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Urban shrinkage as a shock? Challenges for modelling human- environmental interaction

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Abstract: Urban shrinkage is a development path that has spread widely across Europe and worldwide. Shrinkage represents a challenge for urban planning and policy-making. Often, cities have lost population as reaction or response to extreme and unexpected events which will be understood as shocks in this paper. Modelling can help to better understand the relation between shock events and urban shrinkage as a response to them. Given this background, the purpose of this paper is a threefold one: Firstly, urban shrinkage is introduced and discussed as a response to shock events. Secondly, the functioning of urban shrinkage as a response to shock events is explained using the example of the postsocialist transition after 1989 and its effects on cities. Thirdly, processes and variables characterizing urban shrinkage are identified that might form a basis for modelling support for a better and more comprehensive understanding of its impacts. The explanatory power of the shock approach is, finally, critically reflected.

Keywords: urban shrinkage, shocks in human-environmental systems,
urban modelling, postsocialist transition

1. INTRODUCTION

Urban shrinkage is a development path that has spread widely across Europe and worldwide (Rink et al. 2009). Regions affected by urban shrinkage are, for example, in Europe's old industrial regions, large portions of European postsocialist countries and in the "rust belt" in the U.S. Recent shrinkage has also occurred in Japanese, Australian and South African cities. Shrinkage impacts on many fields of human-environmental interaction in cities, e.g. on land use, housing and population development as well as supply-demand relations and density bringing about abandonment, vacancies, underuse and decay of urban residential space, industrial sites and infrastructures (Haase, D. et al. 2007). Shrinkage represents a challenge for urban planning and policy-making since it demands for new strategies for decision-makers who lack mostly the appropriate knowledge and financial resources. Often, cities have lost population as a result of or response to extreme, sudden and unexpected events which will be understood as shocks in this paper. Given this background, the purpose of this paper is a threefold one: Firstly, urban shrinkage is introduced and discussed as a response to shock events. Secondly, the functioning of urban shrinkage as a response to shock events is explained using the example of the postsocialist transition after 1989 and its effects on cities. Thirdly, processes and variables characterizing urban shrinkage are identified that might form a basis for modelling support for a better and more comprehensive understanding of its impacts. The explanatory power of the shock approach is, finally, critically reflected.

2. HOW DO WE CONCEPTUALIZE URBAN SHRINKAGE?

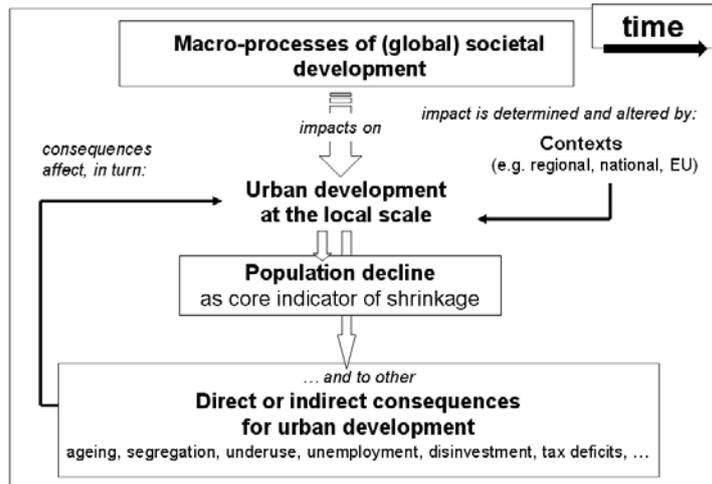
Within the framework of an international research and together with urban modelers, we developed a process model explaining urban shrinkage. We conceptualize it as an empirical phenomenon resulting from the specific interplay of different macro processes of global (societal) development at the local scale (Figure 1). Such macro-processes may be related to the economic decline, demographic change or settlement system changes in form of suburbanization or urban sprawl, as well as to environmental hazards or changes in the political or administrative system, e.g. through border changes, warfare, in- or exclusion of territories.¹ Urban shrinkage occurs when the interplay of the mentioned macro-processes leads to population decline, which we define as being the main indicator for urban shrinkage, and to other direct or indirect consequences for different arenas of urban development.

Apart from population change, the interplay of macro-processes also leads to other direct and indirect consequences for urban development affecting many indicators and characteristics of urban development such as the population structure, labour market, socio-spatial differentiation,

¹ While single macro-processes sometimes are predominant in a particular setting, in other settings it is difficult or almost impossible to work out any hierarchy among them.

housing, land use, social and technical infrastructure, municipal budget, investment and local economy etc. (Figure 1). We speak of direct consequences when they are mediated by population losses (e.g. housing vacancies, underuse of infrastructure, and decrease in income tax revenues). We speak of indirect consequences when they emerge through a combination of feedback loops (e.g. patterns of segregation, specifics of unemployment structure, and strategic policies of housing companies).

Figure 1 Process model of urban shrinkage.



Source: Großmann, Haase, A., Rink (2012)

These impacts of shrinkage on different policy fields affect, in turn, the further urban development in the respective city shaping a specific trajectory. Job losses and a lack of attractiveness to investment can, for instance, lead to even more disadvantages of the city with respect to global market competition and, subsequently, to decreasing investment, decreasing job offers and thus further losses of population of the age groups able to work. Housing supply surplus as a consequence of out-migration, for instance, can lead to a decrease of housing prices or even to a breakdown of housing market segments. It might also offer the opportunity to restructure those areas by less dense, higher quality housing. Although we set the local situation in focus, we are well aware that local processes are impacted and altered by supra-local contexts, e.g. of the regional, national and EU level. Since shrinkage is a highly dynamic process, this causal model has to be set always into a temporal context, too.

2. URBAN SHRINKAGE RESULTING FROM SHOCKS IN HUMAN-ENVIRONMENTAL SYSTEMS

2.1 Debates on shocks in human-environmental interaction

Some of the macro-processes which we identified in our causal model above (Figure 1) as causes for urban shrinkage are discussed in scientific literature as shock events. Shocks can be, in a general manner, defined as events that can cause sudden, drastic changes in different fields such as demography, economy, environment etc. A shock can be either positive or negative; likewise, it can be temporary or permanent. Normally, shocks are surprising (*per se* or with respect to the scope and impacts of their consequences) and hardly to be integrated into planning/strategic thinking since they are hardly to predict. A shock may come in a variety of forms:

- age shocks/ageing *per se* as a shock for societal and economic systems (e.g. Pearce 2010, Williamson 2001, Bauduin and Lambrecht 2006, Kenc and Sayan 1998, Hishow 2011), in more detail: ageing (due to both decrease in births and longevity) as an unexpected shock for pension funding schemes (e.g. Conesa and Garriga 2009, Faruquee and Mühleisen 2003 with respect to fiscal sustainability, also 2001);
- demographic shocks, e.g. the breakdown in birth rates to lowest-low fertility rates (Kohler et al. 2002) as response to political, economic etc. transitions as happened in former state socialist countries in Eastern Europe after 1989, for an overview see Steinführer and Haase 2007);
- economic shocks that may happen in the supply of staple commodities (e.g. oil) and can cause prices to skyrocket, making these commodities expensive to use for business purposes; or: the rapid devaluation of a currency would produce a shock for the import/export industry because a nation would have difficulty bringing in foreign products (<http://www.investopedia.com>);
- there is an increasing body of literature on fiscal shocks caused by the 2008-9 financial crisis (e.g. Calomiris et al. 2010), e.g. their macroeconomic effects (Jermann and Quadrini 2009);

- climate (change) shocks with relation to long-term climate changes with respect to global warming, shortcomings in water resources and weather extremes (e.g. Bard 2002, UNDP 2007);
- shocks caused by resource shortcomings, e.g. through oil or water scarcity (Hamilton 2011).

The use of the term shock in all these debates relates to the following type of events or developments: drastic changes of partly unexpected nature that represent challenges for existing natural and societal regulation systems and mechanisms destabilizing current societal organization principles (e.g. market principles, pension systems, welfare system). Temporally seen, shocks may relate to sudden events but also to longer-term developments when it comes e.g. to ageing or climate change. What is especially interesting for us with respect to these debates is the fact that shocks impact on human-environmental systems without generally being integral parts of these systems themselves. So, there is a causal or dependency relation between the shocks as such and the systems responding to them. Subsequently, for our purpose, we define a shock (generally) as an event or process that produces a significant change within another system, e.g. an urban (human-environmental) system, occurring mostly but not necessarily outside of it. The following section sets the city in its administrative boundaries as a human-environmental system and urban shrinkage in relation to this definition being aware of the fact that a city is not a closed system and influenced by its hinterland and further contexts from regional to global.

2.2 Urban shrinkage as a response to shock events

There is no specific debate on shocks with respect to the urban realm. There is a discussion on the "urban crisis" in the US relating to the decline of old industrial cities such as Detroit in the 1970s and 1980s ("voices of decline", see Beauregard 1993) and in UK on the abandonment in and of large cities (Power and Mumford 1999). There is also a debate on the dissolution of the European city or of settlement structures in general as a consequence of population exodus (Siebel 2004: 36-40, Le Galès 2002: 176, who refers even to a coming "post-city era"). The scholarly debate on urban shrinkage addresses the above mentioned fields in many respects without using terms such as "shock". Major strands of discussion related to urban shrinkage deal with demographic shifts, counterurbanisation uneven economic development at the regional and local scale as a result of an unequal spatial division of labour as well as result of capital shifts/shift changes in capitalism. All these explanation approaches do not point to the term "shock" but to urban shrinkage (as a specific pathway of urban development, alternatively called decline, decay, blight etc. in this literature) as to a response to elements of surprise/sudden, unpredictable events or developments that fulfill the characteristics of calling them a shock. The approach to deal with shrinkage with respect to shock events, would relate more to population loss or urban abandonment in the result of natural hazards such as flood events, or political events such as warfare, in other words: to abrupt, radical changes.

Subsequently, we look at urban shrinkage as a result of or response to shock events. Related to our definition of a shock from above, this means that the event or process itself happens at least mainly outside a specific city or urban system but it impacts on a number of urban systems localized in the scope of its area of influence. Shrinkage represents a result of/response to shocks in a twofold way. On the one hand, cities are losing population as a consequence of economic decline, demographic shifts/breakdowns in birth rates, political turnarounds, environmental catastrophes etc. Subsequently, population loss as such which we determined as main indicator of our conceptualization of shrinkage could be a response to the shock event. On the other hand, the consequences of population decline in different policy fields of urban development, e.g. in the fields of land use, infrastructure, housing etc. could be interpreted as results of or responses to shock event, too. Concluding, we can say that shrinkage as a result of a shock event consists not of one process representing the response but of a complex body of interrelated processes, causal relationships and feedback loops including many single processes. Apart from that, shrinkage as a response to a shock affects both the human and environmental conditions of an urban system. To give an example: Decreasing demand results e.g. in housing vacancies, closure of industrial sites and abandoned land when one looks at the built environment, to selective losses of population, workforce, and human capital when one looks at the social environment, as well as new niches for urban greenery/wilderness and eventually less contamination due to closures of industrial sites when one looks at the ecological environment.

3. EXAMPLE: POSTSOCIALIST TRANSITION AS SHOCK FOR URBAN SYSTEMS AND SHRINKAGE AS RESPONSE

We decided to focus on the postsocialist turnaround as an example of a shock for regions leading to urban shrinkage. The transition brought about a comprehensive, far-reaching change in nearly all fields of society in a very short time, literally "over night", and it was unexpected to happen even some months before. We have mainly two reasons for this choice: Firstly, the postsocialist transition represents not a natural hazard but a societal breakdown which differs due to its very nature from natural "shocks" such as flooding events, earthquakes etc. The second reasons relates to our definition of a shock where we pointed to its surprising nature. The postsocialist transition was surprising to most of the people in the world although there was already knowledge on the stagnation of state socialist societies and the fact that there could be some changes. There

was, however, nothing known about the course and real consequences of the transition, neither about its scope and speed – all this was nearly unpredictable still after its beginning in 1989. Urban regions were heavily impacted by transition in a threefold sense: Firstly since urban regions were main arenas and centres of change, secondly since they saw a rapid transformation of their political, economic and social foundations and thirdly since they had to cope with all the rapid changes without being prepared for that. As a consequence, there were some common new challenges for urban regions in the course of 1989 transition. One of them was urban shrinkage – cities in the former state socialist countries and regions lost population, economic strength and attractiveness as a home to people. Many of them have to fight with shrinkage-related problems until today. Due to recent studies, urban shrinkage has its current pole in Eastern Europe where the majority of large cities is still shrinking (Turok and Mykhnenko 2007). Urban shrinkage as a “problem of transformation” was hitherto rarely addressed (for exceptions see Großmann et al. 2008, Haase, A. et al. 2008, Rink 2010).

3.1 In which respect does the post-1989 transition represent a shock?

The political turnaround in 1989 represents one of the big surprises at the end of the 20th century. There was only a non-public discussion among scientists and opinion leaders in some state socialist countries on alternatives to the state socialist model or necessary reforms before 1989 but nobody expected the breakdown of the whole state socialist block in only a few years – starting with Poland, Hungary and the GDR in 1989 and ending with the breakup of the Soviet Union and Yugoslavia in 1991. It was caused by both endogenous and exogenous forces but its causes and course vary from country to country. Whilst transition brought about sudden, abrupt changes in some cases, e.g. in the GDR with the end of its existence or Romania with the end of abortion prohibition after the disempowerment of Ceausescu’s regime, in other cases it impacted more as a catalyst for already existing developments such as economic decline in some old-industrial regions or decrease in births in countries such as GDR, Poland, Czech Republic etc in the 1980s. So, there is no one “type of impact” of transition on the affected societies but a variety.

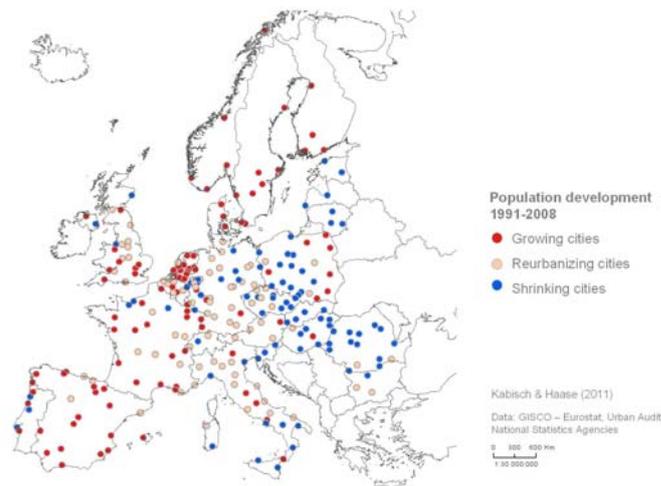
Concerning its impact on urban regions, transition worked both as a trigger for shrinkage in some cases and as a catalyst in others. While some cities fell into shrinkage responding to economic decline resulting from the breakdown of the state socialist market(s) (e.g. cities like Donetsk, Timisoara, Ostrava), others already suffered from stagnation or even population decline during the 1980s (e.g. cities like Łódź or Leipzig). Shrinkage met cities mostly unprepared – planning systems and legal frames were oriented to further growth, all the more since after the political turnaround catch-up modernization and marketization were the main determinants of local and regional policy-making (Haase, A. et al. 2011). Expectations were focused on growth but reality went in the opposite direction.

Despite some warnings from demographers and scientists, the demographic consequences of out-migration and lowest-low birth rates leading to massive ageing were largely ignored in the 1990s, the same applies to the consequences of shock privatization that were applied in some of the transition economies that resulted in mass unemployment and the out-migration of many people from cities to their home regions. Subsequently, shrinkage was “discovered” as a fact/reality and surprised local population and policy-makers although its harbingers were well-known and visible throughout more than a decade. Shrinkage as a response to transition affected all arenas of the urban system – urban society, the built and natural environment in a complex manner (see details in the next section).

3.2 Urban shrinkage as a response to post-1989 transition

Postsocialist transition had an immense impact on urban development, at least on the population development in many cities in former state socialist countries. After 1990, the “pole of urban shrinkage” moved to Eastern Europe where – due to recent studies – 3 out of four large cities (<200,000 pop.) are shrinking (Turok and Mykhnenko 2007, Steinführer et al. 2010). Many of them fell into shrinkage after 1989; others started to shrink before but population losses were accelerated after 1989 – subsequently, shrinkage can be interpreted as a more or less direct response to the changes brought about by the 1989 transition, i.e. the shock event. Figure 2 shows a map with population development trends across Europe from 1991-2008 – the “pole of shrinkage” in its eastern parts is clearly visible but also that urban shrinkage is an issue across the whole continent.

Interpreting urban shrinkage as a response to the post-1989 transition shock in the light of our causal model (Figure 1), the shock would have happened at the level of the macro-processes listed in the model as causes for population decline. It caused or accelerated complex changes within the local setting of an urban system. It is not casually that the post-1989 transition has often labeled also as “turnaround” or “breakdown” – change happened in almost all arenas or policy fields of urban development: the political institutions and government, urban society and population, local economy and labour market, housing market, land use etc. Accordingly, postsocialist shrinkage represents a complex development being characterized by a lot of different consequences as shown in the lower part of Figure 1. Not only that there were a lot of changes, these changes also interacted and led to fluid and hybrid “post-socialist” structures containing characteristics and mechanisms from both the old and the newly emerging system (Haase, A. et al. 2011: 81).

Figure 2 Population development of large European cities 1991-2008

Source: Kabisch, N. and Haase, D. (2011)

3.3 Complexity of urban shrinkage: identifying processes and variables

To allow for a more detailed understanding, we give an example for the complexity of processes related to shrinkage. We show the intersection of selective in- and out-migration, resulting supply-demand mismatches and land use change in shrinking cities. Leipzig in eastern Germany (pop. 1933 713,470; 1989 530,000; 1998 437,000; 2008 515,000) representing a long-term shrinking city over several decades until late 1990s, serves as a meaningful example for this. Leipzig had lost almost 20 per cent of its population between 1989-1998 due to job-related out-migration (being a consequence of de-industrialization) and age-selective suburbanization. Some 80,000 jobs were lost in industry, which led to high unemployment rates, a characteristic that was unknown to the eastern German society so far. As a consequence, people went away for jobs. The residual population has undergone rapid ageing making Leipzig one of the oldest large cities in Germany (Kabisch et al. 2008: 17). These massive population losses led to enormous housing vacancies (which peaked in 2002 with 64,000 flats and some 20 per cent of the whole stock, see Rink et al. 2011: 46) and surplus utility infrastructure in many districts of the city.

Vacancies and moderate housing prices/rents gave opportunity to a relatively broad spectrum of population to move house which resulted in high residential mobility numbers, high fluctuation and an "exchange" of population in some of Leipzig's districts (Steinführer et al. 2009). In 2001, a state funded demolition programme started to re-balance the housing market and save housing companies from bankruptcy (Rink et al. 2011). Neither housing vacancies nor demolitions affected the single parts of the city in an equal manner and thus created new differences in density of population and use of housing, land use etc. Vacancy development and demolition activities were determined by a range of factors such as policy of the housing companies and new investors, priorities of municipal planning, residential mobility decisions by the inhabitants and in- and out-migrants as well as normative settings. The use of single parcels of urban land developed in a chaotic and path-dependent way. Perforation, that is the dissolution of the street or block structure due to abandonment or shortfall of use, evolved to be the predominant characteristics of land use change under the conditions of shrinkage (see also Haase, D. et al. 2007, 2012).

Both housing vacancies and demolition activities affected the attractiveness of residential areas in different ways: While housing vacancies impacted negatively on the attractiveness of some districts from the perspective e.g. of ownership oriented groups or families, these districts became more attractive for other potential in-migrants such as students or migrants. Demolitions led to less vacant housing and more green spaces in the affected districts; at the same time, residents moved out simple due to the uncertainty, that their block could be the next to be demolished. After-housing brown- or greenfields changed the density of built environment in the affected districts, the quality of open/green space etc.

The direction of demolitions and emergence of new brownfields or perforated structures can merely be planned due to different interests of the involved actors (urban planning authorities, land owners, housing companies etc.). Normative settings such as preferences to maintain old housing stock and to demolish post-1945 blocks in large housing estates conflict with real vacancy concentrations and interests of owners.

Summarizing, we can identify the following processes and variables being crucial for modelling causal relations, intersections and feedbacks between the developments described above (Table 1):

Table 1 Processes and variables characterizing urban shrinkage from the perspective of population development and land use

Process	Explanation	Variables
out-migration	Out-migration includes all sorts of population outflow from a city including suburbanization.	- no./per cent of in-migrants - no./per cent of out-migrants - migration balance
ageing	Ageing is meant in terms of changing age structure and longevity.	- age group percentages - ageing index - percentages of old & high aged
above-average residential fluctuation/change	Underuse and moderate rents/housing prices lead to more opportunities of residential mobility for a higher number of social groups. As a result, the residential make-up of districts fluctuates more quickly and can also change.	- percentages of recent out- and in-migration - change rates of socio-demographic and socio-economic features of the residential population
de-densification	With respect to population, built structures, utility infrastructures, transport etc.	- decrease in density values in per cent or other measures
shifts in supply-demand relations	With respect to housing, industrial and commercial structures. Emergence of vacancies or brownfields as a result.	- vacancy numbers and rates - supply-demand ratios for transport & utility infrastructures - number, size and rates of brownfields
perforation	Describes the dissolution of the urban grid creating islands of built fabric in midst of open/green space or woodland.	- decrease in use density in per cent or other measures - increase in non-built land (parcels) in per cent

Source: Authors' work

3.4 How can urban shrinkage be better understood with the help of modelling?

There is a bulk of questions where modellers can help social scientists dealing with shrinking cities: How can models help to understand causal relations and intersections between the described processes and variables? How can feedback loops and contingencies be better understood *ex ante*? How can decision-making by actors be integrated into a comprehensive assessment of urban shrinkage? Or, in a more general sense: How to cope with uncertainty of future development trends? How can complexity of urban development, causal relationships and feedback loops be properly described/depicted? Can modelling help to explore hitherto unknown/hidden dynamics in shrinking cities? What can the aggregate patterns of individual decisions look like if they follow different orientations and logics than in growing cities? How can modellers support the communication between scientists and local stakeholders when it comes to decision-making under the condition of numerous uncertainties, e.g. concerning which part of the housing stock is likely to be still occupied in future?

Some aspects of these questions were already initially addressed by cooperation between social science researchers and modellers at UFZ by dealing with the integration of the specifics of shrinking cities in environmental models (see Haase, D. et al. 2012) and are discussed in the paper by Haase and Schwarz (2012, submitted for the iEMSs 2012 H3, too). This research focused on appropriate approaches to model land use changes in shrinking cities using the example of Leipzig, eastern Germany, too. At the beginning, the conceptual model of urban shrinkage presented in Figure 1 was established and transferred into a system dynamics (SD) modelling software (*ibid.*, Figure 1). This conceptual model was fed by empirical knowledge of urban researchers and built by modellers. The SD model contained a number of variables figuring processes of urban shrinkage as we gathered them in Table 1 above. With the help of the relations between the components of the conceptual model, causal and feedback loops could be identified. With the help of a coupled SD and Cellular Automata (CA) model (Lauf et al. 2011), spatially explicit land use changes for small-scale cells could be simulated, among others for the probable spatial distribution of young or older households in the city as well as the emergence and spatial distribution of brownfields and, thus, the shape of perforation across the city's territory (see Haase, D. et al. 2012, Figures 3-5). The surplus value of this procedure is as follows: By using this procedure and a close cooperation of social scientists and modellers "from scratch", we received a more detailed and thus "realistic" simulation of possible small-scale land use changes which will lead to more detailed forecasts of how neighbourhoods will be affected by in- or out-migration of specific household types. Furthermore, we better understood small-scale change dynamics and further changes determined by these "initial" ones (feedback loops). Last but not least, the expertise on the functioning of causal relations and intersection of impacts of urban shrinkage made it possible to integrate feedback loops into the conceptual model that make the model work also when it is fed with "extreme" data (e.g. population exodus, mass demolition of housing, closure of significant parts of public and social infrastructure) – provided the impacts of shock events should be modelled.

What is still a challenge and likely to be much more difficult to be realized is the integration of human or actors' behaviour into coupled SD-CA models. There is some potential by using agent based modelling (ABM) approaches. A premise for integrating actors' actions is the creation of

clear actor profiles that are standardized as appropriate for the functioning of a model. Social science research on shrinking cities gathered much knowledge on different groups of actors in shrinking cities and their behaviour and specific response to the conditions of shrinkage, be it through increased residential mobility, changed priorities in decision-making or new coalitions (Kabisch et al. 2008; Rink et al. 2011). Therefore, specific knowledge on the structure and behavioural specifics of actors is crucial for building a sound model. A first attempt to integrate empirical research and modeling from the very beginning of a project is presented in Schwarz et al. (2012) where residential mobility and the long-term use of the housing stock in a shrinking city will be modelled using ABM on the base of both qualitative and quantitative survey data generated by social scientists. Modellers participating in the above mentioned research were e.g. provided with an elaborated household typology of urban residents by urban researchers considering not only size of the households but also type/composition and age (Haase, A. et al. 2004). Knowledge on behaviour, decision-making and priorities of urban actors including residents can be gained from questionnaire surveys, interviews or interactive games such as KnETs that identifies decision-making priorities of individual actors with respect to a certain question and with help of a set of criteria (Bharwani 2006). The main challenge here relates to how to deal with bounded rationality, contingent or dependent decision-making and relational priorities.

4. CONCLUSIONS

Modelling can help to better understand developments such as shrinkage as response to a shock. It can also help to improve learning about causal mechanisms and feedbacks; and hopefully, it can show different pathways of future development helping to reduce uncertainty and discover so far hidden challenges or relations. Modelling, however, cannot depict shock events such as the post 1989 transition into its conceptual foundations *ex ante*, since there was no expectation of such an event to happen at the time it happened. What can be modelled under a given uncertainty is how single processes and causal relations in a system as a city interrelate and how the complex response which we call shrinkage happens in detail. Modelling can also be helpful to simulate future development probabilities considering a large scope of varieties; model results can support debates on the future by clarifying relations, irritating existing knowledge “empirically” and revising hitherto assumptions.

Within the scholarly debate on shrinkage, it is not common to use the term shock. The major causes of shrinkage such as demographic change or out-migration gather much more attention than sudden events. The shock terminology is, thus, applicable as a framework although shrinkage only partly comes “over night” how we presented it for political events such as the post 1989 transition or as it is usually the case with environmental hazards such as floods, earth quakes etc. Historically, events such as the world’s economic crisis 1929-1932 or the two World Wars caused the beginning of longer shrinkage periods in cities such as Leipzig, or turning points from growth to (sudden) shrinkage. The recent financial crashes also remind us that financial market disasters can take the shape of a sudden shock, too. Including shock events to the causes of urban shrinkage can, subsequently, help us to further improve our conceptualization of the process. The post-1989 transition represents a good example for, firstly, the fact that societal shocks are often unexpected and cannot be anticipated in their development and second, the fact that consequences of or responses to such shocks can be “successfully ignored” by society over a long time if they do not fit into the normative conditions through which societal development are framed. In eastern Germany where the knowledge on mass out-migration and its consequences was there earlier, shrinkage “surprised” most of policy-makers when it came to the agenda.

As an overall conclusion, we can state that it is possible to learn from experience of post-1989 transition shock but applicability of such knowledge for modelling of urban processes is limited. It is, to our opinion, more realistic to integrate knowledge on responses to the shock on the urban scale into conceptual models and apply these improved conceptual models also in human-environmental/socio-ecological modelling.

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