



JAPAN - ROMANIA KNOWLEDGE TRANSFER FOR EARTHQUAKE DISASTER PREVENTION PREPAREDNESS OF CITIZENS IN BUCHAREST

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SUMMARY

The paper presents the investigation of earthquake disaster prevention preparedness of citizens of Bucharest, as a component of the Japan-Romania Project on Seismic Risk Reduction. This project is financed by JICA – Japan International Cooperation Agency on 2002-2007, in cooperation with the Ministry of Transports, Construction and Tourism – MTCT of Romania in the framework of the National Center for Seismic Risk Reduction – NCSRR as implementing agency.

The objectives of the study are related to identification of present situation of risk perception and new knowledge transfer forms necessary in earthquake education of apartment owners in Bucharest, to facilitate their active involvement in structural retrofitting, as they are living in first class of risk buildings that represent a public danger [1].

The questionnaire survey proved to be useful in understanding the opinions and reasoning of citizens who live in vulnerable buildings, concerning earthquakes effects and retrofitting.

The positive answers show a remarkable consciousness about the seismic risk in Romania and in Bucharest and are very well correlated to the age and profession structure as well as with the experience of living nearby area of collapsed buildings at the March 4, 1977 earthquake.

Since some public apathy and doubts in citizens opinions may be the reason of their reluctance to engage in strengthening works, there is a need of more adequate forms of education and preparedness of keeping alive the public awareness.

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INTRODUCTION

The seismicity of Romania, is dominated by the Vrancea intermediate depth earthquakes (as a rule, depths between 80 and 160 km) that affect with high intensities ca. 50% of the territory. The amounts of elements at the highest risk are large, since the seismic areas cover 65% of the territory, including almost 75% of population (over 60% in strong seismic zones) [2; 3; 4; 5; 6]. The size of actual losses was emphasized by the March 4, 1977 Vrancea earthquake ($M=7.2$) as well as by the November 10, 1940 earthquake ($M=7.4$). Bucharest was affected by building collapses and heavy damage most recently in 1940 and 1977. The March 4, 1977 earthquake was a disaster for Bucharest, due to the concentration of casualties (over 90% of the total 1,570 deaths), collapse of high-rise buildings and other large damage, i.e. 1.4 billion US\$ out of 2 billion US\$ for whole Romania (World Bank, 1978) [11]. Earthquake scenarios emphasized the potential of future losses [5; 7].

Bucharest has 16.4% of the total urban population (or 9% of the country's population), with ca. 2 million inhabitants. The central area has an agglomeration of neoclassical and high-rise reinforced concrete pre-1940 buildings, made of gravitational reinforced concrete skeleton, with masonry infill that are the highest factor of risk in Bucharest, as the available vulnerability data emphasize higher collapse probabilities [5].

THE RATIONALE FOR JAPAN-ROMANIA KNOWLEDGE TRANSFER

Japan and Romania are both earthquake prone countries.

Japan, a country with a strong seismicity and special contributions in the modern earthquake engineering is internationally recognized as an example of a country securing simultaneously a higher development, a gradually increasing disaster prevention and a comprehensive management. (Fig. 1).

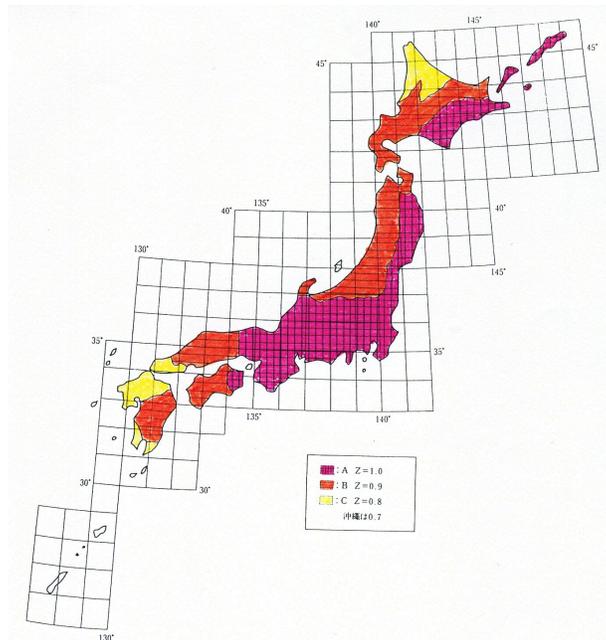


Fig. 1. The seismic zoning map of Japan (for earthquake design of buildings) indicates that almost all territory is subjected to strong motions

Concerning the legal system, one may quote the Basic Act of Disaster Protection which is governing all laws and regulations related to disasters and the Government of Japan gradually adopted some laws for relief and recovery starting from the end of the 19-th century. In 1978, the Large-Scale Earthquake Countermeasures Act was promulgated and this law requires that facilities necessary for disaster prevention be installed.

Besides the highest engineering education and the major revisions of earthquake design codes of 1981 and 2000 [9], the public education for earthquake preparedness is provided in Japan in various forms, starting with the school curricula, exercises of evacuation and fire prevention, mutual help, collectivity cooperation, up to experiencing of shaking in earthquake simulators; booklets and documentary films are used too.

Romania, a country with a moderate seismicity in comparison with other countries, but proving an extended vulnerability of some urban categories of structures, was struck in the last century by four strong earthquakes. After centuries of seismic damaging events, earthquake resistant design codes were enacted in 1942 (provisional rules), 1963, 1970, 1978 and 1981, 1991/1992. The earthquake resistant design codes P100/ 1991, 1992 introduced in chapters 11 and 12 (revised 1997), the obligation to evaluate and, if required, to rehabilitate the existing buildings. The Ministry of Transports, Constructions and Tourism coordinates the implementation of a Law / Government Ordinance on Strengthening of Existing Buildings (Ordinance no. 20/1994), with a system of subsidies. Over 120 buildings of first class risk were documented and few strengthening projects are accomplished, but many are still waiting for rehabilitation works, depending upon their owners decision.

A new earthquake design code, with a new zoning map, is going to be enforced in 2004-2005, increasing the demands for rehabilitation of existing buildings [12] (Fig. 2).

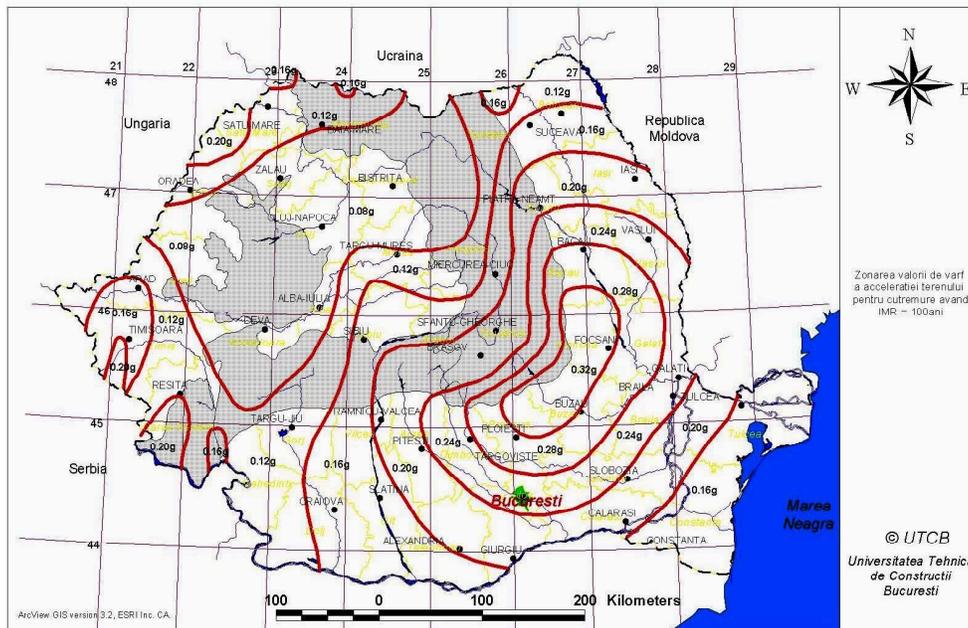


Fig. 2. The newly developed seismic zoning map of Romania for a mean recurrence interval of 100 years (Code P100 – 2004 – in project) [12], shows that zones with high values of PGA (0.32 g to 0.16 g) originating in Vrancea source are expected on over 50% of area, Bucharest being zoned with a PGA of 0.24 g.

The earthquake disaster of Hyogo-ken-Nanbu (Kobe) of January 17, 1995 in Japan proved that recovery is possible in shorter periods than before, using public policies, new engineering techniques and adequate resources, with a direct cooperation of citizens and local communities. As Kobe is similar in size to Bucharest, this example and the larger Japan-Romania transfer of knowledge can be useful. In this respect, one can start from the assessment of the people's involvement in preparedness, evaluating first of all their perception of seismic risk.

If a formative process of consciousness for earthquake preparedness is taken into account, according to Masuda, Midorikawa, Miki and Ohmachi [8], it should be considered that:

- motivation is represented mostly by the past Romanian earthquake damage and losses and the assessments that prove the probability of large losses in the future;
- accumulation of interest and knowledge is supposed to follow motivation, if methods are properly chosen;
- the action for earthquake preparedness efficiency remains to be checked on short, mid and long term as a parameter in loss reduction.

Since earthquake disaster preparedness and risk mitigation constitute two of the important activities of earthquake disaster management, it was considered necessary to investigate the current situation of citizens opinions within the framework of the JICA Project.

THE OUTLINE OF THE JICA PROJECT IN ROMANIA

The Ministry of Public Works, Transports and Housing of Romania (presently named Ministry of Transports, Construction and Tourism - MTCT) and the Japanese International Cooperation Agency, JICA signed on August 1st, 2002, the Technical Cooperation Project entitled "The Japanese Technical Cooperation Project on the Reduction of Seismic Risk for Buildings and Structures". The Project started on October 1st, 2002 in the framework of the National Center for Seismic Risk Reduction –NCSRR as implementing agency and the scope of the Project is to strengthen the capacity of earthquake related disasters prevention activities in Romania.

The main activities of the National Center are as follows:

- issuance of new technologies for retrofitting the earthquake vulnerable buildings and structures as well as new codes for seismic resistant design, with a special component for seismic instrumentation of Bucharest and of densely built areas;
- transfer to specialists of state-of-the-art knowledge in the anti-seismic protection domain and issuing documentation regarding education of the population and knowledge dissemination for preventing risks;
- development of technical knowledge by training, studies and documentation, seminars, courses and lecturers in Romania and abroad, promotion of the international cooperation for seismic risk management, studies and publications in the specific field of activity;

BACKGROUND OF THE QUESTIONNAIRE SURVEY

In the past, there was some experience in questionnaire surveys about earthquake behavior after 1977, 1986 and 1990 earthquakes [2; 10], as well as a recent one about the necessity of buildings strengthening, commissioned by MTCT in 2002-2003. Since the strengthening and rehabilitation of pre-code buildings (before 1940) are somehow a critical point in advancement of risk reduction programs, new more precise questionnaires were drafted in 2003 by NCSRR and JICA experts and distributed by NCSRR and MTCT.

The purpose was to make clear the present state of mind of residents who live in vulnerable buildings on earthquakes effects and building retrofitting, and then to have a feed back on effective actions to promote strengthening of their buildings and also to check the effect of the project activities on residents in respect of earthquake preparedness. The survey was designed so as to link action plans to be followed based on the survey result with the ultimate goal of boosting the number of retrofitting projects:

- if residents are willing and open to retrofitting, identify obstacles that make them still indecisive;
- if they have a negative attitude, identify the alternatives that lead them to agreement.

The questionnaire had 6 basic questions and a general one for grouping the residents, as follows:

- Question C1. State of mind of apartment owners - residents concerning knowledge about earthquake disasters (5 questions, each with 2 - yes / not - answers possibilities);
- Question C2. Preparedness of apartment owners for earthquake disaster prevention (5 questions, each with marks for 6 answers possibilities);
- Question C3. Knowledge and recognition by residents of the vulnerability and risk level of their buildings (3 questions, each with marks for 6 answers possibilities);
- Question C4. Response of residents to retrofitting work (3 questions, one with 2- yes / not - answers possibilities, another with free answer and the last with a suggested alternative answer);
- Question C5. Knowledge level of residents on laws in force and financial incentives concerning retrofitting program (7 questions, each with 2 - yes / not - answers possibilities);
- Question C6. Negative factors against retrofitting work (5 questions, each with 2 alternatives, 1 question about NCSRR existence, with 2 answer possibilities and an additional one). Suggestions to avoid such negative factors, with free place for writing answer;
- Question C0. General data on age, gender, education background, profession, working/retired and income situation of apartment owners (5 items, each with 2...4 answers possibilities).

PROCESSING OF ANSWERS AND SURVEY RESULTS

The questionnaires have been distributed to some 340 apartment owners and to other 115 chairmen of owners associations in class I risk high-rise buildings in the central area of Bucharest. The response ratio was 44.8% (a number of 204 out of 455). The following processing was used:

- for the questions with yes/not answer, the basic processing refers to the ratio of positive answers and a conclusion about the significance of the respective result.
- for the questions with marks, the basic processing will refer to the ratio of answers for each mark, mean value, standard deviation etc. and a conclusion about significance of the respective result.
- for all questions, a special processing provides multiple correlations between questions.

Concerning the survey results and specific comments on the answers, it is worth mentioning that:

- the data about level of knowledge and fields that needs improvements;
- the weights and trends of citizens response, in conjunction with seismic risk and issues of personal, social, economic and legal significance;
- possible improvements of Romanian technical and legal approaches, able to speed up the retrofitting works.

Question C1. State of mind of apartment owners - residents - concerning knowledge about earthquake disasters (5 questions, each with 2 - yes / not - answers possibilities)

-C1-1. 196 citizens (96 %) declare they have the experience of a strong earthquake;

-C1-2. 195 citizens (95.96 %) declare to know that Bucharest is one of cities most exposed to seismic disasters;

-C1-3. 182 citizens (89.2 %) declare to have knowledge about 1977 disaster victims in Bucharest;

-C1-4. 194 citizens (95 %) declare to have knowledge about Vrancea earthquakes disastrous effects in Bucharest;

-C1-5. 201 citizens (98.5 %) declare to correlate the collapse of buildings to the cause of deaths.

These positive answers show a remarkable consciousness about the causes of seismic risk in Romania and in Bucharest and are well correlated to the age / past experience and profession structure.

Question C2. Preparedness of apartment owners for earthquake disaster prevention (5 questions, each with marks for 6 answers possibilities):

-C2-1. 51.47 % are concerned and worried about predictions of strong earthquakes and think to do something and /or to take measures;

-C2-2. 63.72 % are concerned and worried about threats to life posed by earthquakes and think to do something and /or to take measures;

-C2-3. 61.27 % are concerned about seismic disasters in Bucharest, worry and think to do something and /or to take measures;

-C2-4. 67.65 % believe that they can protect their life safety, worry and think to do something and /or to take measures;

-C2-5. 69.60% intends to be more careful to prevent earthquake disasters, worry and think to do something and /or to take measures.

All these answers represent a comfortable majority and denote a positive, reasonable, conscious and protective attitude of questioned residents, at least in their intentions. However, the ratio needs to be increased in order to ensure the efficiency of risk reduction measures.

Question C3. Knowledge and recognition of residents of the vulnerability and risk level of their buildings (3 questions, each with marks for 6 answers possibilities)

-C3-1. 51.96 % know well and very well that there is a Seismic Evaluation Report of their building and are interested to take measures, influencing also others. There are also 63 (30.88 %) that know something about and want to know more, thus the total ratio of concerned people is 82.84 %;

-C3-2. 58.82 % know well and very well that buildings are ranked in classes of seismic risk and are interested to take measures, influencing also others. There are also 22 % that knew something about and want to know more, thus the ratio of concerned people is 80.82 %;

-C3-3. 61.76 % know well and very well that their building is in a category of maximum collapse risk at earthquake and are interested to take measures, influencing also others. There are also 20.59 % that know something about and want to know more, thus the ratio of concerned people is 82.35 %;

All these answers denote a very good information about the risk situation, and the willingness to take measures for seismic risk reduction, although in practice their attitude can be more reluctant.

Question C4. Response of residents to retrofitting work (3 questions, one with 2- yes / not - answers possibilities, another with a free answer and the last with suggested alternative answer)

- a significant majority – 61.28 % consider that strengthening works will increase the safety of buildings, but there are some 25 who do not trust (12%) and some 49 who do not know (24%);

- a significant majority – 63.24 % consider that a 51% ratio of owners votes are necessary for deciding upon strengthening;

These answers denote that the majority of residents are positive and aware about the seismic risk and the role of strengthening and they would like to start strengthening their buildings. At the same time, in order to ensure full cooperation of citizens in this process, there is a need for more educational activities in order

to be closer to consensus, to limit the cases of special legal measures for access in interior only to the situations of absentees and/or bad faith owners.

The causes of 24% negative answers can be related to the exaggerate confidence of some citizens in the efficacy of 1977 strengthening works, combined, amazingly, with the lack of confidence of others in the works of that period (!!!), when many apparently “cosmetically done” works were performed. Thus, there is a need for a better communication to convince citizens that the quality control assurance system provides quality of projects and nowadays earthquake engineering is efficient.

Question C5. Knowledge level of residents on laws in force and financial incentives concerning retrofitting program of buildings in class 1 of risk that presents a public danger (7 questions, each with 2 - yes / not - answer possibilities)

- large majority declare to know the laws in force, as follows:
 - knowledge about OG 20/1994 system of seismic risk reduction: 84.80 %;
 - knowledge about obligation of owners associations in this respect: 79.96 %;
 - knowledge about the risk assessment of their building: 88.72 %;
 - knowledge about the obligation after the risk assessment report: 74 %;
 - knowledge about the incentives set forth under OG no. 20/1994:
 - MTCT financing of risk assessment 83.82 %;
 - MTCT financing of design and retrofitting works: 82.84 %;
 - system of long-term loans: 69.60 %;
 - exemption from monthly payments for low-income families: 72.55 %;
 - exemption from permit fees for retrofitting: 76,47 %;
 - knowledge about the ways to obtain legal incentives 71.08 %;
 - the involvement of owners association in citizens information about legal system of risk reduction and incentives: 52.45 % positive, but also 37.75 % consider its role insufficient.

The answers are positive, but taking into account the situation in fact, their decision is also influenced by other subjective arguments. Consequently, there is a need to encourage owners associations to convince the reluctant people, using legal advice, brochures and seminars organized in their neighborhood.

Question C6. Negative factors against retrofitting works. (5 questions, each with 2 alternatives, 1 question about NCSRR, with 2 answer possibilities and an additional one). Suggestions to avoid such negative factors, with a free place for writing the answer.

We remarked that the questions that are legal, financial and technical in nature describing the actual situation (point *a*) seem to have been expressed in a way that was difficult for citizens. Thus, they did not understand if the answer should be positive or negative, and there is no answer or answers are very scattered.

On the contrary, the *b* answer was clearer to them and the structure of answers shows they really understood the significance of questions.

- C6-1.a.- majority of them – 53.43 % did not answer about the influence of being alone, some disagree others are undecided and only some 24% agree that it can be a reason;
- C6-1.b – support – 70.59 % agree and totally agree to receive support of association and public authorities;
- C6-2.a. - incentives – 44% did not answer, 27.94 % agree + totally agree present limiting of incentives (??? wrongly put question !)
- C6-2.b. - incentives – 64.70 % agree + totally agree to broadening of incentives, others did not answer;

- C6-3.a.- mortgaging: 28.43% – did not answer (??? question improperly worded !), 42.16 % declare disagreement to a negative question about mortgage ? (??? question improperly worded!), 22.55 % agree with the question + totally agree that mortgaging is not positively seen by owners (correct understanding).

These two groups of answers can signify the same, but citizens were misled by the formulation of question.

- C6-3.b.- mortgaging : 29.9 % did not answer, 26.47 % disagree, 8.3 % are undecided, while 35.29 % agree with contracts between owners and authorities. It is possible that citizens did not understand exactly what the alternative was.
- C6-4.a. duration of works: 36.76 % – did not answer, some disagree or are undecided, 43.63 % agree+totally agree that duration of works is too long;
- C6-4.b.- duration of works: some did not answer, but 72.55 % agree+totally agree that urgent measures are necessary to speed up works;
- C6-5.a. – limitation of space: 39.7 % did not answer (??? wrongly worded question !), 19.12 % fully disagree+disagree with the limitation of space ?, 37.25 % agree+totally agree that present situation is as presented in the question !
- C6-5.b. - new technologies: some did not answer, but 76.47 % agree+totally agree with the use of new technologies. This means the owners understood the meaning of questions and ways of seismic risk reduction.
- C6-6. – function and role of NCSRR: - quite many (79) knew about NCSRR but 61.27 % did not know. The explanation can be the recent organization of the center. Therefore, the need for a larger publicity of the activities of MTCT – NCSRR to citizens, about the JICA Project results, as citizens have a lot of expectations from the experience of technologically advanced and seismic country like Japan.

Question C0. General data on age, gender, profession, working and income situation of apartment owners (5 items, each with 2...4 answers possibilities)

The structure of investigated population is as follows:

Question C01-Age:

- 18-39 years: -21-(10.29 %)
- 40-59 years: -64-(31.37 %)
- over 60 years: -119-(58.33 %)

This age structure – a great ratio of people is aged - confirms and explains the reluctance of owners to engage in loans and strengthening works. That also means the need to concentrate further efforts in finding specific ways to convince this category.

Question C02 – Gender of residents: the number of female is 101 and of male 99, this difference has no significance;

Question C03 - Education

C03a – General education: 69 % did not answer (with higher /university education), from the remaining the ratio of citizens having at least high-school education is 26.9 %. There is a good percentage of owners having at least high-school, which shows positive for attitude towards seismic risk reduction and willingness to receive new knowledge.

C03b – University education. The large percentage of superior education situation - a total of 141(69 %) - may be correlated to a rather good understanding of risk and protection measures proved by other answers,

explains also the understanding of risk level as well as the large number of interesting suggestions to the last question with free subject.

C03c – Field of work: 130 did not answer, 10 are workers, 17 business, 47 office employees. The number of non-responders corresponds to the citizens with higher education category.

Question C04 – Activity: 24 did not answer, 58 are active, 122 retired (59.8 %).

This structure, with a lot of retired owners, explains the reluctance to use the loan / credits for seismic risk reduction.

Question C05 - Income source: 3 no answer, 29 private sector, 25 public sector, 128 retired (62.75 %), 19 others. The large number of retired persons with reduced income and not willing to be disturbed or to let their inheritors with debts, explains the reluctance to apply for loans / credits. That indicates also the need to find special solutions for the special situation of retired and low-income people.

SPECIFIC COMMENTS CONCERNING FREE WRITTEN SUGGESTIONS

Question C4-2. Citizens' opinions about who shall be responsible to decide about strengthening of a building :

- owners association + majority vote rule;
- government + State + Parliament + MTCT, using a well defined requirements of law, with sanctions as far as expropriation !!!;
- City Council + Mayor;
- each owner (!?);
- State + specialists;
- State (80%) + owners (20%) since there are too many undecided citizen! ;
- combinations of past answers.

Detailed answers and percentages have been analyzed by MTCT.

Question C6-7. Question about knowledge on NCSRR activities:

- most citizens that answered NO mentioned they did not know about activities but some wrote about their need for more information about activities of the Center;
- few of these know about JICA Project;
- the residents who answered YES know also some technical details about the Center's role, as inspection knowledge dissemination, strengthening technologies, seismic monitoring, seismic risk reduction.

And in this case the explanation is the recent organization of the center and it shows the need for a larger publicity of the activities of MTCT – NCSRR to citizens.

Question C6-8. Suggestions to avoid such negative factors, with free place for writing the answer

Surprisingly, there are a lot of serious answers and useful suggestions on many issues that can be grouped in:

- administrative aspects;
- technical aspects;
- financial aspects;
- psychological aspects

From these answers the following ones are significant:

- the need for clearer legal framework with a simplified administrative approach;
- the rule of 51% ratio of owners vote shall be introduced for decision;
- the duration of works be reduced;

- the cost of works to be well known to owners from the beginning;
- the works be done without evacuation of residents;
- more incentives for retired persons (free cost strengthening !);
- some owners have lack of confidence in new evaluations, since they see that the “strengthening of 1977” are not considered valid by actual experts;
- State is held legally responsible for selling vulnerable buildings after 1990 !;
- strengthening and replacement of piping and remaking of facades are required together with structural strengthening;
- more information is necessary for citizens, including debates about the projects of strengthening
- there is a need of new technologies;
- strengthening of more buildings to start until it is not too late;
- quality control to be made by Japanese specialists and INCERC;
- in some cases demolition may be recommendable instead of strengthening, to reduce costs;
- next questionnaire to be made with consulting of specialists in the field (!!).

GRAPHICAL REPRESENTATION OF RESULTS, ADDITIONAL PROCESSINGS AND CORRELATIONS

The graphical representation of results was presented in several variants:

- as a pie chart for each basic data to show the constituency of questionees;
- as statistical indicators, in the plots type “box and whisker” and tables, as minimum and maximum values, median value, standard deviation, standard error, mean value to have an overall trend at a glance;
- as bivariate 3D histograms, for cross-correlations between questions.

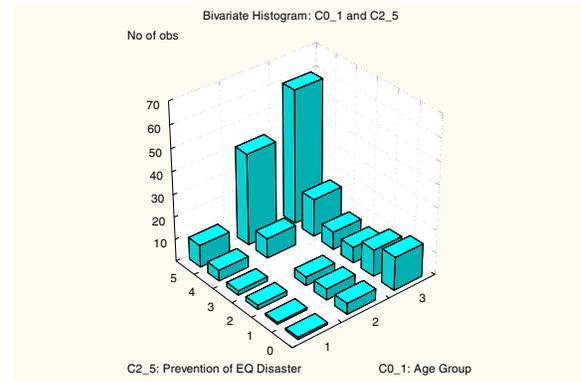
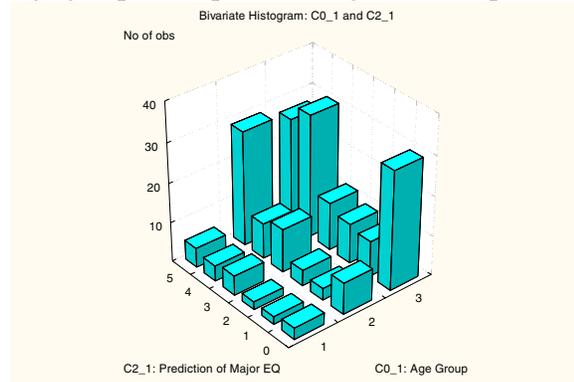
Correlations with the general data on citizens have been done as bivariate 3D histograms

Age correlations. The correlation between question C01 and question C1 was presented in the bivariate 3D histogram and from these data it is obvious that as age is higher the experience, knowledge on vulnerability and past disasters, Vrancea source hazard, causes of disasters, etc. is greater. In case of questions C01 and C2, the correlation reveals that higher age leads to a greater knowledge, own experience and awareness, possible disaster prevention measures, while the correlation between questions C01 and C3 makes it obvious that higher age ensures also specific knowledge on the risk of their buildings. These results mean also that the old and retired citizens are not indifferent to the evolution of risk situation of their building (Fig. 1).

The correlation between questions C01 and C4 proves that higher age ensures a greater confidence in efficiency and safety after strengthening, but there is also a large number of undecided people that need further earthquake education. At the same time, the correlation between base questions C01 and C5 shows that age provides also a favorable position and knowledge about the legal framework concerning risk reduction (OG 20/1994), while C5-7 indicates that higher age creates a higher criticism and demand for a larger support from owners association to their members. It is worth mentioning that the correlation between questions C01 and C6 shows that, irrespectively of age, the present mortgage system is not agreed, especially by the aged, and citizens need new incentives and forms of social partnership, while they fully agree with new technologies

Gender correlations. The correlation between questions C02 and C1 shows little variance related to the gender of respondents in what concerns earthquake experience, knowledge of Bucharest vulnerability situation, past disasters etc. In what concerns the correlation between questions C02 and C2, it is obvious that gender may give local variations for some answers, the trend being the same concerning the awareness about disasters.

Age group vs Preparedness against earthquake



Income source vs Recognition of buildings' vulnerability

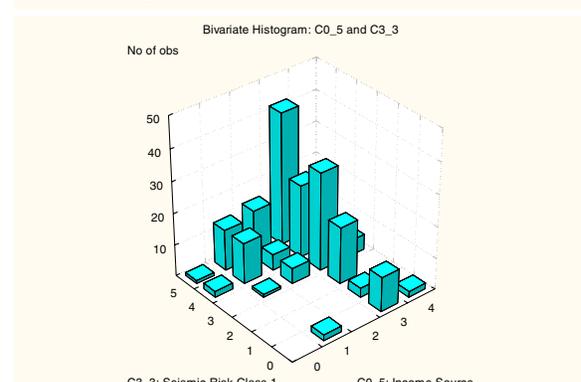
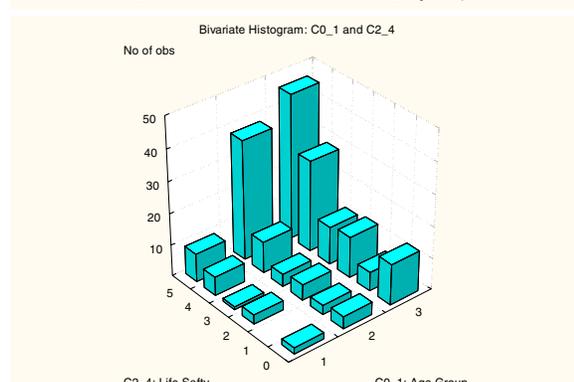
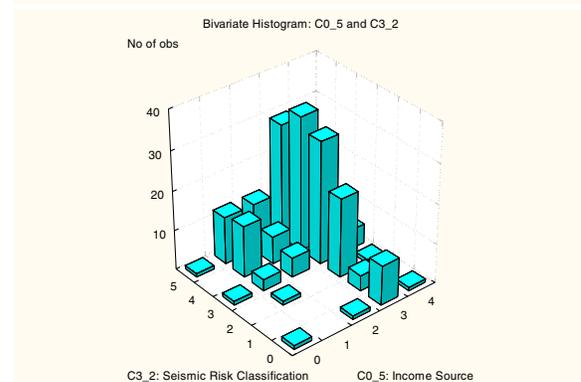
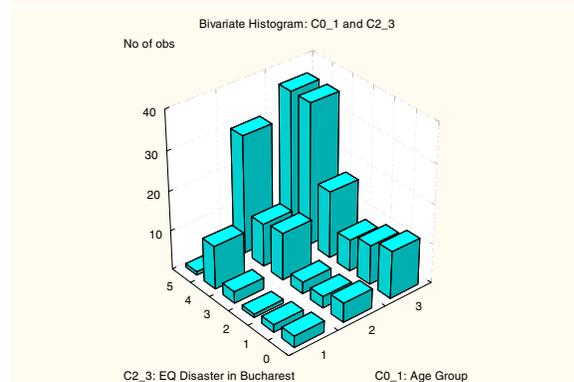
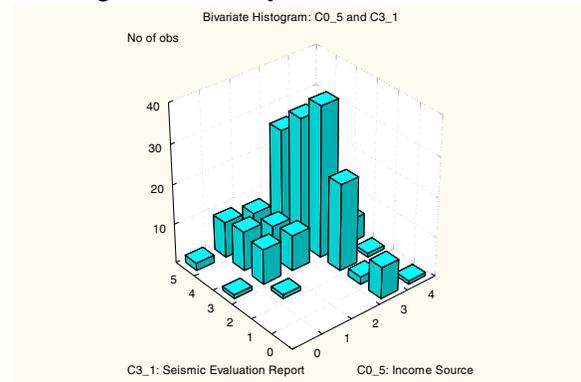
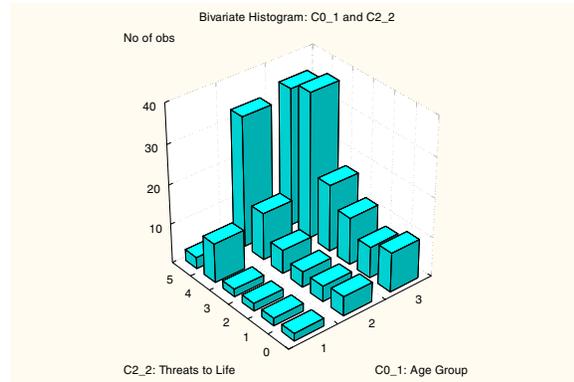


Fig. 2. Example of 3D bivariate histograms for questions C01-age and C2-1...C2-5 - preparedness, and C0-5 – income and C3-1...C3-3 –seismic vulnerability and risk, respectively [1].

Some predominance of males declarative concerns can be related to the classical organization of Romanian family with a larger involvement of husbands as “head of family” in decisions, Further on, the correlation between questions C02 and C3 indicates that although the awareness trend is the same, men are better informed and involved in technical knowledge about their building risk and declare to be interested in taking measures and convincing others.

The correlation between questions C02 and C4 shows that men trust more in future safety measures, while women (possibly older housekeepers) declare some lack of knowledge. Men are much more in the favor of 51% vote rule, thus being more in the favor of an authoritarian rule!!! Although the majority of women agree also with the 51% vote, there are also many that agree to the 100% rule and this can be possibly explained by the women psychic structure, much more inclined to analysis, negotiation and consensus.

Concerning the correlation between question C02 and question C5-7, it proves that there is some communication in associations but people need more guidance.

Education correlations.

General education. The correlation between question C03A and question C1 is presented in the bivariate 3D histogram. From this group of plots it is obvious that high-school graduation is associated with a greater capacity of learning and getting experience from past seismic disasters

The correlation between base questions C03A and C2 makes it obvious that even the people with general education do care about possible disasters, while correlation between questions C03A and C3 allows us to conclude that high-school ensures a background for knowing about the seismic assessment report for building, understanding the importance of risk class 1.

In case of the correlation between base question C03A and question C4 it is obvious that such level of education provides confidence in safety after retrofitting works, understanding the situation and expressing the agreement for 51% vote rule.

University education. The correlation between question C03B and question C1 shows a predominance of technical professions between the people who got experience and knowledge from past events.

From the correlation between question C03B and question C2 is obvious that citizens with technical education background, followed by those with humanistic/legal studies, are more concerned and feel themselves able to take measures of protection.

Concerning the correlation between question C03B and question C4, citizens with technical education background, followed by those with humanistic/legal studies, are more confident about obtaining safety after strengthening. The same is valid about the opinion on 51% vote rule in making decisions. Thus, earthquake education means can also use knowledge with higher technical difficulty, since the residents are able to understand proper information.

We emphasize that the correlation between question C03B and question C6 indicates that all people need more public support, new incentives, a new mortgage system, people with legal knowledge understand and agree more about new forms of contracts with local authorities; technicians agree more on the reducing of works duration, and the use of new technologies.

Field of work. The correlation between question C03C and question C1 suggests that employees in offices also have a great capacity to get experience, while the correlation between question C03C and question C2 confirms that people that work in technical and production field are also concerned about risk and disasters. From the correlation between base question C03C and question C3 it is obvious that employees in offices are more concerned about the assessment report and risk ranking of their buildings than other neighbors of the same activity range.

Using the correlation between question C03C and question C4, it results that employees in offices agree with the safety and 51% vote rule.

The correlation between question C03C and question C5-7 leads to the conclusion that employees and trade workers need more support from their owners associations.

Activity correlations. The correlation between question C04 and question C1 shows that even the retired people still remember, declare and consider their experience in past seismic events and disasters and this can explain the general favorable level of awareness in surveyed buildings.

Significantly, from the correlation between question C04 and question C2 one can remark that retired people are the most concerned about disasters but also extremely positive about possibilities to cope with them. Analyzing the correlation between question C04 and question C3 it is remarkable that retired people are very much informed about the high-risk level of their building and willing to take measures. It should be taken advantage of their high motivation.

The results from the correlation between question C04 and question C4 are also interesting, since retired people look more confident than others in safety after strengthening, being also the most supporting of the 51% rule of votes for decision on strengthening, and consequently so much against wasting time for waiting a consensus. This reaction can be explained by the feeling of residents that these who are against works are not sharing the same destiny with them, because many of such owners are absentees, living abroad or in another residence, while the owned apartment is closed or rented.

Income source correlations. These correlations are, naturally, similar to those of activity correlation. The correlation between question C05 and question C1 indicates the predominance of people with income from pensions among those with past earthquake experience.

As an aspect of interest for Bucharest central area, the correlation between question C05 and question C2 indicates that people with income from pensions are concerned about risk and disasters and would like to take measures of protection. Perhaps surprisingly is the fact that from the correlation between question C05 and question C3 it is obvious that people with income from pensions know some details about the risk level of their building and intend to take measures (Fig. 3).

At the same time, the correlation between question C05 and question C4 allows us to conclude that they are confident in the role of strengthening and agree with the 51% vote rule in decisions, while the correlation between question C05 and question C5-7 proves that people with pension income think about a greater role of the owners associations in informing citizens.

CONCLUSIONS OF QUESTIONNAIRE SURVEY

The questionnaire survey of NCSRR within JICA Project was a first step to evaluate in more depth the risk perception and understanding the opinions of citizens who live in the vulnerable buildings of Bucharest central area, concerning earthquakes effects and retrofitting. The positive answers show a remarkable consciousness about the seismic risk in Romania and in Bucharest and are very well correlated to the age and profession structure as well as with the experience of living in the area of major damage at the March 4, 1977 earthquake.

The age, even in case of retired people, has a positive influence on citizens' experience and attitude towards seismic risk reduction, while gender is significant only in some specific aspects. The presence of many educated persons (high-school and university) explains the understanding of risk level as well as the large number of interesting suggestions. On the other hand, the large number of retired persons with reduced income explains the reluctance to apply for loans / credits.

It was noticed the problematic fact that the young and less educated do not take much heed of the safety of their building. In order to improve the situation, it is strongly recommended to take advantage of senior

citizen's experiences and resourceful suggestions. Past experiences, heart-aching but invaluable, talk a lot more than scientific data or engineering analysis. Only old people with experience of past devastating earthquake could influence young or indecisive people positively. One should consider as being a good strategy to find educated senior citizen and let them convince other people about the importance of retrofitting before they say they are sorry.

The large number of suggestions denotes that citizens are very concerned about their situation at risk. Many of the suggested measures are the same with those promoted recently by MTCT and citizens must be informed about it.

The authorities should find a solution for assisting the retired persons in reducing seismic risk of their buildings, and avoiding disasters, since such people are disqualified because of age and income, in spite of their will.

Using the positive background, the MTCT - NCSRR and JICA Project, next steps will be directed towards risk communication while earthquake education must be directed towards convincing citizens that they have the prime role in speeding-up the strengthening process until it is not too late, using the legal system and unique incentives of OG no. 20/1994, with possible improvements that they suggested during this survey [1; 10].

The transfer of knowledge from a highly experienced seismic country like Japan to Romania will have a positive impact on Bucharest's citizens attitude on seismic risk. In this respect, new seminars, materials and follow-up surveys will be prepared. One can appreciate the first seminar organized by JICA and MTCT in 2003, when Japanese experts presented the Kobe earthquake disaster and lessons for citizens, for a large audience of engineers and chairmen of owners associations in Bucharest, participants being welcomed by the ministers and high level officials of MTCT.

There is a need of a better communication to help citizens in managing the bureaucratic aspects of the Law (OG 20/1994), to fill-in the forms, to answer their legal and financial fears, to convince citizens that the quality control system provides quality of projects and earthquake engineering is efficient.

There is a special need to ensure the full cooperation of citizens in this process, in order to be closer to consensus for deciding about strengthening, to limit the cases of special legal measures for access inside of some apartments only in the situations of absentees and/or bad will owners.

The citizens want to decide within the owners associations, with a 51% vote ratio, but they also want the support of public institutions as MTCT and NCSRR, the assistance of Japanese experts and their advanced technologies, the control of works by INCERC etc. Using this public support, in August 2003 MTCT promoted an improvement to the Law OG 20/1994, stating the majority vote for decisions of owners associations.

Although figures of over 60% agreement of residents in many cases can be considered as relatively preferable rates for the first survey, even such rates are expected to increase by repeated campaigns of raising awareness by NCSRR activities. On the other hand, even if citizens have a risk averse behavior, the prediction of their future actions and decisions is strongly influenced by many social, economic and personal factors, highly depending on their personal risk perception and other goals within family.

They should receive more educational materials, drafted in a variety of forms and levels of knowledge, in order to get closer to authorities in finding various forms of seismic risk reduction and disaster prevention.

The questionnaire survey shall be repeated again later on, in order to compare the progress in earthquake attitude and preparedness of citizens. In this respect the statistical approach used by NCSRR - JICA Project, for manifold questioning can provide fine tuning.

Concerning the public knowledge about NCSRR and JICA Project, the survey emphasized the need of a larger publicity to the activities of MTCT – NCSRR to citizens, since they have a lot of expectations from the Japanese experts.

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