0.02794***
NGOs: (1 very bad – 5 very good)	1.27 (n=257)	1.41 (n=261)	0.2847
Involvement by local authority in recovery process (1 no involvement – 5 full involvement)	1.38 (n=257)	1.22 (n=258)	0.4226
Needs asked after event (1 no needs assessment – 5 extensive needs assessment)	1.46 (n=257)	1.35 (n=257)	0.8175
Willingness to participate in recovery planning (yes)	87.94% (n=257)	90.84% (n=262)	0.2833

***** Calculated with Wilcoxon signed-rank sum test

5. Discussion

In this exploratory study, we compared how local residents perceived the recovery process in their constituency ten months after experiencing a flood disaster. This study included a household survey in two adjacent urban constituencies in Chennai which were affected during the 2015 South Indian floods. The key findings are that although the more affected constituency (Velachery) took longer to recover from the floods, there are little indications that social capital supported the recovery process. Social capital aspects, such as ownership, trust, leadership, communication between the households and other actors of their constituency were perceived equally low in both constituencies. Instead, the recovery process was largely led by the local authorities which did not include residents in the recovery process. Nevertheless, we found that households in the more affected constituency became slightly more active and solidary as a result of this disaster.

Despite the absence of asking the affected residents about their needs and involving them in the recovery process, households in the more affected constituency were not less satisfied with the recovery process although it took longer for them to recover. This may indicate that people have great patience and are able to endure such a disaster regardless of the duration of recovery. Moreover, recovery outcomes were perceived for all physical, social and economic aspects to be higher in the more affected constituency. This implies that the longer the recovery takes, the better the recovery outcome is. This may also indicate that small damages are just fixed to the level that they function again. In contrast, bigger damages, particularly on infrastructures, require a thorough rebuilding and thus are re-built better.

This study showed a weak community-authority interplay in the recovery process. Findings from another case study [14] on the recovery from a super-cyclone in the State of Orissa in India indicate that entrenched and ongoing vulnerabilities may hamper the establishment of an active interaction between residents and local authorities. Thus, not only the affected households are challenged by such a disaster, but as well any other relevant actor. This may have been as well the case for Chennai which suffers from a distrust between residents and local authorities [42].

Further work may look at how to improve the underlying factors of a ‘recovery process’ in a context of distrust and where little interaction between residents and local authorities occur.

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