

Article

Identification of Patterns and Influential Factors on Civil Protection Personnel Opinions and Views on Different Aspects of Flood Risk Management: The Case of Greece

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Abstract: The views and perceptions of the civil protection community have a central position in any risk management process or initiative, and are crucial to its success. However, knowledge of the views and perceptions of officials, and what affects them remains limited in the current literature. This work uses questionnaires to explore the views of civil protection personnel in Greece on different elements of flood risk management and identify factors that influence them. Results provide a basic understanding of officials' views, indicating certain shortcomings in various sectors and dissatisfaction in several aspects of everyday practice. Interestingly, responses of participants to perception- and knowledge-related questions show a pattern, relating to respondents' attributes and characteristics, such as experience, age, qualifications, and others. On the contrary, their views on everyday practice issues of flood risk management are associated with the type of position they have in the civil protection community. The findings contribute to the overall effort to improve the understanding of the characteristics of civil protection organizations across Europe, as a means to enhance cooperation.

Keywords: risk perception; civil protection; officials; flood risk management; personnel

1. Introduction

Floods are one of the most destructive natural hazards, inducing numerous fatalities [1,2], and an extensive amount of damages and socioeconomic effects [3,4]. Despite the improvements in infrastructure and the significant amendments in policy and technology, floods continue to cause an extensive variety of tangible and intangible effects [5,6]. In recent decades (1988–2017), floods induced over three-quarters of the total disasters' cost (US\$2245 billion) [7]. The above realities become even more worrying as they are accompanied by the threat of increased flood frequency, due to climate change [8].

In many countries around the world, different levels of government are put in charge of flood disaster and risk management. In major events, however, the capacity, preparedness, and willingness to deal with various challenges is called into question [9,10], as the number of fatalities and the extent of damages can be outstanding, and on certain occasions, unmanageable or overwhelming [11–13].

Human judgement and perception has a central position in any risk management process, and is crucial for the success of natural hazard prevention and emergency planning [14]. Recently, risk perception has been acknowledged as an essential part of risk management and communication, and its integration with traditional risk estimation approaches has been found to bear positive

results [15,16]. Perception and views of civil protection personnel/officials carry particular weight, as they influence policy agenda in terms of how information and knowledge on natural hazards and protection of communities are framed. They also have an important role in how policies and initiatives are implemented, how risk is assessed, as well as in taking action upon warnings and communicating risk to the general public [17]. Boholm and Prutzer [18] suggest that in the sociological literature on the relationships between science and society, experts are understood to have a key role as agenda setters for discourses on risk issues [19].

Risk management based on expert judgment involves a fair amount of subjectivity [20]. Skjong and Wentworth [20], and Sjoberg [21] find that in areas where experts or professionals are asked for their opinion in fields that are not directly in their area of expertise may exhibit similar attitudes as laypeople and can be vulnerable to similar biases [22–24]. This is particularly true in real-world conditions where multiple natural hazards affect different systems in different ways [25], and often limited personnel [26] is required to plan risk mitigation and make key decisions on a diversity of hazard types. In this sense, officials cannot be expected to function within their area of expertise in every crisis or event; personal views and perceptions, as well as individual characteristics, will potentially influence their judgement and decisions.

Several characteristics of emergency management and civil protection professionals have been shown to influence their responses and perceptions. Bremberg and Britz [27], and Ibem [28] found that officials from different organizations can have diverse mindsets, cultures, or responses in crises [29–32] indicating that the position in the overall civil protection organizational framework can be an influencing factor. Personal characteristics, including the length of service and practical experience, knowledge, and demographics, have also been associated with emergency personnel views, perceptions, and crisis handling [33–39].

However, the literature has not discussed or compared the extent of influence of these factors on views and opinions of officials across different aspects of flood management, including everyday practice and risk perception. This is important as risks are becoming more complex, and at the same time, organizational fragmentation is increasing [40], meaning that resources are distributed among more stakeholders, and that good coordination is becoming more critical [41]. In particular, in the framework of the European community of civil protection, the effort to understand key institutional differences and promote homogeneity would benefit from an improved understanding of the views of civil protection personnel. This, in turn, can have a positive effect on cooperation initiatives such as the EU Civil Protection Mechanism. In this regime, understanding the perception of the people who are responsible for managing risk is particularly useful to understand what are the main problems in civil protection and who is more susceptible to them (e.g., poor cooperation) [32].

Given the significance of their role in risk management, it is considered essential to understanding the views of civil protection personnel [42,43], and the effect that such factors can have on organizational handling and response to risks. This can be particularly important in areas of the world, where the presence of a diversity of natural hazards tests the capacity of organizations. Eastern Mediterranean and Greece, in particular, is a region where catastrophic disasters of different kinds, including forest fires [44], floods [45], earthquakes [46], volcanos [47], landslides [48,49], and others occur in a small geographic area.

Taking into account the above-mentioned considerations, this work aims to explore the views and perceptions of Greece's civil protection personnel regarding flood risk to enhance the body of knowledge on the obstacles or problems they are facing. Specifically, this study aims to:

- a. Provide a basic understanding of how officials perceive flood risk from a perspective of a multi-hazard environment and how they view the current management framework;
- b. Examine the influence of different factors to their views and perceptions in different aspects of flood risk management, including early warning processes, coordination between authorities, assessment of different aspects of flood risk management, resources and obstacles to their job.

For this purpose, primary data has been collected employing structured questionnaires administered to civil protection officials. The results aim to enrich the knowledge of how officials of various positions perceive the flood problem and various prevention processes.

2. Materials and Methods

2.1. Survey Design and Sample Selection

The survey was conducted between February and April 2018 using a self-administered, online, structured questionnaire and was addressed to officials of different levels of a wide range of organizations involved in civil protection in Greece following Palttala et al. [42], Sjöberg et al. [50], and others.

The questionnaire (included as Supplementary Material) was distributed via email to 413 officials from authorities and organizations involved in flood protection, flood risk assessment and mitigation and early warning, etc. Research-oriented institutions and other bodies that are not responsible for the protection of the public against flood risk were excluded from the sample. More specifically, the same structured questionnaire was sent to civil protection departments or civil protection offices of the following authorities:

- i. Municipalities: Municipalities are the first-level, self-governing local authorities in Greece with first-level civil protection departments;
- ii. Regions: Regions are the second-level self-governing local authorities. Greece is divided into 13 regions, each with a civil protection department;
- iii. Decentralized administrations: The seven decentralized administrations are the third level of administrative divisions, tasked with supervising the first and second-level self-governing bodies and they have their civil protection departments;
- iv. General secretariat for civil protection (GSCP): The central state agency devoted to civil protection, planning risk mitigation, providing training and education on disaster protection and risk mitigation, and overseeing or coordinating all civil protection-related departments or offices in the country. GSCP is also responsible for disaster prevention and recovery operations.

In addition, the questionnaire was directed to organizations and institutions affiliated with the above-mentioned authorities and involved in risk mitigation efforts, including:

- i. Ministry of Environment Energy and Climate Change—Special Secretariat for Water: The Secretariat is responsible for the development and implementation of all programs related to the protection and management of the water resources of Greece, including the development of flood hazard and risk maps for the whole country and the implementation of European Union Flood Directive 2007/60/EC;
- ii. Ministry of Infrastructure Transportation and Networks—Directorate-General of technical Support: Natural Disaster's Rehabilitation Directorate (DAEFK): Authority of the Greek State for the assessment and rehabilitation of affected areas, after natural disasters;
- iii. Hellenic Fire Service: The agency responsible for rescue efforts and emergency operations in various natural or human-made disasters. Hellenic Fire Service is part of the Ministry for Citizen Protection and is also responsible for prevention measures and information and education of the public;
- iv. Voluntary organizations: Non-governmental organizations for search and rescue that operate in Greece, certified from the state, with international deployment and long experience in flood and other disasters;
- v. Regional Water Authorities responsible for water management and municipal water and sewerage companies that are involved in water and sewage management, including flood protection measures;

- vi. Army (Corps of Engineers): Division (called “Arm”) of the Hellenic Army that in peacetime contributes to flood disaster mitigation and implementation of emergency measures;
- vii. Forest Service: The main body for protecting and managing the country’s forests, involved in upper-catchment hydrology and flood protection measures in rural areas and forests;
- viii. Hellenic National Meteorological Service (HNMS): Competent agency for providing weather and flood producing forecasts and warnings of extreme weather and flood producing storms to the public and the authorities. HNMS is officially part of the civil protection plans.

The questionnaire had in total twenty-five open- and closed-ended questions. The first group included four questions and examined previous experiences of respondents in flood phenomena and asked their perception about the probability of occurrence and the severity of the consequences of floods in their area of responsibility. The second group of seven questions aimed at exploring:

- (a) The assessment of respondents regarding tangible and intangible resources for flood risk prevention (e.g., personnel, equipment and infrastructure, funding, political will, cooperation with other organizations and volunteer groups, coordination of the agencies, etc.);
- (b) Their knowledge on the presence of different resources including flood-protection measures, risk maps, masterplans, etc.;
- (c) Information about the collaborating organizations (e.g., number and type of organizations, frequency of common meetings, etc.).

The third group also had seven questions and was designed to capture the respondent’s views and beliefs about the existing early warning systems.

The fourth and last group of questions gathered demographic information, including the educational and professional experience of the respondents. The survey used the term “floods” denoting all the different types of flooding.

The questionnaire was anonymous in order to: (a) Ensure confidentiality of the information provided, since participants’ views do not necessarily reflect the official position or policy of the organizations they are affiliated with, (b) allow participants to express their opinions freely, and encourage them to give honest and objective answers. However, respondents were asked to identify their affiliation to monitor the representativeness of relevant authorities and understand their position in the civil protection community.

2.2. Data Analysis

The responses were analyzed using different statistical tests, selected to examine possible statistical relationships between the variables of interest, depending on theoretical conditions. Univariate and bivariate statistical analyses were conducted depending each time from the factors examined (see Section 3 for details of each test in each set of factors), to provide a summary of the data collected from the survey and to determine the potential empirical relationship between critical variables. Furthermore, multivariable models were run for exploring the contributions of various explanatory factors to the views of participants on certain issues. The level of confidence of all statistical analyses was 5% as proposed in similar questionnaire-based studies [51,52].

3. Results

3.1. Respondents’ Profile

In total, 105 completed questionnaires were returned out of the 413 that were originally sent (response rate of 25.4%). The participants were from municipal (49), regional (17) and national authorities (39). Although the resulting sample size is deemed adequate compared with other surveys addressed to experts (e.g., Flyn et al. [53]; Darko et al. [54]), it should be noted that there are limitations to the survey, that is, we can capture certain views and perceptions relating to certain respondents’ attributes and characteristics, such as experience, age and qualifications. Respondents were between

31 and 64 years of age (almost 63% were between 45 and 54 years of age), and almost 70% of them were males. Information on educational level shows that half (50.5%) of the respondents hold a master's or doctoral degree, 36.2% are university graduates, 12.4% have at least secondary education, and the rest (less than 1%) have elementary education. Further, a significant portion of the respondents (i.e., 46.8%) has a relevant scientific background (e.g., geology, civil and/or environmental engineering, forestry, and meteorology), although the majority does not hold a pertinent qualification.

Regarding their professional experience in positions related to civil protection, almost three-quarters (i.e., 74.2%) of the participants have served for less than 10 years, i.e., about 32% between ten and five years, 30% between five and two years, and 12% less than two years. The rest, namely, 25.8%, stated that they have a service record of more than ten years. Out of the 29 respondents who have a service track for longer than 10 years, only 18 have a relevant education indicating an even lower percentage that combines experience and educational background (17%). Moreover, based on their answers, more than half of the respondents (i.e., 55.2%) lack hands-on experience. More specifically, about 37% said that they had experienced one or two flooding incidents, and 18% stated that they have no experience in such events. The rest, i.e., 44.8%, declared that they had faced at least three or more flooding incidents in their area of responsibility.

3.2. Assessment of Various Everyday Flood Risk Management Elements/Aspects

To monitor views on everyday flood risk management practices and aspects, participants were first asked to assess the levels of satisfaction on several critical resources and processes, including funding, workforce, supplies and materials, infrastructure, political will, cooperation and coordination with competent organizations, warning processes and protocols, cooperation with volunteer teams, and public response to authority warnings and guidelines. The ranking was carried out on a 1 ('completely dissatisfied') to 4 ('completely satisfied') scale.

Respondents were found to be mostly dissatisfied by most of the elements assessed (Table 1), with the mean rating being lower than average (2.500). Specifically, "funding" came last (2.019), followed by "political will" (2.067) and others in ascending order of satisfaction. Only "warning processes and protocols" gathered a marginally positive view (2.638) in terms of satisfaction, since 61.0% of the respondents stated that they are mostly or completely satisfied.

Table 1. Assessment of satisfaction on everyday practice for different critical resources and processes.

Critical Resources and Processes	Mean ¹	Standard Deviation
Warning processes and protocols	2.638	0.77
Cooperation with voluntary organizations	2.467	0.89
Cooperation/coordination with other authorities	2.248	0.78
Public response	2.2	0.8
Infrastructure	2.143	0.84
Human resources	2.133	0.89
Equipment and provisions	2.086	0.76
Political will	2.067	0.84
Funding	2.019	0.72

¹ Note: Responses were provided on a scale from 1—'completely dissatisfied' to 4—'completely satisfied'. Average = 2.500.

It is interesting to note, that laypeople's views on early warning processes show a lack of trust with three-quarters of them perceiving them as inadequate or very inadequate [55]. This contrast between the overall satisfaction of officials and laypeople's lack of trust, although no specific evidence is currently available, maybe due to shortcomings in the communication of risk towards the general public and should be further researched.

Chi-square tests were conducted to establish if any relationship exists between satisfaction levels shown above and key socio-demographic (age, experience, qualifications) and other variables

(frequency of cooperation with other authorities, respondent's position, whether he/she is a uniformed or civilian official). Amongst all tests carried out, significant differences were only found when comparing the responses between local and central authority officials, as well as between civilian and uniformed personnel. In both cases, the differences were identified concerning their level of satisfaction regarding human resources, equipment and infrastructure (Table 2).

Table 2. Comparison of mean satisfaction rating regarding human resources, equipment and infrastructure between local officials and officials of central agencies.

Group	Human Resources	Available Equipment and Provisions	Infrastructure
Local authority officials	2.570	2.370	2.490
Central authority officials	1.870	1.920	1.930
Chi-Square test	$\chi^2 = 16.085$ $p = 0.001 *$	$\chi^2 = 9.864$ $p = 0.007 *$	$\chi^2 = 12.338$ $p = 0.006 *$
Civilian officials	1.930	1.970	1.970
Uniformed officials	2.700	2.430	2.610
Chi-Square test	$\chi^2 = 13.833$ $p = 0.001 *$	$\chi^2 = 7.217$ $p = 0.027 *$	$\chi^2 = 10.744$ $p = 0.013 *$

* Significant at 0.05 level.

Using an open-ended question, participants were also asked to indicate the most important tangible or intangible resource/asset in terms of usefulness in flood protection and risk mitigation. Then their responses were grouped in five main categories. The most frequent responses included various types of specific equipment and tools (40%), followed by various operational protocols, processes and communication procedures (29.4%), human resources, (i.e., skilled/trained personnel or personnel with appropriate qualifications) (16.5%), various regulations (10.6%), and various types of structural flood protection measures (3.5%).

The statistical tests showed no statistical differences, indicating that the years of service, the experience of previous disasters, qualifications, self-assessed knowledge and education level do not have a statistical association with the answers. Certain differences were found between local and central authority personnel, but with no statistical significance overall. Local officials mentioned some forms of regulation as the most important resource/asset in a percentage of 2.5%, as opposed to a percentage of 17.8% recorded by officials of central authorities. Similarly, various types of structural flood protection measures were also different, as they were mentioned only by local officials at a percentage of 7.5%, whereas officials of central authorities did not report this type of measures at all (Figure 1). Between these two groups, other answers presented similar percentages.

Non-statistically significant differences in responses were identified between uniformed and civilian personnel, as well. For instance, uniformed personnel considered various types of equipment as the most important resource/asset in terms of usefulness. On the contrary, civilians considered various types of physical infrastructure and structural flood protection measures as the most useful asset (Figure 1).

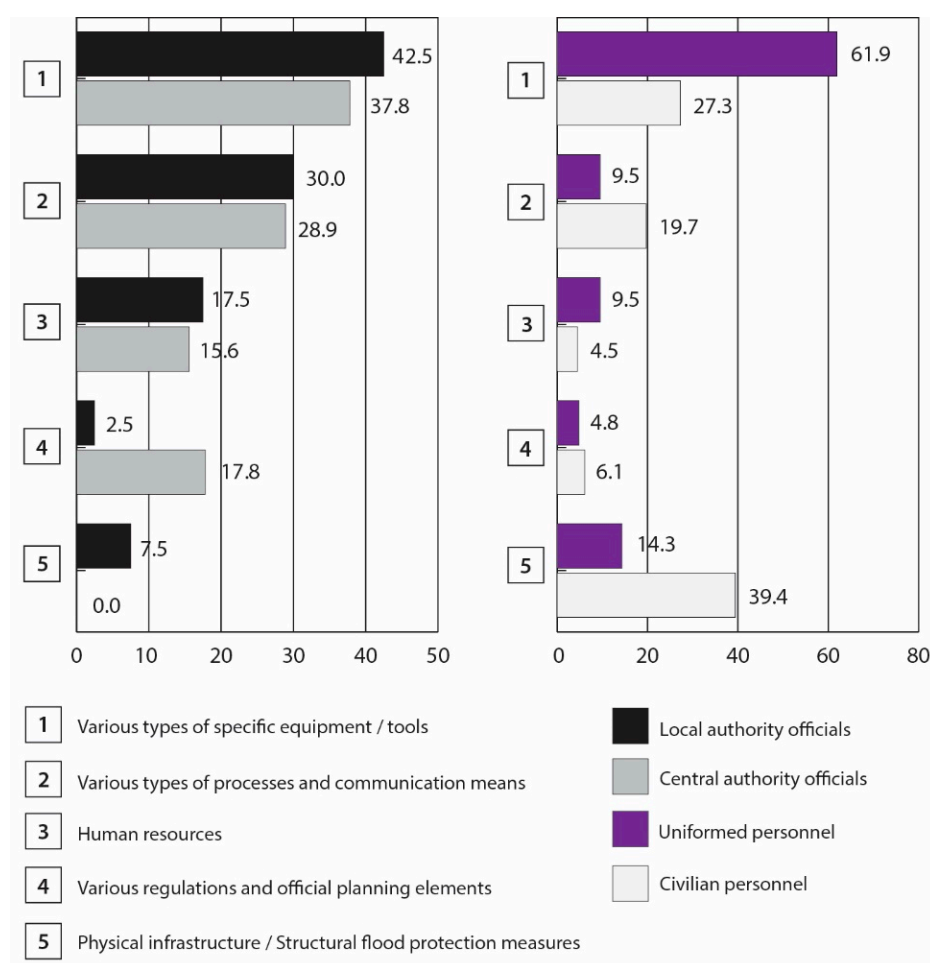


Figure 1. Responses to an open-ended question on the single most important tangible or intangible resource/asset in terms of usefulness in flood protection and risk mitigation in everyday practice (shown here as the percentage of total answers).

Further, using another open-ended question, respondents were required to identify the most important obstacle they face in flood risk mitigation. The most popular responses included: Poor prevention processes and planning (38%), lack or insufficiency of structural flood protection measures (19.4%), inadequate funding (16.5%), problems arising from regulations, bureaucracy, and political will (11.6%), or related to early warning (5.8%), to human resources (4.9%), and connected with the public (2.9%) or other (1.0%).

Statistically important differences were identified only between local authority officials and officials of central authorities, with the former mentioning “inadequate funding” in 28.9% of the responses, in a much higher percentage compared to the latter (5.3%) (Figure 2). On the other hand, officials of central authorities mentioned obstacles “related to the early warning”, “arising from regulations” and “connected with the public in higher percentages than local ones (10.5%, 7.9% and 7.9% as opposed to 2.6%, 2.6%, and 0%, respectively). The differences were statistically significant at 5% level ($\chi^2 = 12.563$, $df = 4$, $p = 0.044$).

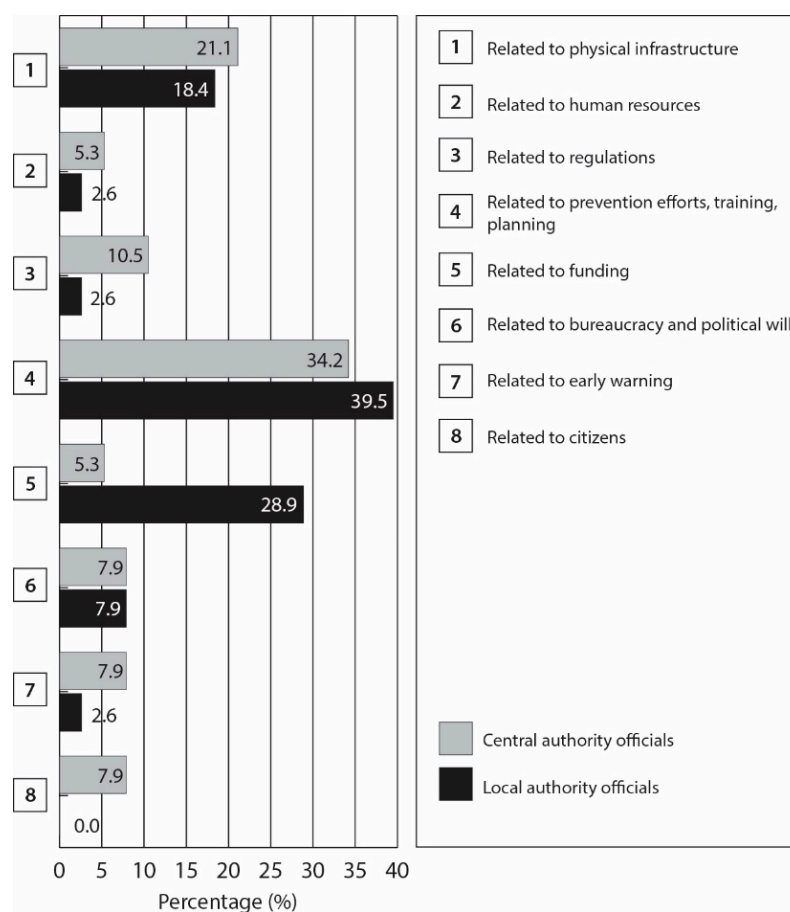


Figure 2. Responses to an open-ended question on the single most important obstacle or problem that participants face in everyday practice in flood risk mitigation efforts (shown here as the percentage of total answers). Respondents are divided into central authority and local authority.

In general, many officials mentioned poor prevention, lack of infrastructure and funding as the most important obstacles in everyday practice along with certain factors that are connected to them, including equipment and human resources. Political will and coordination between competent authorities were also identified as problematic. Climate change or any other climate-related factor was very rarely mentioned indicating that they are low on the priority list of problems. This is in agreement with literature findings on laypeople perceptions [15] suggesting that floods are perceived more like a problem caused by human interference, rather than a nature-induced or climate-induced phenomenon. This tendency has been documented among laypeople in Greece as well [55].

Survey participants ranked regional and municipal authorities (22.6% and 12.8%, respectively), the fire department (16.9%), and the police (13.3%) among the most important authorities in terms of cooperation regarding flood risk management, followed by the General Secretariat for Civil Protection (9.2%), volunteer groups (4.1%), and others (Table 3). The frequency of cooperation of competent authorities was investigated by asking respondents to indicate how frequently they cooperate with other authorities, and which authorities they work with. More than 60% of them responded that the cooperation with other authorities is rare (once per six months or even less), 25% said that they cooperate once or twice a month, and the rest (i.e., approximately 13.5%) stated that they engage in cooperation with other authorities every week or more frequently. Local officials indicated a lower frequency of cooperation in comparison to officials of central authorities with a statistical significance at 10% ($p = 0.084$). Further, more experienced personnel showed a higher frequency of cooperation compared to less experienced individuals ($p = 0.010$).

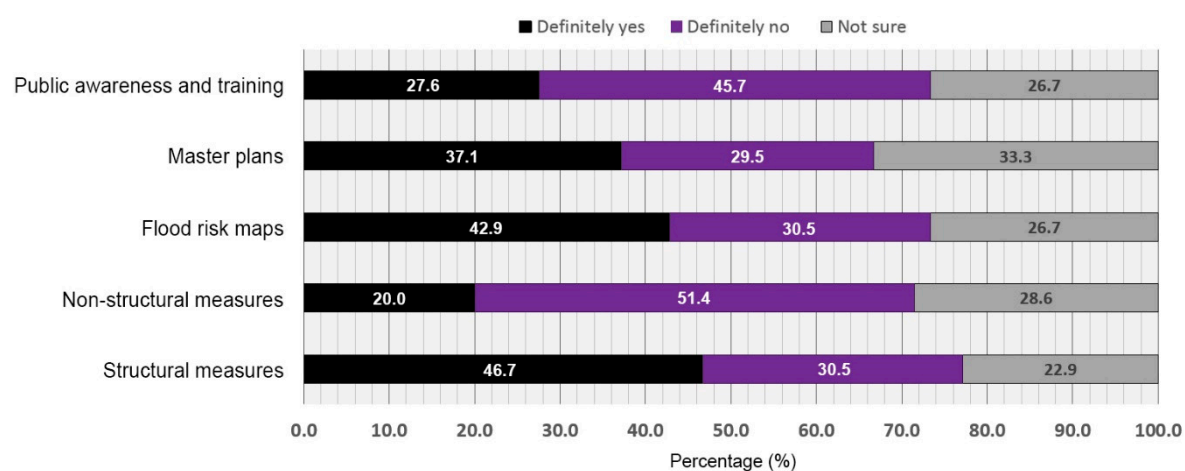
Table 3. List of most important authorities in terms of cooperation mentioned by officials.

Authority	Number of Responses	Percentage (%)
Regional authorities	44	22.6
Fire department	33	16.9
Police	26	13.3
Municipal authorities	25	12.8
General Secretariat for civil protection (national authority)	18	9.2
Voluntary organizations/NGOs	8	4.1
Decentralized ministry authorities	7	3.6
Army	6	3.1
Regional subdivision authorities	5	2.6
Central government (i.e., Ministries)	5	2.6
Private machinery owners	4	2.1
Water Supply and Sewerage Companies	3	1.5
Other authorities/organizations	11	5.5

3.3. Knowledge

When asked to assess their knowledge on floods and flood risk management, 37% of respondents stated that they perceive their knowledge to be high, 49% to be moderate, and 14% to be low. Apart from the self-assessment, respondents were asked to respond on the availability of specific flood-protection measures in their area of jurisdiction as an objective indication of their knowledge.

As shown in Figure 3, almost half of them (46.7%) replied that structural measures had been implemented, followed by flood risk maps (42.9%), integrated flood risk plans (37.1%), public awareness and training (27.6%), and other non-structural measures (20%). Negative responses ranged approximately between 30% and 50%, indicating a significant lack of protection measures in some cases. Further, the data indicated a relatively high level of uncertainty considering the proportion of ‘not sure’ responses (between 23% and 33%), as well as wrong answers.

**Figure 3.** Distribution of answers regarding the existence of different categories of risk mitigation measures in the officials’ areas of jurisdiction.

Indicatively, in the case of “flood risk maps”, in which information on nationwide availability is provided by a Ministry of the Environment and Energy of Greece database, participant responses proved to be wrong in 18.1% of cases. If we add the 26.7% of “not sure” answers to the 18.1% wrong ones, then we have approximately half of the respondents (44.8%) giving a wrong answer, as far as the availability of flood risk maps in their area of jurisdiction is concerned. Nevertheless, those who have both an experience (over five years), and a relevant background present a ratio of right to wrong answers twice as high as that of the rest of the participants (1.34 and 0.65, respectively). In other words,

less trained or less experienced personnel were found to provide more wrong answers than their experienced and trained colleagues.

Further indications of poor knowledge come from the answers on knowledge of structural measures for which information is stored in the archives of the Technical Chamber of Greece. Out of 26 local officials that responded to the question regarding the presence of structural measures in their area of jurisdiction, only 12 (46.1%) gave the right answer, whereas 14 provided a wrong or a “not sure” answer.

Chi-Square tests of independence showed that respondents’ perceived knowledge on floods is associated with the knowledge on non-structural measures ($\chi^2 = 9.394$, $df = 2$, $p = 0.052$), flood risk maps ($\chi^2 = 12.153$, $df = 4$, $p = 0.016$), and integrated flood risk master plans ($\chi^2 = 9.957$, $df = 4$, $p = 0.041$). No other statistically significant associations were observed.

3.4. Risk Perception

The vast majority of respondents rated the risk from floods, in general, as “very important” (49.5%) or “important” (36.2%). Further, almost one-tenth of them rated it as of “average importance”, and a minor percentage (i.e., less than 3%) as of “low” or “negligible importance”.

Compared to other natural hazards, namely, earthquakes, forest fires, landslides, and tornados, floods were ranked third, behind earthquakes and forest fires. On a 5-point scale, with 1 indicating “not important” and 5 indicating “very important”, earthquakes ranked first with an average of 4.74, followed by forest fires (4.34), floods (4.33), landslides (3.49) and tornados (3.20). Multiple pairwise comparisons were conducted using the nonparametric two-sample Wilcoxon rank-sum test (a.k.a. Mann-Whitney test) to assess the differences in importance between the natural hazards. The results show that the null hypothesis (i.e., that the populations have equal medians) is rejected when comparing earthquakes with every other natural disaster, as well as when comparing floods and forest fires with landslides and tornados. The null hypothesis, however, cannot be rejected when comparing floods and forest fires ($p = 0.988$).

As regards the perception on the likelihood of future floods in their area of jurisdiction, almost two-thirds of the respondents (63.5%) believe that such an event is likely or extremely likely, 21.5% that is neither likely nor unlikely, 12.5% that is unlikely, and less than 3% that is extremely unlikely.

Besides the probability of occurrence, the participants were also asked to assess the severity of the consequences of future floods in their area of responsibility. About 22% of them characterized the potential consequences as very severe, 46.6% as severe, 21.4% as moderate, 8% as slight and 2% as negligible.

In order to explore demographic and other factors affecting the views of participants concerning the likelihood of occurrence and the severity of impacts of future flooding events, multivariate linear regression models were fitted to the dataset. The results are presented in Tables 4 and 5.

According to Table 4, the perceived likelihood of future floods (which was stated using a scale of 1 to 5) increases for respondents who provide higher rating to the risk from floods; have experienced flooding events in the past; serve more years in positions related to civil protection; have higher education, and are men. Similarly, based on the sign of the coefficients of Table 5, it seems that the severity of consequences increases for those who provide higher rating to the risk from floods; have experienced flooding events in the past; are more dissatisfied with existing infrastructure for flood risk prevention; serve more years in positions related to civil protection, and are younger.

Table 4. Probability of occurrence model results.

Variables	Coefficient	Details
RISKPER	0.252 * (0.129)	Respondents' perception about the risk from floods (1: Negligible, 5: Very important)
PREVEXP	0.014 ** (0.007)	Previous experience in flood events (1: Yes; 0: No)
GENDER	−0.582 ** (0.225)	Respondent's gender (1: Male, 2: Female)
YEARSEXP	0.034 *** (0.013)	Years in positions related to civil protection
EDUC	0.275 ** (0.109)	Respondent's education level (1: Elementary, 5: Postgraduate degree)
Constant	1.964 ** (0.783)	
Observations	87	
Adjusted R ²	0.233	

Dependent variable: Probability of occurrence; Standard errors in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. For variables' abbreviations please see the "Details" column.

Table 5. The severity of consequences model results.

Variables	Coefficient	Details
RISKPER	0.433 *** (0.115)	Respondents' perception about the risk from floods (1: Negligible, 5: Very important)
PREVEXP	0.017 *** (0.006)	Previous experience in flood events (1: Yes; 0: No)
INFRSAT	−0.405 *** (0.110)	Satisfaction from existing infrastructure (1: Completely dissatisfied, 4: Completely satisfied)
AGE	−0.039 *** (0.015)	Respondent's age
YEARSEXP	0.032 ** (0.011)	Years in positions related to civil protection
Constant	4.352 *** (0.857)	
Observations	84	
Adjusted R ²	0.301	

Dependent variable: Probability of occurrence; Standard errors in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. For variables' abbreviations please see the "Details" column.

3.5. Early Warning Processes Assessment

Another important aspect examined in this survey has been the early warning processes and protocols followed. To this end, both input and output channels of information were sought. The vast majority of the respondents (almost 90%) said that their organization monitors warning information constantly, and more than 80% of those who replied positively said that they take specific measures upon warning. The comparison of the responses of 27 experienced and trained officials with the rest of the participants show a statistical difference (at $p < 0.1$ level) in the ratio of positive to negative answers with regard to taking action upon warning (4.4 and 2.75, respectively). That is, more experienced and trained respondents are more likely to act.

Concerning the input of warnings, about 46% stated that they receive warning information from official channels, 18.1% from the media, 15.2% from other organizations through non-official channels

(e.g., personal communication), 12.4% from automatic early warning systems, and the rest declared other sources of information (e.g., social media, online community or forum, etc.). Only one-third of the participants claimed that their department warns the public for upcoming flood threats. Further, respondents were asked to express their opinion on the reliability of weather warnings about flooding events. As shown in Figure 3, the majority of respondents (80.7%) gave a positive answer, whereas approximately 1 in 5 (19.3%) gave a negative one.

An ordered logit model was used to identify the factors that affect respondents' opinion about the reliability of weather warnings for potential flooding, the results of which are reported in Table 6.

Table 6. Reliability of weather warnings model results.

Variables	Odds Ratio	Details
WARNSAT	3.379 *** (1.131)	Satisfaction from warning processes (1: Completely dissatisfied, 4: Completely satisfied)
RISKPER	1.830 ** (0.548)	Respondents' perception about the risk from floods (1: Negligible, 5: Very important)
EDUC	1.467 * (0.356)	Respondent's education level (1: Elementary, 5: Postgraduate degree)
Observations	103	
LL	−66.340	
Pseudo-R2	0.157	

Dependent variable: Reliability of weather warnings; Standard errors in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. For variables' abbreviations please see the "Details" column.

Among the respondents' characteristics analyzed, education is a statistically significant factor. Based on the coefficient, for a one-unit increase in education (i.e., going from secondary to tertiary education), the odds of believing that warnings are more reliable are 1.5 times higher, given all of the other variables in the model are held constant. Similarly, if a respondent provides a higher rating to the risk from floods and is more satisfied with existing warning processes, the odds of warnings reliability between two consecutive scales of reliability are 1.83 and 3.38 times higher, accordingly. It has to be noted that respondents from local authorities provided fewer positive answers (64.3% against 80.7% of the total), although no statistical significance was observed.

Finally, participants were asked to suggest potential measures or initiatives towards improving early warning processes and protocols through an open-ended question. Among the measures suggested, the most important ones, in order of popularity, were: Improvement of spatial and temporal accuracy of predictions, adoption and use of additional technologies (e.g., SMS and other electronic messages), overall improvement of authorities' preparedness as well as public awareness campaigns and improved communication with the public. Statistically significant differences were found by comparing local to non-local actors and uniformed to civilian personnel. In detail, uniformed personnel prioritized public awareness and improved communication with the public at a higher rate than civilian personnel ($\chi^2 = 15.449$, $df = 3$, $p = 0.001$). In the same fashion, local personnel provided answers showing a higher percentage than non-local in improving prediction accuracy and adoption of additional new technologies ($\chi^2 = 9.598$, $df = 3$, $p = 0.022$).

4. Discussion

In this study, we used questionnaires addressed to civil protection personnel in Greece to examine their views and opinions on several flood risk management aspects, ranging from everyday practice to individual perceptions on risk. Then, through statistical analysis, we explored the degree to which officials are influenced by personal characteristics and views, as well as their position in the civil protection framework.

4.1. Assessment of Current Framework

Approximately two-thirds of the participants feel that future floods are likely or extremely likely to happen. Especially, participants with higher education and experience believe that the probability is higher. This overall response shows that officials tend to perceive the likelihood of future floods to be higher in comparison to that of laypeople [55], in which “likely” and “extremely likely” aggregate a percentage of only 41.2%, (much lower in comparison to the 63.5% of the officials). Moreover, as regards the impacts of future floods, over two-thirds of respondents, and in particular, those who are younger, more experienced and dissatisfied with flood protection infrastructure, perceive them as severe or very severe.

In terms of risk perception, the ranking follows the same order to the one found by Diakakis [55] and Papagiannaki et al. [56] in laypeople risk perception surveys in Greece. This is probably attributed to the fact that the country has experienced catastrophic damages and fatalities (over 1000 in the last century) from numerous catastrophic earthquakes in the past [46]. As research in the field suggests, people tend to have an increased fear of hazards that feel uncontrollable, unfamiliar, or catastrophic [57]. Greece has also experienced catastrophic forest fires that have affected public opinion, due to significant damages, fatalities, and environmental impacts provoked by them [58] (such as the multiple fatality fires in Peloponnese (2007), and in Attica (2018) [59]). Given the persistence of this ranking in different studies, it is interesting to note that floods in Greece have caused more damages and an almost double number of fatalities in comparison to forest fires in the last century [44,60].

Self-reported qualifications showed that the majority of the officials who participated in the survey lacked the pertinent education level and background, as well as hands-on experience. For instance, only 37% rated their knowledge on floods as “high”, and further, a high percentage responded “don’t know/not sure” or was wrong when asked about the measures taken in their respective areas of jurisdiction. Respondents were highly uncertain on whether flood protection measures are applied to their area. This could be primarily attributed to the lack of an official register of flood protection measures and to the absence of delivery-acceptance certificates or protocols when the service is transferred to a new official. This is an indication of a lack of continuity in civil protection departments. Furthermore, as mentioned above, this is related to the lack of knowledge and proper training, and organization in the respective departments. Finally, it could be attributed to the fact that civil protection departments are often headed by elected officials (a pattern identified by Papanikolaou et al. [26]) that terminate their service with the end of their incumbency, thus affecting continuity of practice and knowledge. As argued, officials do not have the necessary proficiencies and expertise in all areas, and this, in turn, increases the chances to be subject to laypeople biases [20,21], as seen for example in the perception ranking between floods and forest fires presented above.

Furthermore, the transmitted information is questioned, in terms of validity and time. A noteworthy percentage of participants (42%) stated that they receive warnings through unofficial channels (i.e., from mass media, personal communications, social media, etc.), and only 12% use a functional warning automatic system. Based on the survey, it is clear that the majority of the agencies take specific actions upon receiving warnings. A notable percentage of them re-transmit the warnings through various channels (i.e., website, press release, social media post, and others). It is worrying, however, that almost one-fifth of the respondents stated that they do not take specific actions upon a warning, although they are obliged to do so based on current regulations.

The majority of the respondents denoted specific machinery or equipment as the most useful asset in flood risk management, followed by human resources, early warning processes, and structural measures. In general, many officials declared dissatisfied with the funding situation of the agencies and certain factors that are connected to it, such as materials, equipment, human resources, and infrastructure. Political will and coordination between competent authorities also gathered negative views. In general, climate change is very low on the priority list of problems. This is in agreement with literature findings on lay perceptions [15] suggesting that floods are perceived more like a problem caused by

human interference, than a nature-induced or climate-induced phenomenon. This tendency has been documented in laypeople, in Greece, as well [55].

4.2. Influencing Factors

Results show that some of the respondents' characteristics are associated with perceptions and knowledge about everyday risk management practices, flood risk, etc. This difference forms an interesting pattern described in detail below.

Specifically, we found that responses on knowledge- and perception-related questions showed a statistical correlation mostly with personal characteristics of the participants, such as the years of service, hands-on experience in previous disasters, education level, qualifications, age, and gender, as well as how probable and how severe they perceive future floods to be. The position of the respondents (i.e., civilian, uniformed, local authority, or central authority official) was not found to influence their views or perceptions in this type of questions.

For example, concerning the rating of flood risk (negligible importance—very important), experience and qualifications showed an important correlation with answers. When the views of 27 of the respondents that have both experience (over five years), and a relevant background are isolated, there was an increase in the “very important” and “important” answers to a sum of 92.5% ($N = 27$), in comparison with the 85.7% recorded by the total of participants ($N = 105$), and the 56% reported by laypeople [55].

With regard to the perceived consequences and the probability of a future flood, over two-thirds of the respondents perceive them as “severe” or “very severe” and “likely” to “extremely likely to occur”, respectively. These percentages are higher amongst more experienced participants and participants of higher education. As far as the knowledge questions are concerned, we found that hands-on experience and pertinent qualifications, as well as self-assessment, are correlated with responses. Further, we found that responses to questions connected with everyday practice and processes (e.g., frequency of cooperation with other authorities, identification of the single most important obstacle in everyday practice and suggestions on early warning improvements, etc.) were influenced mostly by the participants' positions, rather than their characteristics or perceptions of risk.

The correlation of responses with participants' position was identified regarding satisfaction of various aspects of practicing flood risk management, frequency of cooperation with other authorities, identification of the single most important obstacle in everyday practice and suggestions on early warning improvements. An exception to this pattern was the correlation of experience and qualifications with taking action upon warning. Also, the experience was found to correlate with the frequency of cooperation, which could be influenced by the number of personal connections and networks created throughout the years of service.

Overall, two clusters of associations were identified (Figure 4). Knowledge and perception-related questions presented correlations with personal characteristics and perceptions of the respondents, whereas questions relating to everyday practice and processes showed correlations mostly with their position in the civil protection framework. In questions related to perception and knowledge, correlations with the position of the respondents are completely absent. In questions related to everyday practice, personal characteristics seem to play a far smaller role compared to the position of the respondents. This creates a contrasting pattern between the two categories of questions.

With regard to risk perception, the results coincide with findings reported in the relevant literature, which shows that various personal characteristics, such as age, experience, knowledge, and education, have an effect or are associated with how individuals perceive the importance of flood risk [16,36,38,55]. Correlations between the impact and the likelihood of future floods with the overall risk perception have also been acknowledged in previous works [61]. Working experience, involvement in disaster response and having relevant qualifications had a significant association with higher everyday practice scores [62].

		1		2					3		
		Local authority official / Central authority official	Civilian official / Uniformed official	Experience (Years of service)	Hands-on experience (Number of flood events)	Qualifications (Qualified / not qualified)	Education level	Age and/or gender	Perceived flood probability & consequences	Perceived knowledge (Self-assessment)	Perception of the importance of flood risk
Responses related to perception & knowledge	Knowledge (Structural measures availability)										
	Knowledge (Risk maps availability)										
	Perceived flood probability & consequences										
	Perception of the importance of flood risk										
	Perception of reliability of early warning										
Responses related to everyday practice & processes	Acting upon flood warning										
	Suggesting early warning improvement types										
	Frequency of cooperation with other authorities										
	Most important obstacle type										
	Most important tool / resource type										
	Satisfaction regarding everyday processes / practices										
		<div> <div></div> Significant at the $p < 0.05$ level <div>1 Parameters related to respondent's position</div> <div>3 Parameters related to respondents' perception</div> <div></div> Significant at the $p < 0.1$ level <div>2 Parameters related to respondent's personal characteristics</div> </div>									

Figure 4. Summary of statistically significant correlations between responses (rows) and respondents' characteristics (columns grouped in 1, 2, and 3). Colored squares denote association between variables, whereas white squares denote no association.

As far as the qualifications and education level are concerned, contrary to what was found by Fischer and McCullough [39], we did not find any role in everyday practice views, except for acting after receiving an early warning.

Differences in the views and priorities or suggestions of risk professionals depend on their position in the civil protection framework, as has been acknowledged before [28,63]. According to previous works, there exists a pattern even at institution-level studies [27]. Practical reasons may lead to different responses in this case. For example, regarding early warning processes, answers of local officials show a higher percentage in suggestions to improve prediction accuracy, as well as a lower ratio of positive to negative answers concerning satisfaction of current early warning processes. This difference can be attributed to the poor spatial and temporal accuracy of the early warning processes in Greece that may have practical implications or not meeting the practical needs of local officials whose area of jurisdiction is very localized (such as a municipality). Given that, in Greece, early warning is provided at the regional level, municipality-level officials probably need higher resolution predictions. Similarly, the higher frequency of cooperation that central officials indicate, could be the result of coordination efforts with more actors and a larger area of jurisdiction, as suggested by Lin et al. [41].

Local officials indicated funding as the most important problem or obstacle in their everyday risk management efforts. This is probably attributed to the relatively recent involvement of local authorities in risk management in the country (Law 3013/2002) [64] that has not been accompanied by propionate or adequate budget increases [26].

5. Conclusions

This survey aims to contribute to an existing knowledge gap in understanding the views of civil protection personnel and provide a basic understanding of how officials perceive flood risk and view everyday flood risk management practices. More specifically, the current work enhances the knowledge regarding the current framework in Greece, and contributes to the overall effort to improve the understanding of civil protection organizations across the EU, by providing insights of one piece of this puzzle. This is considered an important step towards addressing country-level problems, but also in providing a good understanding of a piece of a larger structure, that is the EU civil protection community [65–67]. Overall, it is a critical part of providing a foundation for leading a more homogenous, high-standard community of flood risk professionals. Understanding and improving professional qualifications has the potential to improve coordination in the long term [68], as institutions understand better each other's role, to benefit organizations, as they are linked to higher organizational performance [69], and to address the problem of fragmentation in flood risk management [70].

The study, using an extensive mapping of various characteristics of officials, presents evidence of shortcomings in hands-on experience and appropriate qualifications when it comes to personnel in Greece. The association of personal characteristics with perceptions of the personnel indicates that a rigorous standardization of qualifications would be beneficial in the sense that would lead to common views and possibly a common understanding of risks among officials. Additionally, the results reveal a general lack of continuity between and poor cooperation between organizations. To the authors' best knowledge, this is the first study that reveals a pattern between influencing factors, showing that the views on everyday flood risk management practices are influenced mostly from the position of an official in the civil protection community. In contrast, perception and knowledge are mostly associated with her/his characteristics. This "mapping" can provide a foundation for further research into improving training and cooperation among relevant authorities.

Future efforts should focus on training programs targeting officials to ensure the improvement of knowledge, as key factors and intermediate steps that correlate with a range of aspects in flood risk. Improvement of knowledge and qualifications is expected to enhance awareness of the variety of resources and assets, and increase their exploitation. Besides, it is expected to influence flood risk perception leading possibly to a positive increase in risk mitigation efforts. Training programs should highlight the effects and importance of climate change in flood risk, and the value of continuity in civil protection departments. Particularly, to enhance continuity, flood protection would benefit from the development of an official register of flood protection measures or other assets and resources.

In addition, regulations should be modified to become stricter in hiring trained personnel with pertinent qualifications, and retaining them for the long term to benefit from its training and experience.

Supplementary Materials: The following are available online at <http://www.mdpi.com/2071-1050/12/14/5585/s1>, Table S1: List of questions used in the questionnaire survey.

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