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Small and Medium-Sized Enterprises, Flash Flooding and Organisational Resilience Capacity: Qualitative Findings on Implications of the Catastrophic 2017 Flash Flood Event in Mandra, Greece

Antonis Skouloudis, Georgios Deligiannakis, Panagiotis Vouros, Konstantinos Evangelinos, Ioannis Nikolaou

***Abstract*—**On November 15th, 2017, a catastrophic flash flood devastated the city of Mandra in Central Greece, resulting in 24 fatalities and extensive damages to the built environment and infrastructure. It was Greece's deadliest and most destructive flood event for the past 40 years. In this paper, we examine the consequences of this event to small and medium-sized enterprises (SMEs) operating in Mandra during the flood event, which were affected by the floodwaters to varying extents. In this context, we conducted semi-structured interviews with business owners-managers of 45 SMEs located in flood inundated areas and are still active nowadays, based on an interview guide that spanned 27 topics. The topics pertained to the disaster experience of the business and business owners-managers, knowledge and attitudes towards climate change and extreme weather, aspects of disaster preparedness and related assistance needs. Our findings reveal that the vast majority of the affected businesses experienced heavy damages in equipment and infrastructure or total destruction, which resulted in business interruption from several weeks up to several months. Assistance from relatives or friends helped for the damage repairs and business recovery, while state compensations were deemed insufficient compared to the extent of the damages. Most interviewees pinpoint flooding as one of the most critical risks, and many connect it with the climate crisis. However, they are either not willing or unable to apply property-level prevention measures in their businesses due to cost considerations or complex and cumbersome bureaucratic processes. In all cases, the business owners are fully aware of the flood hazard implications, and since the recovery from the event, they have engaged in basic mitigation measures and contingency plans in case of future flood events. Such plans include insurance contracts whenever possible (as the vast majority of the affected SMEs were uninsured at the time of the 2017 event) as well as simple relocations of critical equipment within their property. The study offers fruitful insights on latent drivers and barriers of SMEs' resilience capacity to flash flooding. In this respect, findings such as ours, highlighting tensions that underpin behavioural responses and experiences, can feed into: a) bottom-up approaches for devising actionable and practical guidelines, manuals and/or standards on business preparedness to flooding, and, ultimately, b) policy-making for an enabling environment towards a flood-resilient SME sector.

***Keywords*—**Flash flood, small and medium-sized enterprises, organisational resilience capacity, disaster preparedness, qualitative study.

I. Introduction

NATURAL hazards result to significant losses on human lives, building inventory and critical infrastructure. In this respect, several studies indicate the effects of extreme weather and severe flooding in business operations [1], [2]. They show that heavy rainfall, hail, extreme windstorms and flash floods can have a profound impact on business operation [3]-[5].

On November 15th 2017, an extreme flash flood event caused extensive damage to the city of Mandra, near Athens, Greece (Fig. 1). The flood was triggered by a high-intensity storm that produced a total rainfall amount of nearly 300 mm in 13 hours, with the majority of the rainfall falling within 6 hours [6]. Apart from the extensive damages to buildings, infrastructure and transportation networks, the flood resulted in 24 tragic losses, making it the deadliest flood in Greece over the past 40 years. Since then, the Mandra 2017 flood has been studied by various researchers regarding its meteorological and flood properties [6]-[8], the impacts on the natural and built environment, and on humans, livestock and infrastructure [9], [10], in victims psychology [11], in mortality patterns [12], in transportation infrastructure [13], and in the adjacent marine environment [14]. However, to our knowledge, this is the first research study that focuses on the organisational resilience capacity of local SMEs after this catastrophic flood. Our paper focuses on the way local SMEs reacted and managed to recover after such a disastrous event.

II. Methodology

An extensive interview guide spanning 27 topics was devised to investigate in detail the attitudes, perceptions, responses and experiences of SMEs owners-managers that encountered the flood effects. The topics pertained to their experience of the catastrophe, knowledge and attitudes towards climate change and extreme weather, aspects of disaster preparedness, as well as expectations on related assistance needs.

Members of the research team with experience both in social research methods and the 2017 flood effects conducted 45

Antonis Skouloudis is with the Department of Environment, University of the Aegean, Lesvos, 81132, Greece (e-mail: skouloudis@aegean.gr).

Georgios Deligiannakis is with the Mineralogy – Geology Lab, Department of Natural Resources Development and Agricultural Engineering, Agricultural University of Athens, Athens, 11855, Greece, and with the Hellenic Survey of Geology & Mineral Exploration (H.S.G.M.E.), Athens, 13677, Greece (e-mail: gdeligian@aua.gr).

Panagiotis Vouros and Konstantinos Evangelinos are with the Department of Environment, University of the Aegean, Lesvos, 81132, Greece.

Ioannis Nikolaou is with the Department of Environmental Engineering, Democritus University of Thrace, Xanthi, 67100, Greece

interviews. The initial objective was to include business owners or business representatives (i.e. managers) through face-to-face interviews. In cases where the COVID-19 restrictions or related obstacles were applicable, the interviews were conducted remotely using (video) calling platforms. A list of local SMEs was prepared, comprising of enterprises that were located within the 2017 inundation area (see Fig. 1) and were fully operational at the time of the 2017 flood event.

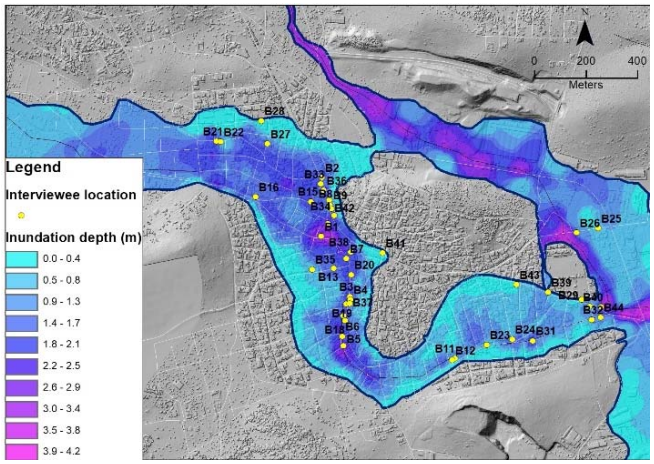

Fig. 1 Flood extent and inundation depth during the 15th November 2017 extreme flash flood in Mandra city, Greece. The exact locations of the interviewees are shown in yellow dots. Background map modified after [4]

The participants were informed that their answers would remain strictly confidential and anonymous and that they would be used as input for academic research. All participants preferred to be interviewed within their enterprise premises, as they felt convenient, and they would also be able to recollect more details of events that took place during the flood. In the few cases where the interviewee requested his/her responses not to be tape-recorded, extensive notes were taken by the interviewer(s).

The interviews were guided by a set of pilot-tested questions but remained flexible with new questions asked impromptu (during the interview) in order to better suit the interviewee's specific experience. Thus, the interview guide was adaptive to topics raised by the interviewees in order to better attend their experiences of the flood event consequences. In most cases, the order of the questions was altered in order to facilitate the flow of the interview and stimulate fruitful discussion. The questions were specifically designed to maintain a focused dialogue and enable meaningful responses based on the experiences of the participants. In cases where interviewees were reluctant to participate due to doubts regarding the purpose of the survey, the researcher(s) reassured them that neither personal nor business information would be used by any means. In this respect, the aim of this study was thoroughly explained, along with the potential benefits it could yield to similar cases in the future.

In order to stimulate the discussion with the SME owners and yield meaningful qualitative data, questions were clustered into three general groups. The first group included questions related to the disaster experience of the businesses. In essence, the description of the flood disaster and its perception by the business owners-representatives was captured with questions such as: "Tell us about the flood: In which way did the flood event affect your enterprise and how did you get over it?" or "What are the key learnings from the flood experience?" and "Can you identify factors that intensified or reduced the consequences of the flood to your enterprise?". The second set of questions pertained to aspects on knowledge and attitudes towards climate change and extreme weather and included questions such as: "Do you believe that such extreme catastrophes are related to climate change and, if yes, to what extent?" and "How would you evaluate flood risk compared to other business-specific risks?". The third group of questions referred to the business's disaster preparedness and business owners' viewpoints on assistance needs. It comprised of questions such as: "Have you ever conducted an internal audit on flood vulnerability issues within your enterprise?", "Would you consider implementing flood prevention measures at your property?", "Are you engaged in basic mitigation measures and contingency plans in case of future flooding events?" or "Are you willing to apply mitigation measures at your business premises based on experts' suggestions?".

III. Results

In total, 90% of the SMEs owners-managers reported either moderate damages or total destruction of their businesses after the 2017 flood (Fig. 2). The damages were related to fences, facades and wall collapse, building content and business commodities destruction, with business interruption lasting from several days to several months due to asset damages and changes in consumer behaviour after the disaster.

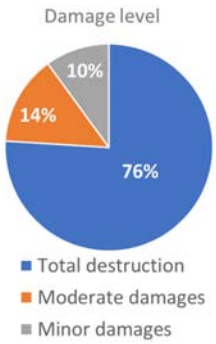

Fig. 2 Distribution of responses regarding the level of the damages suffered by the SMEs that were affected by the 2017 extreme flash flood in Mandra. More than 75% of the businesses were totally destroyed, and only 10% had minor damages

Key learnings from the flood event and its aftermath, expressed by most interviewees, were that critical institutional stakeholders had a profound lack of preparedness for such an extreme phenomenon. In addition, nearly all interviewees reported multiple post-trauma effects, such as fear for their lives and business, a sense of helplessness or suppressing anger, post-disaster preoccupation with danger and anxiety-insecurity

during each rainfall, reflecting on possible underlying psychological health disorders.

Factors that intensified the consequences of the flood included the limited assistance received by the Government, the post-disaster excessive bureaucratic procedures to recover, the lack of support by local authorities' officials and the absence of flood prevention measures. On the other hand, interviewees denoted various means of recovery support, such as a fixed, yet insufficient, State compensation, insurance coverage where applicable, in-kind or financial assistance from friends, colleagues and/or relatives, help from volunteers' labour to address community needs, and continuous aid from the Army and the Fire and Rescue Service during the first days after the flood event. Donators were also reported to have provided charitable contributions towards the recovery of local communities.

The devastating effects of the flash flood in their business and mainly the extended business interruption were the main reasons why the vast majority of the interviewees demonstrated a relatively increased risk appraisal of natural hazards and flooding compared to other business risks, such as financial distress, negative publicity, and low competitiveness (Fig. 3).

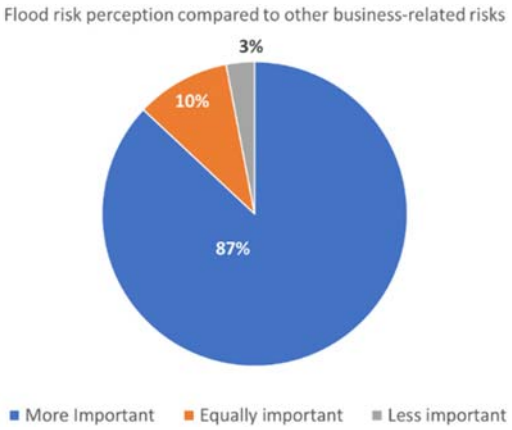

Fig. 3 Responses regarding the flood risk perception of the business owners affected by the 2017 extreme flash flood in Mandra. The vast majority of the interviewees believe that flood risk is much worse than the other (standard) business-related risks

Most of the business owners-managers (95%) that were interviewed believe that the 2017 extreme event is strongly linked to climate change. In this respect, they mostly blamed the lack of mitigation measures on behalf of the Central or Local Government. Nevertheless, 71% of the interviewees were convinced that climate change is the primary reason for such extreme and catastrophic phenomena (Fig. 4). In addition, the majority of the interviewees believe that flood prevention measures are essential for their business; however, many of them were unable to apply property-level prevention measures due to cost-specific considerations as well as complex and/or cumbersome bureaucratic processes, or because they simply are unwilling to modify critical business characteristics that may change their store's façade (and overall identity).

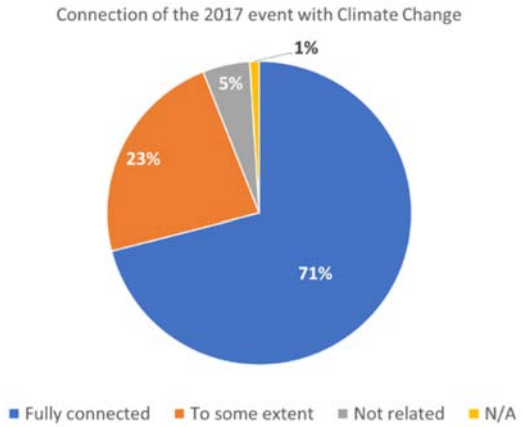

Fig. 4 Responses regarding the relation of climate change to the catastrophic event of 2017. More than 70% of SME owners believe that such extreme flash flood is fully connected to climate change

Interestingly, and even though the 2017 event was not the only flood event that the interviewees had experienced in Mandra, only 8% of them would consider relocating to another, less flood-prone area. Almost 55% of the interviewed business owners-managers reported that the high relocation costs were the most critical factor for not leaving their current location, referring to either transportation costs (from their residence to their enterprise) or the current owner of the property of the business and, thus, their unwillingness to switch to a commercial lease. A strong place attachment was expressed as the main reason for not moving to a 'safer' location by 37% of the interviewees, who stated that they felt connected to Mandra city and the local community (Fig. 5).

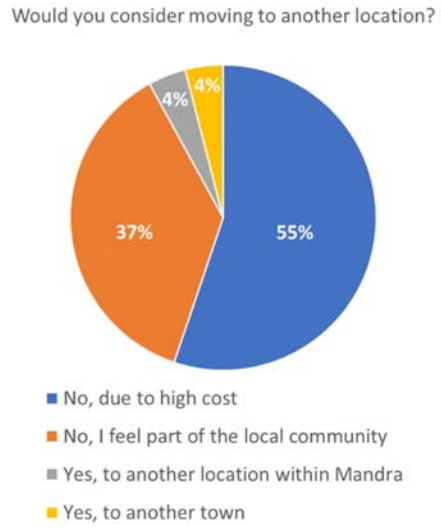

Fig. 5 Responses regarding the willingness of the business owners to move to another location in order to evade future flood events. The vast majority of the interviewees would not consider moving to another location due to cost-related barriers or emotional bonds formed between them and the local community

Since the 2017 extreme flash flood, nearly all interviewees have inspected their properties for vulnerable spots in case of flooding, and they have engaged in basic mitigation measures

and/or contingency plans in case of future flooding events. Such measures and plans mainly include business insurance policies, simple relocations of critical equipment within the property and basic reinforcements of outdoor installations. The vast majority of interviewees also reported that they could not afford more advanced or sophisticated prevention measures or were not allowed to implement such (more structural) interventions due to Town Planning regulations and related building restrictions. Still, many of the retailers we interviewed reinforced the façade of their enterprise during the restoration-recovery process after the event. Further reinforcement was not reported as an option for restaurant, coffee shop and grocery store owners, who were hesitant to make such changes in their façade in order to preserve the overall image of their enterprise and its existing identity to the customers.

Chambers of Commerce and Business Associations the interviewees are subscribed to were reported as not particularly helpful, with some exceptions which provided assistance in bureaucratic-related bottlenecks during the post-disaster recovery phase. There was also widespread criticism of the Central Government and Local Authorities' ability to apply appropriate and effective flood protection measures. Lastly, the majority of the SME owners stressed that the banks should have been more flexible in lending those enterprises that have suffered extensive damages and significant losses from the flood.

IV. Discussion and Conclusions

The 2017 flash flood event in Mandra was the most catastrophic flash flood over the last 40 years in Greece. As such, its consequences were devastating for the majority of the city's business entities, which were widely unprepared for such weather extremes. The low levels of flood resilience capacity of SMEs in Mandra and maladaptation to extreme weather events warrant further attention and investigation. Nearly all SME owners were dissatisfied with the Government's response, but at the same time, most of the SMEs were uninsured towards natural disasters before the event. Recovery was primarily based on the owner's savings and assistance from friends, relatives and/or volunteers, as reported by the interviewees. Lastly, basic prevention measures were applied in almost every SME by their owners after the event.

The study offers some preliminary but fruitful insights on latent drivers and barriers of SMEs' resilience capacity to flash flooding. It seeks to highlight tensions that underpin behavioural responses and experiences that can be employed in bottom-up approaches for devising practical guidelines, manuals and/or standards on business preparedness to flooding, and, ultimately, policy-making for an enabling environment towards a 'flood-resilient' SME sector.

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