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Public interest in seismic building retrofitting

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Research Paper

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Public interest in seismic building retrofitting

Slovenia is confronted by significant seismic risks and has many seismically vulnerable buildings. Reducing this risk requires not only technical solutions but also an understanding of the public's willingness to implement retrofitting measures. Based on a convenience sample of 250 respondents in Slovenia, this study examines resident perceptions of seismic risk through an online survey conducted in 2024. This study investigates how systemic regulatory measures and financial incentives influence attitudes toward strengthening residential buildings. The results suggest that respondents most frequently identified access to professional seismic vulnerability assessments as the most important measure, followed by the simplification of administrative procedures and public information campaigns. Financial incentives were perceived as increasing the respondents' stated willingness to retrofit. As the survey relied on a convenience sample, the findings should be interpreted as exploratory instead of representative estimates of the Slovenian population.

Key words:

seismic risk, social behaviour, public awareness, earthquake preparedness, seismic building retrofitting

Prethodno priopćenje

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Interes javnosti za protupotresno ojačanje zgrada

Slovenija je izložena značajnom potresnom riziku i ima velik broj potresno ranjivih zgrada. Smanjenje tog rizika zahtijeva ne samo tehnička rješenja nego i razumijevanje spremnosti građana na provedbu mjera protupotresnog ojačanja. Na temelju prigodnog uzorka od 250 ispitanika u Sloveniji ovo istraživanje analizira percepciju potresnog rizika među stanovnicima putem internetskog anketnog upitnika provedenog tijekom 2024. godine. Istraživanjem se ispituje kako sustavne regulatorne mjere i financijski poticaji utječu na stavove građana prema protupotresnom ojačanju stambenih zgrada. Rezultati pokazuju da su ispitanici kao najvažniju mjeru najčešće izdvajali dostupnost stručnih procjena potresne ranjivosti zgrada, nakon čega slijede pojednostavnjenje administrativnih postupaka i javne informativne kampanje. Financijski poticaji prepoznati su kao čimbenik koji povećava iskazanu spremnost ispitanika na provedbu protupotresnog ojačanja. Budući da se istraživanje temelji na prigodnom uzorku, dobivene rezultate treba tumačiti kao eksplorativne pokazatelje, a ne kao reprezentativne procjene stavova cjelokupnog stanovništva Slovenije.

Ključne riječi:

potresni rizik, društveno ponašanje, svijest javnosti, pripremljenost za potrese, protupotresno ojačanje zgrada

1. Introduction

1.1. International experiences and selected cases in seismic-risk management

Countries worldwide have responded differently to major earthquakes. Following the 2015 Gorkha Earthquake, the Nepalese governed has extensively implemented institutional mobilisation measures, including mason training programs and the construction of demonstration buildings. Financial support from the government increased the sense of security, although individual advisory services failed occasionally because of residents' limited capacity to implement recommendations [1]. In Haiti, a bottom-up approach was tested; seismological stations were installed in selected households for over a year, which stimulated public interest and engagement through social media [2].
International studies confirmed that low seismic resilience typically originates from a combination of unsatisfactory construction practices, inadequate regulation, and limited public awareness. The case of Haiti [3] revealed that 93 % of buildings were damaged during the earthquake, primarily because of the absence of building codes and enforcement. The earthquakes in Algeria [4] highlighted deficiencies in public awareness and inconsistent regulation application. Poland [5] stressed the importance of informing residents about the safety of the buildings they inhabit, whereas Tanner [6] advocated for active public involvement in the development of measures to ensure alignment with societal expectations. By contrast, Turkish labour migrants demonstrated distrust toward structural engineers, believing that their involvement would not reduce seismic safety [7], whereas residents in the United States demonstrated willingness to exceed minimum safety standards through private investment [8]. In Indonesia, discrepancies between theoretical knowledge regarding earthquake-resistant design and its practical applications were observed, thus indicating challenges in transferring knowledge into practice [9].
Limited public understanding regarding post-earthquake expectations, recovery duration, and retrofit feasibility can be mitigated by greater resident participation in preventive and preparatory activities. Additionally, financial incentives can enhance seismic resilience. Therefore, Tanner recommended the formation of multidisciplinary expert teams that can provide engineering and social science perspectives [6].
The Italian Sismabonus program represents a government initiative aimed at promoting the seismic retrofitting of existing buildings through tax incentives, provided that interventions improve the building's seismic-risk class [10]. The guidelines for seismic-risk classification allow for a standardised assessment of building vulnerability based on the safety index and expected annual losses, thus forming the basis for determining eligibility for a tax incentive of [10]. An empirical study utilising a discrete choice experiment showed that potential property buyers in Italy are willing to pay between 19 % and 56 % more for seismically retrofitted buildings compared with similar properties with a higher risk [11]. These results suggest that the public prioritises reduced seismic vulnerability, thus confirming both the economic and societal rationale for tax incentives such as Sismabonus to promote seismic resilience and reduce risk in urban environments [10, 11].

1.2. Seismic resilience and recovery strategies in Croatia

In northern Croatia, the absence of major earthquakes for more than a century has resulted in low public awareness and preparedness [12]. However, this changed after the 2020 Zagreb earthquake (Mw 5.5), which-despite its moderate magnitude-caused one fatality and extensive damage to approximately 25 000 buildings. The direct and indirect financial losses exceeded EUR 10 billion [13, 14], and a crisis-management team was formed to rapidly assess building usability [12].
The Zagreb and Petrinja earthquakes exposed the structural vulnerabilities of buildings and institutional weaknesses. Approximately 30 % of buildings were constructed before 1963- when no seismic design standards were enforced, -using primarily unreinforced masonry [13, 15]. Even after 1964-prior to the adoption of modern standards-the prescribed seismic loads were considerably lower than those required currently [14].
The adoption of Eurocodes in Croatia began with a 2007 cooperation agreement, followed by the first HRN EN 199x editions in 2008 and Croatian-language consolidated versions with National Annexes between 2011 and 2013 [16]. Implementation was ensured through technical regulations issued by the Ministry of Construction [16].
Additional challenges included unsatisfactory maintenance, unauthorised construction legalised without technical documentation, and strict requirements for cultural-heritage protection, which limited seismic upgrading options [15]. The previous version of the law required owners to fund the comprehensive reconstruction of public and cultural-heritage buildings while providing co-financing for the structural retrofitting of damaged private residential and commercial buildings [15]. As the earlier cost-sharing model was unrealistic, the amendments explicitly eliminated the requirement for citizens to partially bear the structural reconstruction costs. Under the revised framework, reconstruction in the Zagreb area is now 80 % and 20 % financed by the state and city, respectively, whereas in the Banovina region, reconstruction costs are fully borne by the state [17]. Implementation has been hampered by limited resources, technically demanding heritage-zone projects,

and demographic decline, particularly in the Sisak–Moslavina County [15].

For public buildings in Zagreb, approximately EUR 680 million allocated from the European Solidarity Fund was to be spent within 18 months for hospitals, schools, cultural-heritage sites, and other public facilities [15]. Integrating seismic retrofitting with other construction improvements, particularly energy renovations, has been proven effective for increasing acceptance among owners. Since 2023, approximately EUR 40 million in subsidies for public-sector energy renovation has included co-financing for other technical features, including seismic resilience [18].

Despite the moderate seismic intensity of the 2020 event, three critical shortcomings became apparent: ineffective response by municipal and national authorities, insufficient operational military construction units, and a high proportion of seismically vulnerable buildings [15]. These experiences initiated discussions on proactive risk reduction measures and the necessity for a systematic, long-term approach to seismic-risk management [12, 14, 19]. The Croatian seismic hazard map [20] for Zagreb predicts peak ground accelerations between 0.20 and 0.28 g for a 475-year return period, which corresponds to 0.275 g for Ljubljana (Slovenia) [21], thus confirming that both countries are confronted by similar seismic-hazard levels.

1.3. Seismic risk and measures in Slovenia

Slovenia has experienced two significant earthquakes in the Posočje region in recent decades. The Bovec earthquake that occurred on 12 April, 1998 reached a magnitude of Mw 5.6 and maximum intensities of VII–VIII (EMS-98), thus causing widespread damage in the Upper Soča Valley. A second event occurred on 12 July, 2004 in the same area with a magnitude of Mw 5.2, which affected buildings in the Bovec basin [22]. Post-earthquake reconstruction after the first event amounted to approximately EUR 100 million and lasted 11 years [23]. The second earthquake was followed by several years of reconstruction and recovery activities in the affected area [24]. One and a half months after the first earthquake, the National Assembly adopted the Act on Post-Earthquake Reconstruction of Buildings and Development Promotion in Posočje [25], which defined financing measures, development assistance, and the organisation of implementation activities.

A study using a probabilistic seismic-risk model with 10,000 simulations assessed the potential impact of the 1895 Ljubljana earthquake on the Slovenian building stock. The median (50th percentile) results indicated complete damage to approximately 8,404 buildings, 568 fatalities, and approximately EUR 10.5 billion in direct economic losses. Additionally, the study showed that 42,000–102,000 buildings could be damaged in varying damage states. To capture uncertainty in ground motion and building vulnerability, the results were reported using percentile values: complete building damage ranged from 1,638 buildings (5th percentile) to 22,982 (95th percentile), fatalities from 99 to 1662, and direct economic losses from EUR 3.6 billion to EUR 21.7 billion [26, 27]. These findings underscore Slovenia's high vulnerability to strong earthquakes.

The historical development of seismic legislation in Slovenia mirrors that in Croatia, as both countries constituted the former Yugoslavia and shared the same legal framework. Therefore, seismic codes were introduced at similar times with comparable requirements for shaping the current building stock. In 2005, Slovenia adopted the Regulation on the Mechanical Resistance and Stability of Structures [28], which mandated the use of Eurocodes to ensure structural resistance and stability. In particular, Eurocode 8 sets the design criteria for earthquake-resistant construction and comprehensive retrofitting of existing buildings. Its mandatory application was enforced in 2008, i.e. earlier than that in Croatia. Currently, Eurocode 8 applies to both countries, thereby ensuring a harmonised approach to seismic design and retrofitting.

Recently, the systematic framework in Slovenia has advanced owing to the adoption of the Resolution on Strengthening Seismic Safety (December 2023) [29]. The Resolution outlines measures to reduce earthquake impacts as well as an action program for implementation, phased execution, and five-year updates. The key objectives include public awareness, legal and institutional framework development, professional training, building-stock assessment, financial support, retrofitting design and implementation, quality control, and monitoring of building conditions.

1.4. Conducted study

Seismic risk is shaped not only by hazard levels but also by the exposure and vulnerability of the building stock, thus highlighting the importance of understanding the perception and response of residents to this risk. Although this manuscript primarily focuses on seismic vulnerability, the term seismic risk is occasionally used for broader readability and accessibility to a wider audience. This study aims to examine how residents' perceptions of seismic risk influence their willingness to consider seismic mitigation measures. Additionally, this study investigates institutional and societal responses following major earthquakes. Emphasis is placed on the comparative experiences of Slovenia and Croatia, two countries that share similar seismological conditions and contend with an aging and seismically vulnerable building stock. A comparison between the Posočje region and the post-earthquake case of Zagreb enables the design of retrofitting strategies customised to Slovenia's demands using tested and transferable international approaches.

In 2024, a survey was conducted to assess Slovenian residents' awareness of seismic risk and their attitudes toward the seismic retrofitting of buildings. Data were obtained via an online questionnaire based on convenience sampling. Selected results are presented herein, with emphasis on the respondents' perceptions of the regulatory framework and financial incentives. In Slovenia, the amount of empirical evidence pertaining to the effect of examined factors on individual decision-making processes is limited, particularly in relation to expressed attitudes toward building seismic retrofitting. Thus, the presented findings provide primarily exploratory insights into individuals' attitudes instead of a direct reflection of their actual behaviour. The study aims to address the following research questions:

1. Under which circumstances do residents report greater willingness to consider seismic retrofitting measures?
   1a. Which aspects of the systemic regulatory framework have the greatest influence on residents' decisions?
   1b. How significant is the effect of financial incentives on residents' decisions?
2. How do demographic characteristics influence respondents' expectations and responses to seismic retrofitting?
   2a. How do demographic factors shape perceptions of systemic regulatory measures?
   2b. How do demographic factors shape perceptions of financial incentives?

The rationale for these questions is the recognition that effective seismic-risk reduction depends not only on technical solutions but also on residents' willingness to adopt them. Previous studies underlined the importance of regulatory frameworks and financial mechanisms as key external drivers of retrofitting; however, their relative weights in shaping individual decisions remain insufficiently examined in the Slovenian context. Moreover, demographic characteristics, such as age, education, residence type, and socioeconomic status, are known to influence risk perception and attitudes toward preventive action; however, systematic evidence related specifically to seismic retrofitting remain limited. By addressing these discrepancies, this study aims to

- identify the circumstances under which residents are most likely to undertake seismic retrofitting;
- evaluate the effects of systemic regulatory and financial measures; and
- investigate how demographic differences affect respondents' expectations and responses.

These exploratory findings may contribute to discussions on possible policy approaches and interventions that support the development and societal acceptance of earthquake risk-reduction strategies.

2. Research methods

This study employed a quantitative survey method in conjunction with structured questionnaires to obtain data regarding respondents' attitudes and perceptions regarding the seismic strengthening of buildings. The main objective of this study is to identify factors influencing residents' attitudes toward earthquake protection measures for residential properties.

2.1. Participants

The sample comprised 250 individuals. Analysis of the sample revealed a slightly higher proportion of males than females. Most of the participants were between 40 and 65 years of age, followed by under 40, with the smallest group being individuals over 65 years of age (Figure 1). In terms of educational structure, only two respondents had completed primary education, approximately one-sixth had completed secondary education, while the majority held a higher education degree. Approximately a quarter of the participants had a specialisation or doctoral degree. Regarding residential area, the proportions of participants residing in suburban and rural areas were comparable, whereas less than one-fifth resided in city centres. Most respondents were employed, followed by retirees, who constituted approximately one-sixth of the sample. Secondary school or university students comprised a smaller proportion, while only two respondents were unemployed (Figure 2).

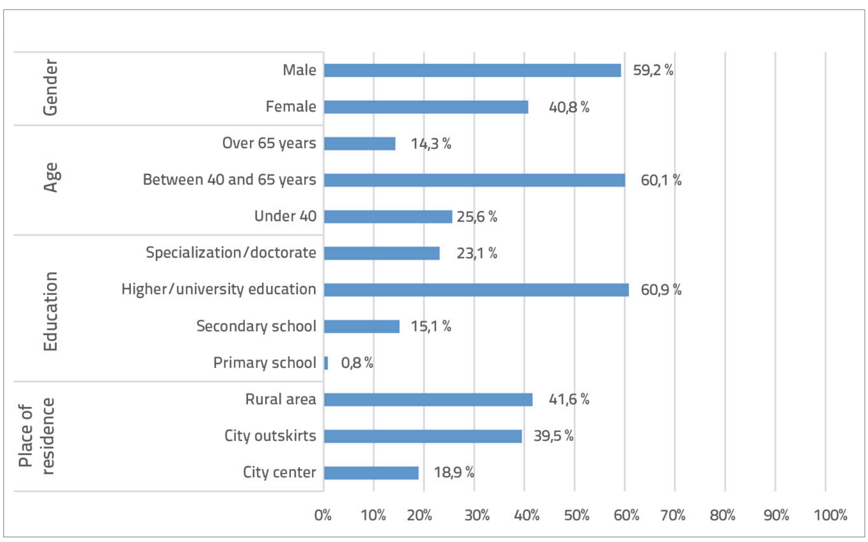

Figure 1. Structure of respondents by gender, age, education, and residential area

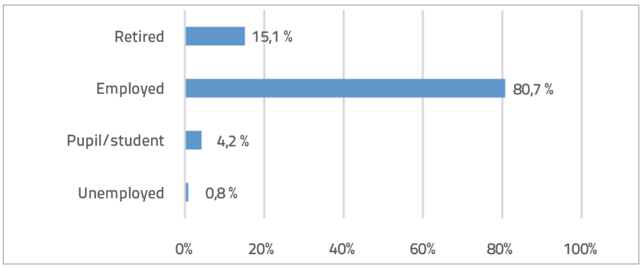

Figure 2. Structure of respondents by employment status

Regarding the residence type, one-quarter of the participants resided in apartment buildings, whereas the majority resided in houses (Figure 3). Most participants resided in their own property, while a few rented apartments or houses.

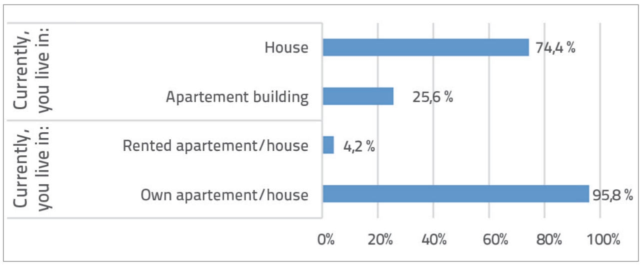

Figure 3. Structure of respondents by residence type

2.2. Materials and procedure

The study was conducted via an online survey administered using the 1KA platform [30]. Participants were invited through email, which included a direct link to the closed-ended questionnaire. Prior to data acquisition, a pilot study was conducted to evaluate the reliability of the instrument used, assess the clarity of the questions, and refine the final version of the questionnaire based on participant feedback. The survey comprised 32 questions segmented into three sections. The first section (11 questions) assessed the respondents' personal perceptions of earthquake risk and their general awareness of seismic-risk issues. The second section (11 questions) focused on the respondents' views regarding the property in which they reside, and the final section (9 questions) pertained to the acquisition of demographic information.

Data were analysed using IBM SPSS (version 29) [31]. Chi-square tests were performed to examine the effects of systemic measures on the implementation of earthquake-mitigation measures. The effect of financial incentives on renovation decisions was assessed via independent-sample t-tests for comparisons between two groups and one-way analysis of variance (ANOVA) for comparisons among more than two groups.

3. Results

The findings provide insights into the respondents' views regarding two key aspects regarding the seismic retrofitting of buildings: systemic regulatory frameworks and financial incentives. The analysis aimed to identify measures perceived as the most effective in motivating the residents to undertake seismic strengthening, as well as to determine the variance of expectations across selected sociodemographic characteristics.

3.1. Systemic regulation

The respondents were instructed to select the most important measure among several policy instruments to identify priority perceptions. The forced-choice format may impose an artificial hierarchy among complementary measures instead of mutually exclusive ones. When inquired about the most important systemic measure to promote seismic retrofitting, most respondents emphasised the possibility of obtaining a professional assessment of the seismic vulnerability of existing buildings (Figure 4). The second most frequently mentioned factor was the simplification of procedures for acquiring building permits and approvals, followed by public awareness and information campaigns. Only approximately one-tenth of the respondents highlighted legislative change as the key measure, whereas a smaller proportion mentioned that systemic regulation did not affect their decision making.

A more detailed analysis conducted using the chi-square test revealed a statistically significant association between the preferred systemic measure and gender ($p = 0.032 < 0.05$).

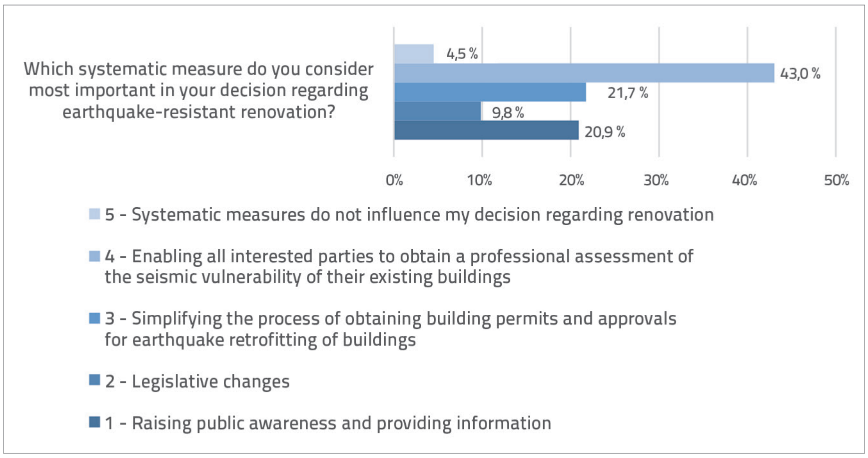

Figure 4. Respondents' opinions regarding the most important systemic regulatory measure when deciding on seismic retrofitting

Table 1. Association between respondents' expectations regarding key systemic regulatory measures and socio-demographic variables

Socio-demographic variable	Test performed	p-value	p < 0.05
Age	Chi-square	0.064	No
Education	Chi-square	0.508	No
Place of residence	Chi-square	0.102	No
Employment status	Chi-square	0.232	No
Property ownership	Chi-square	Test assumptions not satisfied	No

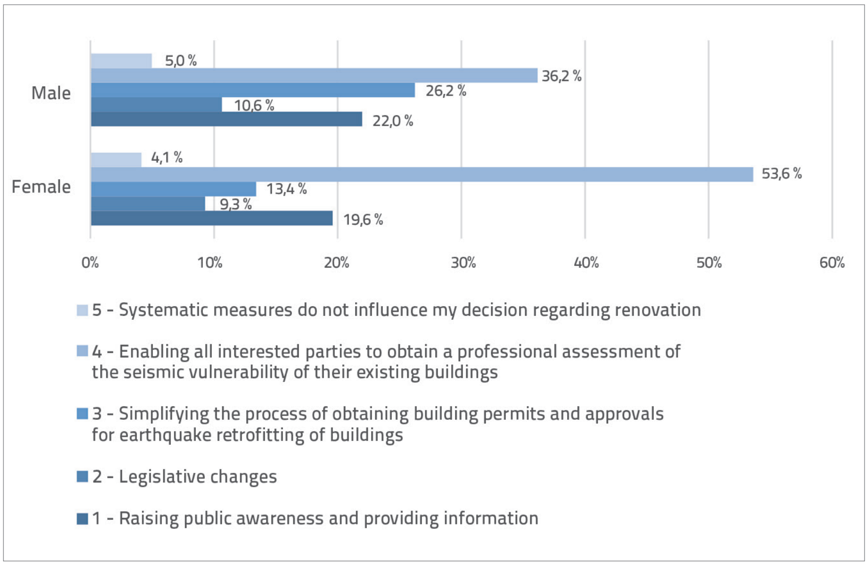

Figure 5. Respondents' expectations regarding the most important systemic measures by gender

Whereas women emphasised professional vulnerability assessments and public awareness initiatives, men expressed slightly lower support for expert assessments. In general, approximately one-quarter of the respondents identified procedure simplification for obtaining building permits and approvals as the most important measure (Figure 5). For the other variables (age, education, place of residence, employment status, and property ownership), no statistically significant associations were observed ($p > 0.05$), as presented in Table 1.

3.2 Financial incentives

Additionally, the analysis examined the effect of potential government financial incentives on decisions to undertake seismic strengthening (Figure 6). Most respondents indicated that financial incentives would exert a strong or very strong effect on their decisions, with the combined proportion of these two responses amounting to 54.9 %. Fewer than 10 % of the participants reported that financial incentives would not affect their decisions. The average score was 3.45 (SD = 1.303), thus suggesting that financial instruments were perceived as a relevant factor influencing the stated preferences (Table 2).

A gender-based comparison revealed statistically significant differences ($p = 0.033 < 0.05$), with women attributing higher importance to financial incentives than men (Figure 7). For other sociodemographic variables (age, education, place of residence, employment status, and property ownership), no statistically significant differences were observed ($p > 0.05$), as presented in Table 3.

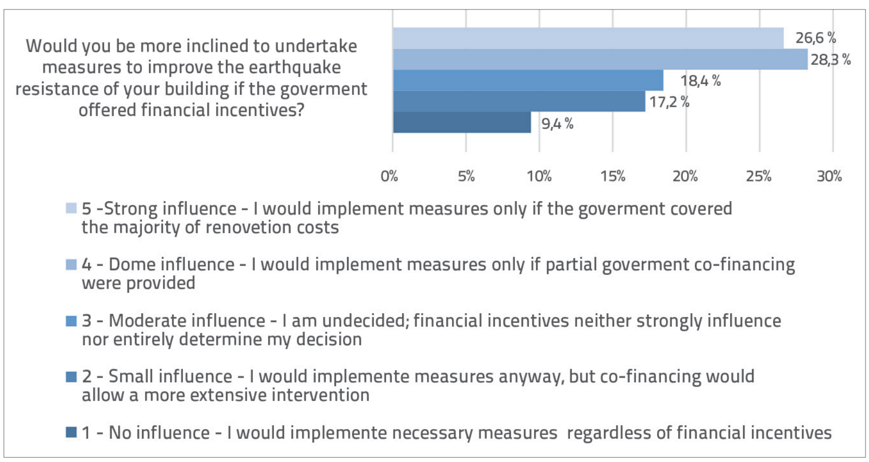

Figure 6. Respondents' opinions on whether financial incentives would increase their likelihood of undertaking seismic strengthening

4. Discussion

The survey was conducted using a convenience sampling approach in conjunction with an online questionnaire. Therefore, the results should be interpreted as exploratory

Table 2. Descriptive statistics for respondents' opinions regarding role of financial incentives in seismic retrofitting

Research question related to financial incentives	N	Minimum	Maximum	Mean	Std. deviation
Would you be more inclined to undertake measures to improve the earthquake resistance of your building if the government offered financial incentives?	244	1	5	3.45	1.303

Table 3. Respondents' expectations regarding seismic retrofitting measures in relation to financial incentives by socio-demographic variables

Socio-demographic variable	Test performed	p-value	p < 0.05
Age	ANOVA	0.685	No
Education	ANOVA	0.392	No
Place of residence	ANOVA	0.965	No
Employment status	ANOVA	0.053	No
Property ownership	t-test	0.278	No

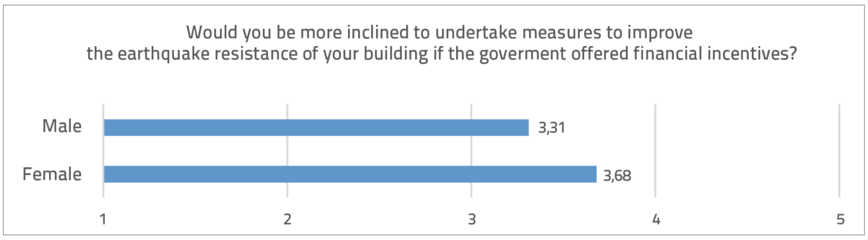

Figure 7. Average respondents' expectations regarding seismic retrofitting measures in relation to financial incentives by gender

informed decision-making by owners. Procedure simplification for obtaining building permits and approvals for seismic retrofitting (21.7 %) along with public awareness and information campaigns (20.9 %) were identified as the next most important factors. Only 9.8 % of the participants emphasised legislative change as the key measure, whereas 4.5 % reported that systemic

insights into the respondents' attitudes instead of statistically representative estimates for the Slovenian population. Relatively uniform responses across sociodemographic groups may reflect sample bias, in particular the overrepresentation of highly educated respondents. The survey did not include a detailed geographic stratification by region, proximity to past earthquake impacts, or local seismic exposure levels. Because perceptions of seismic vulnerability may vary depending on previous earthquake experience and regional hazard awareness, future studies should incorporate geographically stratified sampling approaches to allow for a more detailed comparative analysis.

Despite the exploratory nature of the survey, this study provides useful insights into the respondents' perceptions of seismic retrofitting in Slovenia-a topic that has received limited empirical attention. This study addresses two research questions. The first concerns the circumstances under which residents are more likely to implement seismic retrofitting measures, considering systemic arrangements and financial incentives. The survey results indicated that the most frequently identified factor was the availability of a professional seismic-risk assessment of buildings, as selected by 43 % of the respondents. This finding highlights the lack of accessible, standardised information regarding the actual risk of individual structures, thus hindering

arrangements did not affect their decision to undertake retrofitting. Poland's [5] thesis resonates directly with the findings of the present study, which demonstrated that residents expressed the strongest support for systemic measures that enable access to professional seismic-risk assessments of their properties. This suggests that transparent information is key in motivating individuals to undertake seismic retrofitting, particularly when the decisions entail substantial financial investment.

Financial incentives were perceived by the respondents as influencing their stated willingness to undertake retrofitting, with most (54.9 %) reporting that such measures affected their choices, whereas only 9.4 % indicated that they would proceed regardless of the financial support. This underscores the central role of economic considerations in retrofitting decisions, which is consistent with Hendriks [1], who discovered that most respondents would pursue seismic strengthening only if co-financed by the state, and with Fajfar [32, 33], whose findings suggest that even experts in Slovenia would implement retrofitting in only one-third of cases without favourable loans or subsidies. Interestingly, Joffe [34] observed that economic resources were not consistently decisive in certain contexts (the United States, Japan, and Turkey).

The second research question focused on the differences in the respondents' expectations regarding systemic arrangements and financial incentives across demographic groups. The analysis revealed statistically significant differences by gender, whereas no such variations were observed with respect to age, education, residential area, or employment status. This indicates a relatively homogeneous perception among respondents regarding the key conditions for action, which may support the design of broadly acceptable measures without requiring narrowly targeted differentiation.

Additionally, the importance of financing is emphasised in the Resolution on Strengthening Seismic Safety [29], which identifies the establishment of financial mechanisms for retrofitting earthquake-prone buildings and systematically reducing seismic risk among its key objectives. These findings highlight the necessity of aligning the legislative, technical, and social dimensions of seismic retrofitting, which encompass not only engineering solutions but also institutional and financial mechanisms, along with active public engagement.

Slovenia and Croatia encountered similar challenges. In both countries, systemic changes were primarily triggered only after major earthquakes. In Slovenia, this occurred after the earthquakes in the Posočje region, whereas in Croatia, it occurred following the 2020 Zagreb and Petrinja earthquakes. Croatia subsequently incorporated co-financing for seismic resilience into public building energy renovation programs in 2023 [18], where an integrated model was introduced that simultaneously enhanced energy efficiency and seismic safety while ensuring a more rational use of public funds. The 2020 Croatian earthquakes revealed the low seismic resistance of the existing building stock [12, 13, 15], a condition similarly recognised in Slovenia [26]. Experiences from both countries confirmed that systemic change can be initiated by crisis events; however, such measures are typically confined to affected areas instead of contribute to the formation of a comprehensive, long-term strategy.

5. Conclusion

Seismic safety in Slovenia and Croatia represents a strategic challenge because both countries are situated in seismically active regions and have a substantial proportion of vulnerable building stock. Despite having seismic-risk awareness, the Slovenian survey respondents were less likely to undertake seismic retrofitting without appropriate incentives. The most widely supported measure was the introduction of professional seismic-risk assessment. These findings provide insights that may inform future policy discussions and the development of policy instruments aimed at promoting more systematic seismic retrofitting. The respondents indicated preference for solutions that combine such assessments with administrative simplifications and financial incentives. However, international studies emphasised that legislative reforms alone, without effective public awareness and regulatory enforcement, cannot secure long-term seismic safety. The Resolution on Strengthening Seismic Safety explicitly includes the establishment of financial mechanisms for retrofitting and seismic-risk reduction among its key goals, which aligns directly with the findings of this study. The survey results indicated a degree of alignment between the respondents' expectations and the measures outlined in the Resolution, thus suggesting that consistent implementation can increase residents' willingness to pursue seismic retrofitting.

Experiences from Croatia after the Zagreb earthquake demonstrated that integrating seismic resilience into existing programs, such as energy renovations, generated multiple benefits and strengthened the motivation for comprehensive retrofits. A similar model could apply to Slovenia, as it would simultaneously advance seismic safety and environmental goals while introducing state subsidies for seismic strengthening modelled after existing incentives for energy efficiency. Additionally, comparing the cases of the Posočje region and Zagreb enables the formulation of comprehensive retrofitting strategies that are both effective in Slovenia and informed by international experiences. Such cross-country learning demonstrates the potential for regional cooperation, where Slovenia and Croatia, confronted by similar seismic risks, can mutually benefit from an exchange of approaches. This comparative perspective highlights the importance of adapting proven models to national contexts to design policies that are technically sound, economically feasible, and socially acceptable.

A comprehensive approach to seismic retrofitting must integrate engineering, legal, financial, and social dimensions. Undertaking energy renovations without prior structural strengthening risks creates a false sense of security and may ultimately increase long-term costs. Therefore, seismic resilience should be regarded as an equally essential component of sustainable renovation, which is closely related to other strategic objectives. These findings offer exploratory insights into the development of legislative reforms, financial instruments, and policy measures aimed at promoting more systematic and accessible seismic retrofitting in Slovenia. Only through such a comprehensive and long-term approach can a safer, more sustainable, and economically resilient living environment be ensured, thereby effectively reducing seismic risk and population vulnerability to future earthquakes.

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