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ABSTRACT

DISASTER RESILIENT URBAN SETTLEMENTS

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Recently, natural disasters with devastating effects on human settlements have proliferated. Against this background, this study outlines a resilience model for urban settlements with respect to natural disasters. The focus on urban settlements has been chosen because of their high disaster risks due to (i) their dense population and construction, (ii) their position as a center of economic and cultural activities, (iii) their location on the significant cross-roads of transportation routes and other modern networks, and (iv) their exploitation of natural resources and generation of environmental pollution. In addition to these reasons, variables of disaster risks in urban settlements may be grouped in two main categories, namely "Risks Stemming from the Urban Settlement" and "Risks Stemming from the Natural Disaster". An assessment of risks stemming from the urban settlement will start with an analysis of peculiar existing features of urban settlements under consideration including the site of the settlement (coastal settlement, hillside settlement, alluvial plain settlement ...), the ground survey of the settlement (whether urban settlement sits on firm ground or not, land liquefaction factors, ground water levels...), the planning standards and criteria of the settlement, land-use, population density, population profile and public awareness for disasters (social indicators),

construction density and quality of the settlement, quality in urban infrastructure & services, economic profile of the settlement (sectors, employment rate and profile, scale of production such as domestic scale production or country scale or international scale). The risks stemming from the natural disaster can be captured in terms of magnitude and range of the natural disasters; the frequency, occurrence time, duration, and type of disasters (e.g. only earthquake or earthquake + flood triggered by earthquake). The combination of such variables determines the degree of risks of a certain urban settlement prone to natural disasters.

The natural disaster risk profile of urban settlements as drawn above shows that it is not possible to resist all devastating effects of natural disasters. Thus, the term resilience implies the adaptation capacity of urban settlements potentially exposed to natural hazards for maintaining or restoring an acceptable level of functioning and structure. This study concentrates on the physical resilience of urban settlements rather than on strengthening social, political, administrative, etc. structures. However, since an urban settlement is a space in which multi-dimensional functions interact, other relevant issues such as political, administrative, economic, and social factors are also taken into consideration to support the physical resilience of urban settlements.

To build a disaster-resilience model for urban settlements, the main objectives are synthesizing data from international studies such as project reports from the UN, World Bank, and EU as well as best country examples; determining strengths, weaknesses, opportunities, and threats for urban settlements prone to disasters; transferring lessons learned from the 1999 earthquakes in Turkey; structuring guidelines; and testing the proposed guidebook. In this respect, a two-fold method is used comprising theoretical and empirical aspects. The theoretical part encompasses literature reviews, desktop researches, institutional documents, and project evaluations as well as lessons learned from various countries and international projects. The empirical part offers a

comparative case study of two high seismic cities: Yalova/TURKEY and Cologne/GERMANY.

While this study searches for best indicators and approaches to design a disaster-resilience model, it also takes into account differences of urban settlements as regards their disaster risks. Especially, in terms of priorities in disaster mitigation activities, two different approaches are proposed for urban settlements of developing countries and developed countries, respectively. First of all, from the perspective of a city planner, it is possible to distinguish between urbanization processes and urban settlements in developing countries and developed countries. According to UN statistics and relevant international data the rate of urbanization in developing countries increased more than that in developed countries due to the rapid population increase in developing countries. The growth of urban population has different reflections to the urban space in developing and developed countries, respectively. While urban settlements grow in a decentralized form in developed countries, agglomerations around urban settlements become the trend of urban growth in developing countries. Secondly, urban settlements play a much more dominant role in developing countries than in developed ones. While urban settlements are the concentration of political, administrative, economic, cultural, technical, and infrastructural functions in developing countries; they are just larger rings of the whole chain of infrastructure and services in developed countries. Due to the dominant role of urban settlements in developing countries, the vulnerability of such settlements translates into vulnerability of the country at large. Thirdly, urban settlements in developing countries tend to be more vulnerable to natural disasters than those in developed countries in terms of physical, social, economical, and environmental aspects. Thus, as a principle, the pertinent priorities of countries are found in disaster mitigation plans developed on the basis of the sustainability concept. Saving lives tends to be the prime focus of disaster mitigation activities in developing countries. On the other hand, disaster mitigation plans and programs in developing countries primarily concentrate on saving assets and establishments of settlements.

In the light of key findings and approaches mentioned above, the model consists of two main parts, namely risk factors of an urban settlement and elements of resilience. Risk factors are classified as natural disaster variables and urban settlement variables. The coping capacity, policies, and instruments of disaster resilience of an urban settlement are assessed in the part of elements of resilience. The model is structured as a standard checklist of key questions to relevant authorities and actors, and it addresses optimum standards for the physical resilience of an urban settlement concerned. However, it suggests different approaches for developing countries and developed countries, respectively. These different approaches are designed in terms of different priorities as already mentioned. The model is flexible enough to be modified for urban settlements with different features in terms of geographic, demographic, administrative, and social aspects. The variables used in the model and the checklist are open to be updated to changing conditions of urban settlements over time. Multi-dimensional features and prospective methods of the discipline of city planning are taken into account in designing the model. Thus, the model concludes with a feedback on a selected country as well as international data on the basis of periodical monitoring and scientific research.

The comparative case study serves a basis for developing and testing the aforementioned model. A synthesis of the 1999 Eastern Marmara Earthquakes lessons learned and the international experience with comparable features provide guidance to building the thrust of the model. Yalova located on the Eastern Marmara Earthquake Zone has been selected to add further specifics to the aforementioned lessons learned. Cologne as a high seismic city in Germany is used to test the proposed model. If the proposed guidelines of the model are confirmed in Cologne, they might also be relevant for other disaster-prone urban settlements. Although there are several urban settlements which are prone to earthquake risks, the City of Cologne was selected due to its remarkable particularities in the dimension of earthquake potential and possible

loss in its valuable urban assets as well as its lack of experience in terms of devastating earthquakes.

The comparative case study also provides an opportunity to support the proposed distinction between urban settlements of developing countries and developed countries, respectively for mitigating natural disasters. Despite the fact that Turkey is not a developing country, she has similar vulnerability features as developing countries due to her rapidly increasing population and densely constructed urban settlements. Firstly, the proposed model is assessed and formed entirely in the frame of the existing urban physical resilience features of Yalova such as recent spatial plans, building codes as well as relevant authorities and their responsibilities. As a result, the degree of its resilience is measured in accordance with the model in accordance with the recommended priorities of developing countries. Secondly, the degree of the physical resilience of Cologne is measured in the lights of interviews with relevant authorities and outputs of questionnaires in the worst case earthquake scenario in accordance with the recommended priorities of developed countries.

The test results aim at paving the way to developing earthquake resilience in Cologne. They may also provide guidance for further disaster resilience activities towards other types of natural disasters by modifying relevant parts of the model. In this respect, the proposed model is an instrument providing guidance to the local authorities as well as to policy- and decision-makers of Cologne by asking them some key questions and proposing some studies in response to their answers. However, due to time constraints for the study, the confidential nature of some data, and the hesitation of some authorities to give genuine answers to questions on earthquake risks, the proposed model could not be entirely completed on the basis of information received from authorities. Rather, the model was supplemented according to data collected via interviews and questionnaires in Cologne.

The proposed model of disaster resilience can be modified according to the different features of an urban settlement concerned as well as characteristics of the natural disaster which threaten that urban settlement. If applied correctly, the model will provide guidance towards a disaster resilient urban settlement. The success of the model depends on the willingness and openness of the relevant authorities to apply it. In the meantime, the checklist form of the model provides an opportunity for further development. Experience from applying the model to different urban settlements prone to various disasters can add further questions or modify existing ones. To have a potential for dynamic development, the proposed disaster resilience model can provide long-term guidance to urban settlements.

Keywords: Disaster mitigation, urban settlements, physical vulnerabilities of urban settlements, risk assessment, disaster resilience, disaster resilience model

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