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-Araştırma Makalesi-

A Participatory Approach to Improve Local Resilience in Düzce

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Abstract

In this study, we examine and evaluate local knowledge to develop an integrated participatory model for spatial planning. We used participatory approaches in Düzce province to enhance risk communication, and to obtain the local point of view related to natural hazards and vulnerabilities through collaborative workshop techniques. We integrated multi-knowledge sources including geoecological research data and local expert knowledge, and including the results of questionnaire surveys' analyses from workshops and town-watch exercise. This paper presents integrated information that can be useful in risk communication, and valuable analyses in terms of stakeholders' responsibilities and sources in disaster risk reduction towards resilience.

Keywords: *disaster risk reduction, questionnaire survey, local knowledge, participatory approach, resilience, risk communication, town-watch*

Düzce'de Yerel Dirençliliğin Geliştirilmesinde Katılımcı Bir Yaklaşım

Öz

Bu çalışma kapsamında katılımcı mekânsal planlama için, Düzce İli'nin doğal yapı hassasiyetleri, tehlike ve risklerine ilişkin farkındalığını sağlamak, afet risk azaltma ve risk iletişiminin sürdürülebilirliğini arttırmak üzere odak grup çalışmaları yapılmıştır. Odak gruplarına, doğal yapı hassasiyetleri ve tehlike verilerine dayalı bütünleşik değerlendirme sonuçları paylaşılmış ve farkındalıkları hakkında geri bildirim alınmıştır. Masabaşı anket ve mahalle risk tespit saha çalışmaları ile katılımcıların riskleri İl ve yerel düzeyde derecelendirilmeleri istenmiştir. Bu makalede yerel bilgi ve jeoekolojik verilerin bütünleştirilmesinin yanısıra afet risk azaltmadaki sorumluluklar ve kaynaklar bakımından katılımcıların değerlendirmeleri ile ilgili dikkat çekici bulgular sunulmaktadır.

Anahtar Kelimeler: *afet risk azaltma, anket çalışması, dirençlilik, katılımcı planlama, mahalle risk tespit, risk iletişimi, yerel bilgi*

1. Introduction

Collaborative activities are essential in disaster risk management. At the local level, collaborative actions bring all stakeholders to work together to improve risk communication,

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and develop attitudes related to disaster resilience. For these reasons, participatory workshops are used as a practical tool to engage stakeholders, understand local problems, and develop strategic solutions for risk management and planning (Ogawa *et al*. 2005; Okay *et al*. 2014; Tezer *el al*. 2018). Studies have reported that participatory workshops have been facilitated to integrate different types of local information assembled from different scientific disciplines for planning (e.g. Huntington 2002; Patela *et al*. 2007; Knapp *et al*. 2011; Holling 2011; Alexander 2013). Such workshops have been shown to improve risk awareness, through knowledge sharing and social learning, building trust, and increase engagement in comprehensive planning processes (Patela *et al*. 2007; Knapp *et al*. 2011).
There is a significant challenge for local governments to reduce disaster impacts, achieve effective collaborative planning, and develop local disaster risk reduction (DRR) and resilience strategies in order to meet their *Sendai Framework for Disaster Risk Reduction* (2015-2030) commitments (UNISDR 2015). Local authorities have difficulty in dealing with disaster risks due to the fact that they are overburdened by their other responsibilities. Implementation of risk management requires engagement and support from various institutions and levels.

Current methods in disaster risk management are not successful enough to engage communities, share their local knowledge, involve in the planning and implementation processes, and improve local resilience. Most participatory workshop methods mainly address disaster risk awareness, rather than local community's viewpoint. Usually, these conventional methods assume that the community plays a passive role, and absorbs the information. This forced participation fails to resolve risk reduction, and to achieve resilience. There is an increasing need to develop participatory approaches in risk management planning beyond enhancing risk awareness (Na *et al*. 2009; Okay 2018). For example, Samaddar *et al*. (2017) and Na *et al*. (2009) argued that a true participatory approach should allow local stakeholders to enjoy their involvement, and share their opinion throughout the planning process from risk reduction to implementation of mitigation, and preparation. This technique creates a platform for face-to-face communication of stakeholders to understand concerns of each other, improve knowledge, and achieve sustainable implementation of strategic plans at the local level.

DRR and adaptation measures require multidisciplinary efforts and comprehensive local data. Workshops are generally based on regional information, and very little attention is paid to local level detailed data and knowledge. In most workshops, integrating local knowledge is missing, or not well addressed (Berkes *et al*. 2000; Kachergis *et al*. 2013). Local knowledge reflects community's concerns and requirements as well as their resources and capacities.

This paper specifically emphasizes the participatory approach that is required to develop local knowledge in comprehensive planning process. We carried out a research project which is founded by *The Scientific and Technological Research Council of Turkey (TUBITAK)* to develop an integrated ecological planning with participatory approach for building resilient settlements against complex geological/ecological risk factors (Tezer *et al*. 2018a, 2018b; Aydın *et al., in this issue*). Düzce Province has been selected as a case study because of its complex geological and ecologic risk characteristics as witnessed many times in past in the city and in its region.

2. Methods

Our goal was to achieve four distinct sets of tasks in the project: (1) geological and ecological data *assembled* by our multidisciplinary team; (2) local knowledge obtained using participatory workshops; (3) *integration and evaluation* of the workshop results, and (4) *setting up strategic priorities* in risk management (Figure 1).

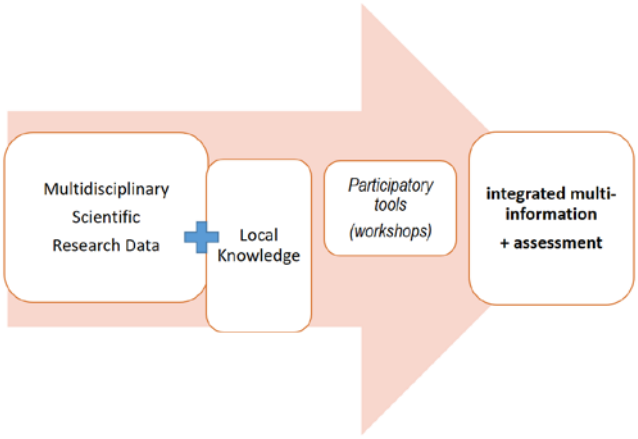

Figure 1. Overview of the multidisciplinary integrated model development for Düzce.

2.1. Participatory Workshop Process

Participatory workshops in the content of the project were held over the three years to get feedback from local experts. During the workshops, questionnaire surveys, field exercise were conducted which are described in this section. We invited diverse local knowledge holders to attend, the workshops including individuals with expertise of scientific knowledge from different disciplines. Both central and local government, including Disaster and Emergency Management Authority (AFAD) representatives, local experts attended these collaborative activities. These workshops aimed to raise awareness, and obtain responses on natural hazards and vulnerabilities in Düzce Province. First, we presented concepts and terms, and then introduced local scientific research data on natural hazard, vulnerabilities and integrated risk assessments. The available data included maps, remote sensing sources, geomorphological, geological, hydrological, and ecological information.

Each workshop was designed to obtain feedback in the form of both individual and group work. During these exercises, participants filled out questionnaires. Two types of surveys were conducted "individual questionnaire" and "group workshop questionnaire". Questionnaire responses, written sets of notes, comments, and photos provide qualitative analysis of these workshops. *Individual questionnaire* was designed for both Düzce Province (city) level and local (district) level to assess the degree of understanding and local knowledge of the stakeholders on natural hazards and vulnerabilities. Participants were asked to consider natural hazards and vulnerabilities, and rate spatial risks for both provincial and district levels. In this study we used two terms as *natural hazards* (earthquake, landslide, erosion, flood), and *natural (geoecological) vulnerabilities* (permeability, soil and habitat vulnerability, land use suitability, infiltration, weathering).

In the second workshop, a *participatory process design* was conducted with focus groups in Kaynaşlı, one of the districts of Düzce Province. With focus groups a detailed survey work was carried out on *Sendai Framework for Disaster Risk Reduction* (SFDRR). Participants were asked about what they think about the most important issues on responsibilities related to disaster risk and resilience management to address through sustainable collaborative approaches in planning process, and to improve implementing and using sources (financial, technical, knowledge, natural and human). We could learn from local experience and knowledge in Düzce in that regard to develop new resilience framework for local conditions and focus on "building better now". We documented the results to associate our project with SFDRR using views and concerns from group discussions. We also asked what source they use and how they collaborate in risk mitigation. Participants were asked about specific

hazards (earthquake, landslide, flood) for Düzce Province to discuss how to do management and express their concerns on legislation, policy development, planning, source management, research, education and training, as well as response and recovery.

2.2. Local Risk Evaluation Field Work (Town-watch)

A collective watching and participatory mapping was conducted with focus groups in Kaynaşlı District of Düzce Province to enhance the engagement of communities in risk reduction efforts. Town-watch was used as an effective tool to establish a comprehensive risk-informed framework at the local level where there are three main outputs: risk information, building trust on risk information provided and capacity building at local level (Ogawa *et al*. 2005; Takeuchi *et al*. 2012; Shaw 2014). On the other hand, the researcher's information is usually difficult to understand. Town-watch was used to help local communities to identify and watch vulnerable parts of Kaynaşlı, and understand scientific information, as well.

Experts from different agencies-mostly AFAD attended the field work. Participants were divided into four groups based on their expertise and agency representation. We presented the field study, and then discussed the concepts and terms. Local research data and new results about integrated natural hazard and vulnerability maps were also presented by the project team. Groups conducted town walk with the project members and observed vulnerabilities in four different sections of Kaynaşlı. Specifically, we asked participants to take photos, and also evaluate certain questions, to provide details on the field. During the town walk participants shared their photos and comments simultaneously via a *WhatsApp* group which set up at the orientation prior to exercise.

After the field work we asked participants for their opinion about local hazards, vulnerabilities and risks and asked to draw their comments with colored markers directly on a poster sized printout of map. This exercise provided a visual representation of groups' overall view.

2.3. Statistical Evaluations

We evaluated results using statistical methods. SPSS software was used to run several statistical analyses to evaluate results from questionnaires. Statistical tests were applied to compare several variables or populations (Ural and Kılıç, 2005). Distributions of variables (frequencies, percentages) were generated including statistical computations of modes, median, average and standard deviations. Results were tabulated, and graphics and charts were produced. Participants evaluated natural hazard and vulnerability factors for Düzce at both provincial and local levels. We used the *Wilcoxon Matched Pairs test* to determine participants how to rank them, examine the distribution of differences, and any significant differences between them. We also applied *T-test* to compare two averages and determine how significant the differences are. In these evaluations, *Friedman test* was used to determine rank of awareness of participants about natural hazards and geoecological vulnerability factors, to compare three or more related variables (with identical population) if there any significant differences. We used *Kruskal Wallis H test*, to compare risk factors which determined already using *5-likert scale* survey during focus groups workshop, and calculated differences between groups which were compared (Ural and Kılıç 2005). Stakeholders' specific roles and responsibilities in risk management were evaluated by using *Chi-Square Goodness-of Fit test* to determine significances. We used *Sign test* for one median to interpret the differences statistically significant.

3. Evaluation of Results

We collected data including notes and comments from group discussions, and questionnaires from workshops. Participants expressed their agreement about the usefulness of the local knowledge based on local data and information about the region.

3.1. Natural Hazards and Vulnerabilities

Participants rated natural hazards and vulnerabilities for Düzce. Based on the results of individual questionnaire surveys, statistically, there is no significant difference between risk indicators at both provincial and local levels. First, we found that workshop participants were already aware of risks in Düzce. Based on Friedman test result, we also found that participants specifically learned about the concept of permeability, habitat vulnerability and basin protection zones (X^2=63,08; p= 0,00). This suggests that information during the workshop was useful to raise their awareness of experts and help to learn new knowledge (Table 1 and Figure 2).

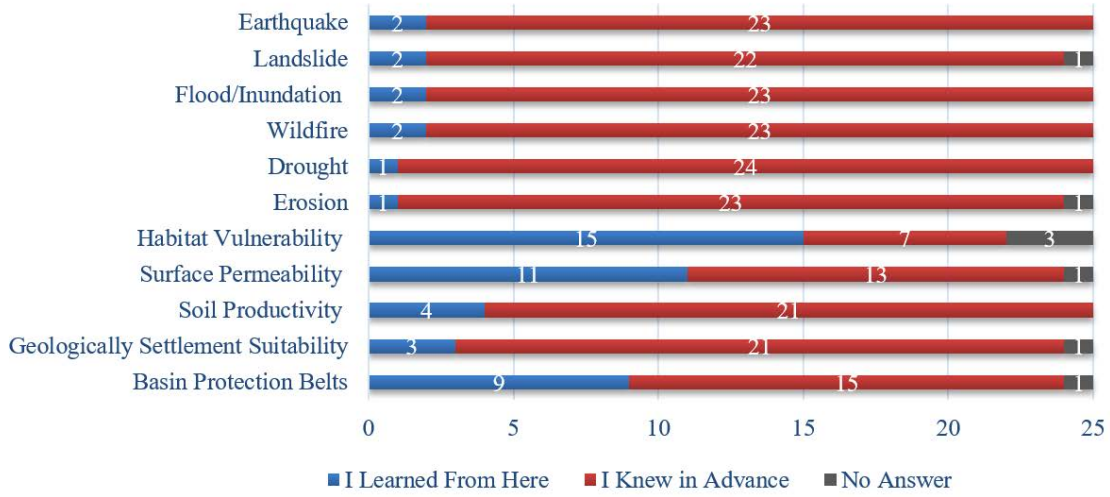

Figure 2. Participants' awareness on local natural hazards and vulnerabilities in Düzce.

3.2. Risk Evaluations

During participatory workshop we asked focus groups to rate the risks related to natural hazards, specific geoecological vulnerabilities and integrated land use suitability for Düzce (Figure 3). Three groups gave similar opinions for both province and local level. Results were tabulated in Table 1. Earthquake is considered the highest risk factor by all three groups. Erosion, landslide and flood are considered as medium risk group of hazards. In terms of natural vulnerabilities all groups agreed that the land suitability assessment is the most important factor. Habitat vulnerability and basin protection zones were found less important. Based on Kruskal-Wallis test differences were not significant: habitat vulnerability $X^2(2)$= 2.000; p=0.368, basin protection zones $X^2(1)$= 1.000; p=0.317) (Figure 3).

3.3. Responsibilities of Stakeholders

In the second workshop, a *participatory process design* was conducted with focus groups in Kaynaşlı District. Using focus group studies in Düzce the type and degree of stakeholders' responsibilities in risk management were determined. We asked participants: which stakeholder is responsible in risk reduction and mitigation, and to what level. Participants

were asked about specific hazards (earthquake, landslide, flood) for Düzce province to discuss how to do management and express their concerns on legislation, policy development, planning, source management, research, education and training, as well as response and recovery. We examined median values to determine degree of responsibilities among stakeholders (Table 2).

Table 1. Natural hazards and geoecological vulnerabilities

Natural Hazard and Vulnerabilities		*n*	*Z-value*	*p-value*
Pair 1	Earthquake	20	-1,00[a]	0,32
Pair 2	Landslide	19	-0,95[a]	0,34
Pair 3	Flood/Inundation	18	-1,41[b]	0,16
Pair 4	Wildfire	20	-1,22[a]	0,22
Pair 5	Drought	20	-1,00[b]	0,32
Pair 6	Erosion	18	-1,34[a]	0,18
Pair 7	Habitat Vulnerability	14	-1,41[a]	0,16
Pair 8	Surface Permeability	16	-0,82[b]	0,41
Pair 9	Soil Productivity	16	-0,82[b]	0,41
Pair 10	Geologically Settlement Suitability	18	-1,34[b]	0,18
Pair 11	Basin Protection Belts	16	-0,33[a]	0,74

**p<0.05, **p<0.01, ***p<0.001*
a. Based on positive ranks
b. Based on negative ranks
c. Wilcoxon Signed Ranks Test

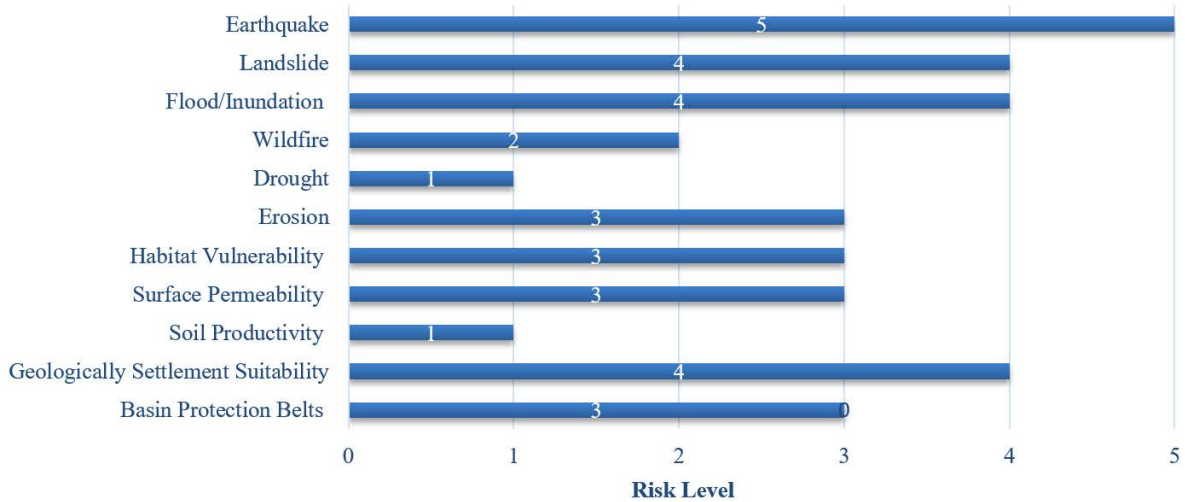

Figure 3. Based on participants' responds the distribution of risk levels for Düzce.

Table 2. Degree of stakeholders' responsibilities in disaster risk reduction activities

	Central Government	Local Government	Public	Private Sector	Academia	NGO's	Int'l Org
median values	5	5	5	4	4	4	3

Then we statistically looked for differences between stakeholders' responsibilities. We used *Sign test* to compare median values of groups. There were significant differences among responsibilities of central government and research institutions, NGOs, international organizations, private sector (Table 3). Majority of participants responded that the most responsible institution in managing spatial risks is local government, following by local community, private sector, research institutions and NGOs. Participants stated that the least responsible stakeholders were international organizations. There was a significant difference in degree of responsibilities between private sector and local community (Table 3). However, participants thought that the degree of private sector's responsibilities should be less than local community's responsibilities (Table 3).

Table 3. The comparison of Stakeholders' responsibilities

Stakeholders	p-value
Central Government - Private Sector	021*
Central Government - Academia	,000***
Central Government - NGO's	,000***
Central Government - Int'l Org	,000***
Local Government - Private Sector	,002**
Local Government - Academia	,000***
Local Government - NGO's	,000***
Local Government - Int'l Org	,000***
Private Sector - Int'l Org	,000,***
Private Sector - Public	,021*
Academia - Int'l Org	,008**
Academia - Public	,013*
NGO's - Int'l Org	,001**
NGO's – Public	,001**
Int'l Org – Public	,000***

n = 19
**p<0.05, **p<0.001, ***p<0.001*

We asked participants what type of activities should the stakeholders take in managing spatial risks. With focus groups a detailed survey work was carried out on issues targeted by global agreement of SFDRR. Type of activities are listed as data collection/analysis, planning, decision making, implementation, and monitoring in Table 4. Participants agreed that local governments should take biggest role in steps of data collection and analysis, planning, and implementation. Participants thought about the most important issues on responsibilities on disaster risk and resilience management to address through sustainable collaborative approaches in planning process, and to improve implementing and using sources (financial, technical, knowledge, natural and human). Based on the results central and then local government should take responsibility in decision making planning and implementation. According to the participants, private sector and community should take part in stage of implementation. However, research institutions, NGOs and international organizations should take part in data collection and analysis. We learned, based on local experience and knowledge in Düzce, to develop new resilience framework for local conditions and focus on "building better now". We documented the results of our project with SFDRR using views and concerns from group discussions.

Table 4. Type of responsibilities of stakeholders in disaster risk reduction

Actors / Responsibilities	*Data Collection and Analysis*	*Decision Making*	*Planning*	*Implementation*	*Revision*
Central Government					
Local Government					
Private Sector					
Academia					
NGO					
Int'l Org					
Public					

≥ 16 | 15-11 | 10-6 | ≤ 5

3.4. Using Sources in Disaster Risk Reduction

We asked what source they use and how they collaborate in risk mitigation. We also asked the type of resources that can be used in 4C (coordination, cooperation, communication and capacity building) activities in local DRR and planning. Participants stated that financial resources should be mostly provided by central government, following this, local government and international organizations. It was stated that the equipment supply should be provided by the local government and private sector, and then central government. Based on these responses the technical staff support should be provided especially by local government. It has been stated that especially academic institutions, then central government and NGOs should provide support for education and training (Table 5).

Table 5. Type of sources used in disaster risk management

	Finance	*Equipment*	*Staff*	*Education*	*Technical Support*
Central Government					
Local Government					
Private Sector					
Academia					
NGOs					
Int'l Org					
Public					

≥ 16 | 15-11 | 10-6 | ≤ 5

Most of the participants stated that at provincial level in Düzce the central government should take part in risk management actions related to natural hazards and vulnerabilities (Table 6). In issues of legislation, policy, planning and risk management, and financial support, participants thought that central administration and provincial organization are responsible. The central administration and provincial organization, local administration, research institutions should take role in problem solving and management activities. Based on survey analyses, the most authorized institution in terms of research-innovation is considered the central government which was followed by academic institutions, local or provincial organization of central government, local professional chambers and non-governmental organizations. In terms of technical support, equipment supply, education-training central government, international organizations, professional organizations, NGOs are responsible in mitigation activities. Participants stated that the provincial organization of both central and local government should take part in response and recovery actions (Table 6).

Table 6. Responsibilities of stakeholders for specific natural hazard and vulnerabilities

	Earthquake	Landslide	Flood	Erosion	Habitat Vulnerability
Policy					
Legislation					
Planning and Risk Management					
Financing					
Research & Implementation					
Technical Support					
Education/Training					
Equipment					
Staff					
Problem Management					
Response					
Reconstruction					

Central Government
Local Government
Local Agencies of Central Government

3.5. Results from Kaynaşlı Field Exercise

During second workshop, a town-watch study was conducted to help local communities to identify vulnerable parts of Kaynaşlı. Four groups expressed their opinions about high risk areas. The biggest concern was land use and building on most vulnerable areas such as river beds and agricultural land. Participants generally agreed that emergency services (safety and fire departments, hospitals, schools) which moved after the 99 earthquake are located in safer places in Düzce. Participants also discussed about some non-natural and technological hazards in Kaynaşlı. More participants expressed their concerns about lack of assembly areas in some parts of the settlement, for example, narrow streets which reduce the capacity of local response. Experts provided more detailed opinions like these are important which were summarized in Table 7.

Table 7. Kaynaşlı Town-watch field study results

	Group 1	*Group 2*	*Group 3*	*Group 4*
Q: *in terms of land use and local risks?*	Flooding risk:  Land with potential landslide:  Excavation in the creek	Electric transformer near the minaret:  Electrical, transformer, high-voltage lines in the open and close to buildings.	The school is close to the fuel station:  High-rise buildings: 	Built on agricultural land The proximity of industrial and residential areas; Adjacent order:  Detached houses and wide streets are needed
Q: in terms of assembly area	insufficient There must be twice as much open space.	a park or football field can be defined as the meeting area.	Gas station can be dedicated as the assembly area	need indoor sports hall, stadium, playground, mosque garden and large green park areas
Q: risky areas in terms of transportation	There is no inconvenience in terms of accessibility in the study area There is a risk of chemical explosion on the D-100 motorway.	The roads are wide in this study area	End of a local street in the study area is risky due to the lack of access to main road The electric poles on the roads are irregular and low.	narrow street turns - sharpness of intersection points. Not specifying the natural gas lines passing through the roads.
Q: in terms of Emergency Services risky areas?	in terms of ES there is no risk in this study area.	after the earthquake 1 hospital, 2 schools were built in strong ground	Gas station is close to primary school and kindergarten, and there are adjacent buildings around it.	no ES in this study area narrow streets and electric cables are considered as risk

Discussions and Recommendations

Our analysis was based on participatory workshops and evaluations of questionnaires. These workshops represent the three years of work collecting different types of data: documentation of local knowledge and geological/ecological field data. Based on SFDRR (2015-2030) we conducted participatory focus group studies on two priority issues of "assessment of disaster risks" and "DRR and resilience management" in Düzce.

1. The SFDRR relates to resilience by providing a guide for governments to demonstrate progress in achieving the goals at national and local level (UNISDR 2015). The SFDRR recognizes the important role that local governments play in managing disaster risks and risk reduction efforts. The Sendai Framework indicates that a people-centered approach is needed when applying disaster prevention measures. Therefore, it is vital for communities to learn and build practices achieving local resilience. For improvement to achieve these targets further involvement among local government, research institutions, and private sector are necessary. Participatory approaches are key action that will allow for stakeholders to ensure a strategic long term prospective in reducing risks and improving local disaster resilience.

2. The participants felt that central government was the most responsible on DRR and resilience. Based on survey analyses, it is understood that central government institutions should have more responsibility than the local administration provincial organization. Participants set out priorities and actions which would help governments to achieve DRR activities. The results highlighted in recommendations for building better in Düzce.

   Governments must enforce laws to ensure that development investments across sectors are risk informed, for example the use of risk assessments in DRR. Government funding for disaster risk management needs to be mainstreamed within sectors, that it is part of regular activities: planning and investments across sectors. Based on discussions it is recommended that governments establish some mechanisms to bring responsible institutions together for sectoral development in adaptation, risk reduction and resilience.

3. In Düzce focus group studies on integrated risk indicators most participants expressed their opinions that a critical risk-drivers are building settlements in safer places based on land used assessments and building codes. Besides natural hazards both geological and ecological vulnerabilities are crucial risk-drivers, also control on building capacity and resilience (Holling 2011; Tezer *et al*. 2018a,b). New approaches demonstrate the possibility of improving local knowledge/scientific information, risk communication and risk reduction. Mapping different local information is essential in developing strategic DRR policies toward implementation. Integrated natural hazard, vulnerability and risk maps should be updated accordingly. Integrated risk maps are used based on local needs, practical/expert knowledge and research information, and disseminated by all stakeholders as most credential tool for risk communication as well as risk awareness, risk assessment and planning.

   While the role of local authorities is well recognized, the challenge of implementation and achieving the targets set forth by the global indicators for local authorities must be met through concrete actions and not through short duration project activities. Importantly, the sustainable development of resilient cities requires a strategic long term approach disseminated within all stakeholders of the urban system. Participants

discussed that planners in local governments were legally obliged to bring private and public sector together, set up sustainable policies, and further activities, 4C (Okay 2018).

Success in resilience management will be the result of working closely with private and public sectors. Based on participatory workshop results, there is an increased emphasis using local knowledge from different sectors to integrate different types of information with multidisciplinary approaches in spatial planning processes.

Participants concerned that mainstreaming DRR issues has not attracted enough attention and has not received the required priority at the political levels. A critical achievement needs to be mainstreaming DRR. Our message is that development of awareness and 4C are required at all levels of government in reducing the risk of disasters. Increased awareness and building capacities of stakeholders are essential for resilience that are required at all levels: from policy and decision levels at the center to the implementation levels at the communities.

4. Finally, participatory workshop methods can be utilized as a useful tool to improve motivation for community building and understanding of disaster risk reduction, mitigation activities for enhancing local resilience. The communicative survey framework provides the link between researchers and local experts in the questionnaire survey and information distribution. When it comes to translating new scientific research results and knowledge into action there is often a challenge. Thus, visual tools like town-watch are necessary to be used to explain and make people to understand the risk information and situation at local level, thereafter, help to take proactive action. Such change and effectiveness are capacity building for disaster resilience. Learning from the project indicated that local communities continuously need to engage DRR activities in building trust and resilience.

   We hope that this discussion encourages to address underlying vulnerability/risk drivers such as lack of risk-informed land use, participatory urban planning, development activities to reduce risk and vulnerabilities; lack of sustainable and integrated natural resources/environmental management that increase natural hazard intensity and frequency.

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