The Interrelation of Social Vulnerability and Demographic Change in Germany

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Abstract:
Social vulnerability in a developed country like Germany has a distinct profile that is significantly shaped by dynamic demographic changes. In-migration from other countries and the ageing of the population reform the fabric of society. New vulnerabilities arise not only through marginalisation or disturbances in the social welfare system, but also in context to natural perils. This social-environment interaction has implications on different scales, ranging from the household to the national level. Each level has its distinct vulnerability profile regarding exposure, susceptibility and adaptive capacities, which is transformed over the years by dynamical demographic modifications. River flood risk is constructed at the intersection of the hazard and the social patterns. This coupled system is in constant transformation which is a challenge for both scientific analyses and resulting policy recommendations. While scientific studies elaborate already extensively on demographic changes, hazard modelling, ecological stability, risk and vulnerability conceptualisation, still integrative applications are scarce. Whether this is due to lack of conceptual clarity or due to methodological limitations alone has to be clarified. The purpose of this study is thus to first apply a conceptual framework to identify social vulnerability and to integrate demographic dynamics and second, to reveal the
implications of demographic change for social vulnerability assessment in Germany. Within this assessment indicators and maps are constructed to enable integration of statistical data and household interviews. These tools allow for a regional comparison that may help to track changes in vulnerability dynamics.

1. Background of social vulnerability root causes in Germany

The scope of research on social root causes of vulnerability is subject to political orientations and intensive disciplinary debate (Wisner et al. 2004). With no aim of engaging into this debate, this paper will capture only certain social peculiarities using the structure of a widely accepted standard literature source on social vulnerability (Wisner et al. 2004, formerly Blaikie et al. 1994). Applying their model and terminology, the political and economic processes and structures underlying German society are ‘root causes’ and ‘dynamic pressures’ of a baseline social vulnerability. Social vulnerability cannot be reduced to poverty, but poverty is certainly a major topic in vulnerability research (Wisner et al. 2004: 12). A review of social strategies of the German government reveals that the scope of ‘poverty’ reduction has undergone major transformations (Bartelheimer et al. 2005). In the 1970s reporting of social conditions in Germany aimed at welfare development and ‘quality of life’ indicators (Zapf 1979). This social monitoring aimed at measuring welfare by social status and economic conditions. Mainly focused on economic conditions, this approach was augmented in later social reporting by topics like participation, exclusion, or precarious job-situation. Unemployment and integration problems are in the centre of the European ‘Lisbon Strategy’ and steer social cohesion and development agendas in Germany (Bartelheimer et al. 2005).

Social cohesion and inequality is defined by more facets than just absolute poverty in Germany. Poverty in Germany is often termed ‘relative poverty’, based on an average standard of living. Relative poverty is multi-dimensional, i.e. not restricted to financial resources (Strohmeier and Kersting 2003). Still, poverty in Germany is mainly tied to conditions of the national economy. The angst of unemployment is a major driver of a
new social reporting focus on ‘precariousness’. Unemployment has even been stated as a risk in a global questionnaire survey of comparing different risks (Eisler et al. 2006: 113). Low income interns and students were described as ‘generation precariousness’ (Bonstein and Theile 2006) because of an uncertain job-situation. Even a new class debate started, instigated by a report that detected a new poverty and precarious underclass in Germany (Neugebauer 2007). Although the class debate seemed outdated in political science by individualistic perspectives (Gillies 2005, Lawler 2005), especially market research uses social milieus (Sinus Sociovision 2007). Like class, certain milieus designate persons with a certain profile to lower class or upper class. This is done regarding the status of the persons in the political system of social democracy and capitalism in (social market economy) Germany. The downward mobility of the middle-class and a rising poverty gap are topics that dominate recent media coverage (Dougherty 2008, Tagesschau 2007) and economy (DIW 2008).

The demographic composition of German society undergoes major transformations. The age pyramid changed its shape dramatically in the past 50 years. The reproduction rate is so low that the population in Germany declines (BBR 2006: 19). This is partly compensated by a strong increase of immigration, which is more the case for western Germany (EEA 2006: 11). There are two ‘macro-forces’ or ‘dynamic pressures’ (Wisner et al. 2004); German society is ageing, and second, social integration is a major issue (Strohmeier and Alic 2006: 7). The ageing of the German society has severe consequences for maintaining the social welfare system of pensions and taxes. More and more old people live in Germany and the ratio is still on the increase (BBR 2006: 30). This imposes a strain for both the working population and the dependent elderly. It drags on economic growth, health and long-term care systems, and household resources (United Nations 2007). The second demographic change is led by immigration but also by a relative higher fertility of the population with migration background (Strohmeier and Kersting 2003). This is a benefit for the ratio of young people in Germany and partly buffers the problems posed by the ageing of the population. However, education and job qualification is often lower among youths with migration background (BMI 2007, Baumert et al. 2003). While this is not generally the case, it allows for identifying certain
social groups that might lack certain capacities like language proficiencies for understanding flood warnings, for example.

Social segregation and marginalisation can be observed for ethnical groups, but also for income and age groups. Social problems or ‘unsafe conditions’ are often related to urbanisation and population density (EEA 2006: 17) that create social focal points (Strohmeier and Alic 2006). Some city quarters are typified by integration problems of ethnical background, in combination with unemployment rates, social welfare recipients and pending poverty (Sturm 2007: 388). Older building structure, lack of access to public transportation and low education are further attributes of social focal points (Aehnelt et al. 2004: 63). Problems in some city quarters are the selective migration of affluent population into outer-urban areas, localised polarisation of special needs and social insecurity, erosion of traditional family- and neighbourhood-networks, integration problems, criminality, poverty and unemployment (Strohmeier and Alic 2006: 7). However, there are also some positive aspects like active networks and initiatives (Aehnelt et al. 2004: 76). Sub-urbanisation processes have replaced the favourite living areas from the city centres to the urban rims. While young and more affluent (double-income) families prefer the less densely populated suburbs, the elderly often remain in the city centre (Sturm 2007: 383). The prices of real estate and rent steer the location choice of specific age and income groups like young low income people or elderly citizens with low pension.

The spatial population distribution is not driven by economic aspects only. Housing structure is also a result of values and tradition. The life-style of the one family detached house is one predominant goal for many Germans and Europeans (EEA 2006: 20). Houses in Germany are a prime investment to be made in a lifetime and often connectivity to one location lasts for several years or even generations. This rooting manifests itself in the mindset and the persistence behaviour of many traditional Germans. Life-styles of cultural tradition and political tradition often imbue certain spatial regions.
Baseline social problems and specifications of the social fabric of Germany are summarised in the following table (Table 1). These problems can be structured into the Pressure-And-Release (PAR) model (Wisner et al. 2004). It highlights the backdrop upon which people are rendered generally vulnerable against stressors and natural hazards.

<table>
<thead>
<tr>
<th>Root causes</th>
<th>Dynamic pressures</th>
<th>Unsafe conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social welfare system</td>
<td>Unemployment</td>
<td>Poverty</td>
</tr>
<tr>
<td>Federal system</td>
<td>Social status – lifestyle</td>
<td>Precariousness</td>
</tr>
<tr>
<td>Social market economy</td>
<td>Ageing of the population</td>
<td>Underclass</td>
</tr>
<tr>
<td>Culture</td>
<td>Integration</td>
<td>Social segregation</td>
</tr>
<tr>
<td></td>
<td>Lack of or access to education</td>
<td>Urban density related problems</td>
</tr>
<tr>
<td></td>
<td>Persistence of tradition</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(Globalisation)</td>
<td></td>
</tr>
</tbody>
</table>

2. Who are the vulnerable to flooding?

“We are not an endangered species ourselves yet, but this is not for lack of trying.”

Douglas Noel Adams

When looking at humans they are not determined by a single factor like poverty only. Human profiles are composed of several characteristics and conditions. With a limited set of characteristics, certain ‘typical’ social groups can be identified. Of course, such a typology necessarily comes too short to explain the complexity of human facets. But they are helpful to identify patterns of vulnerable groups. Studies on social milieus or class describe disadvantaged people. For example, the political milieu of the precarious group is characterised by low social status, downward social mobility, low to middle level of education, the highest ratio of unemployment, blue-collar working class, predominantly male, living in Eastern Germany and in rural areas (Neugebauer 2007: 82). Eight percent of the population belong to this political milieu. This group is much related to social welfare and unemployment, especially long-time unemployment. Social milieus and class are constantly shifting. End of the 1980s, German poor were elderly women, in the 2000s the poor are the young children and young mothers (Strohmeier and Kersting 2003). Children of single-mothers are especially hit by poverty, as are children of immigrants and recipients of social welfare (UNICEF 2008). The education opportunities of children
are linked to family structure and social class, however less in Eastern Germany (Baumert et al. 2003). All here presented typified groups are rendered disadvantaged concerning general social standards. They struggle mostly for economic equality but also for status recognition.

But are those groups ‘the vulnerable’ to natural disasters, or more precisely to river floods? This is a very difficult question to answer for at least three reasons: First, there are yet too few studies on this issue in Germany to have clear criteria what makes a person vulnerable to natural hazards. Second, those who are most social disadvantaged must not be the same that are exposed or get most severely affected by floods. The affluent, one may argue, have more values to lose and can afford to live more exposed along attractive river-side location. Third, who is vulnerable is very much dependent on interpretation and definition. If vulnerability is a function of economic loss, then start-up entrepreneurs who bear a high financial risk would be the most vulnerable group, not the poor.

Few studies have established a relationship between flood impact and social groups in Germany (Table 2). The studies are typically of a very local focus and the findings cannot easily be generalised. In Beuel, a city quarter in Bonn, new and inexperienced residents had been more affected by the floods of the Rhine in 1993 and 1995 than the old population (Pfeil 2000). The new residents were not yet integrated and familiarised with flood protection and emergency behaviour. Conversely, in Eilenburg and surrounding towns at the flood of 2006 of the river Elbe, the elderly and long time residents were especially hit. Reasons were they believed the flood would not rise above previous flood level. They were sceptical about preparedness measures and evacuation, whereas young working people were more mobile, flexible and better informed (Kuhlicke, pers. com. 2006, Steinführer and Kuhlicke 2007: 64). The study of Eilenburg seems especially support that old age and tenure played a key role (Steinführer and Kuhlicke 2007: 114). The following table reviews typical characteristics of social vulnerability as found in studies in Germany.
<table>
<thead>
<tr>
<th>Demographic characteristics</th>
<th>Characteristics of higher vulnerability</th>
<th>Characteristics of higher capacities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Old people</td>
<td>Suffering physical/health consequences&lt;br&gt;Received less support (Steinführer and Kuhlicke 2007: 113, 114)&lt;br&gt;Less capable of performing emergency measures effectively (Thieken et al. 2007: 1031)&lt;br&gt;Forced to seek shelter in emergency accommodations (Birkmann et al. 2008: 134-6)</td>
<td>Holding insurance (Steinführer and Kuhlicke 2007: 113)</td>
</tr>
<tr>
<td>Very young people</td>
<td>Need more time to evacuate (Birkmann et al. 2008: 134-8)</td>
<td>Suffering less physical/health consequences&lt;br&gt;Suffering lower general impact on household (Steinführer and Kuhlicke 2007: 113)</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td>Female gender: Higher risk perception and preparedness for action (Martens and Ramm 2007, for city of Bremen)</td>
</tr>
<tr>
<td>Education</td>
<td>Lower education: Received less support (Steinführer and Kuhlicke 2007: 114)</td>
<td>Higher education: Capable of performing emergency measures effectively (Thieken et al. 2007: 1031)</td>
</tr>
<tr>
<td>People without local networks</td>
<td>Experiencing lack of information (Steinführer and Kuhlicke 2007: 113)</td>
<td></td>
</tr>
<tr>
<td>Household size</td>
<td>One person households: A majority considers itself dependent on others in case of an evacuation (Birkmann et al. 2008: 134-6)&lt;br&gt;They spend the least amount of money for flood protection (Kreibich et al. 2005a: 122)</td>
<td>Younger families seem to invest in insurance and retrofitting Household size correlated with taking effective emergency measures&lt;br&gt;(Thieken et al. 2007: 1031, 1034)&lt;br&gt;3-5 person households are more ready to take action and take more responsibility (Martens and Ramm 2007, for city of Bremen)</td>
</tr>
<tr>
<td>Long term residents</td>
<td></td>
<td>Better informed than new residents (Pfeil 2000: 57, for city quarter of Beuel, for certain aspects Wöst 1992: 60 for community Irbach at the Danube)</td>
</tr>
<tr>
<td>Students</td>
<td></td>
<td>Less damage and loss (Plapp 2004: 396, for city of Passau)</td>
</tr>
</tbody>
</table>

The social vulnerability characteristics have to be regarded in the context of international vulnerability studies for the theoretical framing. Lists and reviews of social vulnerability parameters are provided by several authors (Morrow 1999: 10, Tapsell et al. 2002: 1520, Cutter et al. 2003: 246, Schneiderbauer and Ehrlich 2006: 88, Simpson and Katirai 2006: 14, Masozera et al. 2007: 301) summarise social vulnerability characteristics found in other countries for comparison. This comparison is therefore valid, since some
characteristics like old age are generally due to cause higher degrees of mortality to
floods. Eight of nine persons killed within buildings by a flash flood in Southern France
in 1999 were of pensioners’ age (IKSR 2002: 14). A study in the UK (Tapsell et al. 2002:
1522) states that age of 75+ has been shown in epidemiological research to display a
sharp increase in health problems. Experiments revealed thresholds up to which people of
average age and constitution could withstand loss of stability or manoeuvrability due to
water height and velocity (RESCDAM 2000: 44). The findings concluded that people
with reduced physical strength would have lower thresholds to withstand and this would
typically include the elderly, disabled or persons with additional loads like women caring
for children.

On the characteristic of income deficiencies, the financially deprived are less likely to be
insured and therefore have more difficulties in recovery (Tapsell et al. 2002). But there
are also special groups severely affected by floods which are often forgotten in standard
vulnerability assessments. One of them are the transient or homeless who typically are
not recorded in standard statistics (Wisner 1998, Masozera et al. 2007). Campers are
often highly exposed as camp sites are often in flood plains. 23 campers died in Savoy
1983 when camping in a flood plain (IKSR 2002: 15). 10 of 24 persons during a flash
flood in Southern France in 1999 were killed inside their cars (IKSR 2002: 14).
Evacuation assistance needs are identified as a major indicator of social vulnerability
(Chakraborty et al. 2005). Certain variables have been analysed for the construction of a
social vulnerability for evacuation assistance index. They include the population up to 5
years of age and population over 85 years (Chakraborty et al. 2005: 26). Similar
observations on evacuation needs of special needs groups like children, the handicapped
or persons in need of special medical care have been made for Germany and
neighbouring countries (IKSR 2002: 16).

3. The Social Vulnerability Index (SVI)
At the county level, the SVI a pilot approach as to how to identify and compare social
vulnerability for whole river-channels in Germany. A procedure is conceptualised as how
to incorporate social vulnerability within a coupled human-environment system’s
perspective with disaster risk assessment: the theoretical concept of the BBC framework (Birkmann 2006 and applied in: Fekete 2009) which combines hazard and vulnerability in a risk reduction perspective. The BBC framework also incorporates different spheres, the social, economic and ecological and thus provides an entry point for the integration of coupled social-ecological systems analyses. It also permits the inclusion of more social-perspective-driven research to identify the root causes of vulnerability (see first section of this paper). The framework furthermore enables later cross-validation with data and studies from other sources and other spatial levels (Fekete et al. submitted, Fekete 2008). The theoretical foundation of this vulnerability assessment is the base-line for the methodological development of the vulnerability indicators which capture the exposure, sensitivities or capacities of social groups concerning river-floods.

The SVI is an index that is aggregated by equal weighting and simple summation from three main indicators of social vulnerability:

- Fragility: elderly persons above 65 years per total population
- Socio-economic condition: unemployed persons and graduates with only basic education per total population; apartment living space per person
- Region: degree of urbanity or rural area, measured by population density lower / higher than 150 persons per km² and the number of apartments with 1-2 rooms per total number of apartments

Indicator creation: the 6 input variables are normalised to values from 0 to 1 and by simple summation the three indicators are created. The SVI contains value ranges from 1,8 to -1,8 and is displayed in defined equal intervals in 0,2 steps. The indicators contain value ranges from -1 to 1 and are displayed in defined equal colour intervals in 0,1 steps.
The main outcome is a social vulnerability map of population characteristics towards river-floods covering all counties in Germany (Figure 1). This map is based on a composite index of three main indicators for social vulnerability in Germany - *fragility*, *socio-economic condition* and *region*. These indicators have been identified by a factor analysis of selected demographic variables obtained from the federal statistical office. Therefore, these indicators can be updated annually based on a reliable data source. The data selection for these indicators has been conducted after the general patterns of baseline root causes of vulnerability in Germany (see section 1) but also after the indications of impact on different social characteristics by floods in Germany (section 2).

Low SVI counties are characterised by strengths towards river-floods. These strengths are prevailing capacities for river-flood mitigation, for example, financial capacities for private preparedness measures and recovery from floods by high income sources. These counties lack indications for potential exposure to floods like high population density. Sensitivity like physical fragility of elderly citizens is also typically low. Counties with
high SVI are characterised by predominating weaknesses towards river-floods. These weaknesses are lack of capacities, high degrees of sensitivity and indications for exposure potential. The SVI allow for displaying the root causes of social vulnerability and the spatial identification of vulnerable regions in Germany.

4. Social vulnerability and demographic change
Demographic change is one key driver transforming the pattern of social vulnerability in Germany. From the two main drivers of demographic change in Germany (first section of this paper) the ageing of the population is of major concern for aggravating the quota of fragile people in Germany. The distribution of a projected increase of ageing population is not uniquely dispersed over Germany (Figure 2). Regions with less economic prosperity especially in the East of Germany are especially prone to this change. The whole population and social system is affected by lesser and lesser working age people to provide for taxes and medical care of the elderly. Since the elderly are those most dependent on assistance for example in the case of evacuation (Chakraborty et al. 2005, Fekete 2009), these areas with a higher ratio of population increase are priority areas for disaster mitigation planning.
Ageing of the population is only one driver of demographic change. The Federal Office for Building and Regional Planning (BBR) regards the low birth rate since the 1970s, the growing internationalisation by in-migration and the individualisation of the population with more and more single households as key drivers of demographic change (BBR 2008 and www.bbr.bund.de, accessed 25 March 2009). Since demographic change affects different regions in Germany, social vulnerability patterns will also change, independently of the hazard development e.g. by climate change, urbanisation, global change, etc. This is an important future field of research. The SVI is one tool for monitoring and projecting static as well as dynamic compositions of society in relation to various hazard and demographic change scenarios. It is capable of integrating demographic change indicators and recalculating the social vulnerability part that is not directly linked to the hazard. Social vulnerability is therefore an important topic for cross-cutting planning like spatial planning or civil protection. It is thus also an important cross-cutting topic for capturing specific human facets of global environmental change by focusing on demographic and human dimensions rather than on the hazards only. This includes climate change in terms of developing necessary adaptation strategies but is at the same time not limited to it. Demographic monitoring and natural hazards mitigation will continue to receive attention in the future. The integration of demographic scenarios is just one area for further exploration of the versatility of the SVI. Scientists and decision makers will need to explain complex risks and developments to the public. The social vulnerability and the disaster risk maps that can be derived by combining the SVI with hazard scenarios like extreme floods (Fekete 2009) are contributions to the generation of long-term monitoring and comprehensive illustration of complex risk developments.

**Literature**


