



## Interdisciplinary approach to disaster resilience education and research

**Faber, Michael Havbro; Giuliani, Luisa; Revez, A.; Jayasena, S.; Sparf, J.; Mendez, J. M.**

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## Interdisciplinary approach to disaster resilience education and research

Faber M.H.<sup>a</sup>, Giuliani L.<sup>a,\*</sup>, Revez A.<sup>b</sup>, Jayasena S.<sup>c</sup>, Sparf J.<sup>d</sup>, Mendez J.M.<sup>e</sup>

*a* Civil Engineering Department, Technical University of Denmark, Denmark

*b* Department of Geography, National University of Ireland - Galway, Ireland

*c* Department of Building Economics, University of Moratuwa, Sri Lanka

*d* Department of social sciences, Mid-Sweden University, Sweden

*e* Centre for Social Studies, University of Coimbra, Coimbra, Portugal

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### Abstract

This paper is based on the results of a survey on “Interdisciplinary working in disaster resilience” conducted by the WP4 work group of the ANDROID Network. The survey had the aim of gathering information on the state of art and practice in the field of disaster resilience and promoting co-operation and interdisciplinary methodologies in research and education. The survey has been carried out by means of a questionnaire focusing on disaster-resilience projects and on the main challenges faced in interdisciplinary working. The results of the questionnaire, which collected 57 answers from more than 20 European countries and few extra European countries as well, allow for three main considerations: i) projects involved 5 different disciplines as average and geography and sociology were present in the majority of the projects; ii) the level of interconnection between disciplines seems intermediate, meaning that information and methods are exchanged, but a full integration of methods and concepts into a common shared language and system of axioms is missing; iii) the lack of a common framework and common terminology represents a major barrier to good interdisciplinary work. The results highlight the role played in disaster-resilience design by social and cultural aspects, which are instead not often adequately considered in the practice. The establishment of an education on resilient design of urban system, which includes both social and technological aspects, emerges as a possible solution to overcome barriers to interdisciplinary work and improve the efficacy and quality of resilience design.

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*Keywords:* ANDROID Network; Interdisciplinary work; Disaster Resilience; Survey; Questionnaire; Transdisciplinary approach; Education.

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\* Corresponding author. Tel.: +45 45251812; fax: +45 4588 3282.

E-mail address: [lugi@byg.dtu.dk](mailto:lugi@byg.dtu.dk)

## 1. Introduction

This paper is based on the results of the activity of the WP4 work group of the ANDROID Disaster Resilience Network (ANDROID, 2011). ANDROID is an Erasmus academic network funded by the Lifelong Learning Programme of the European Union and aimed at promoting co-operation and innovation among European Higher Education Institutions (HEIs) for increasing the resilience of urban communities to disasters of human and natural origin. In particular, the Hyogo Framework for Action 2005-2015 (The Hyogo Framework for Action 2005-2015, 2005) makes calls to “promote and improve dialogue and cooperation among scientific communities and practitioners working on disaster risk reduction, and encourage partnerships among stakeholders”. In recognition of this, WP4 has been established with the aim of identifying, collate and disseminate good practices for interdisciplinary working in research and teaching.

In order to achieve this aim, the WP4 Working Group has developed a survey on “Interdisciplinary Working in Disaster Resilience”, which has been distributed and advertised through the ANDROID network. The survey collects all types of research and educational projects related to disaster resilience and supplements the survey developed by WP5 “European inventory of disaster resilience education”, which focuses on teaching and educational projects in European HEIs. The results of the two surveys will be made available online in the Open Educational Resource (OER) platform, a free searchable repository to be developed by the WP8 working group, and serve as basis for understanding the state of art and practice in designing urban systems to be resilient towards natural and human induced hazards.

The implementation and the results of the WP4 survey have been described in detail in a report entitled “Good practice review of interdisciplinary working in disaster resilience education” (Faber, et al., 2014) and are summarized in this paper with a focus on the main challenges to be faced in disaster resilience projects and on possible solution for mitigating them.

### 1.1. *Interdisciplinary character of resilience-based design*

Resilience is defined in literature (Bruneau, et al., 2003) as the ability of a system (an infrastructure, an urban area, or a social community) to mitigate hazards and consequences of hazards, in terms of loss of performances of the system and time needed for a full recovery of the initial performances.

The entity of the performance loss depends on the hazard and on properties inherent to the system, such as: i) the ability to withstand the accidental event without being damaged; and ii) the ability to cope with local damages induced by the event by maintaining a sufficient level of functionality. The resilience framework (Bruneau, et al., 2003) developed by the Multidisciplinary Center for Earthquake Engineering Research (MCEER) defines the two system properties as robustness and redundancy, respectively.

The time needed to achieve full restoration of the system is instead affected by social, economic, and political aspects. In the above mentioned MCEER resilience framework, the properties of resourcefulness and rapidity are referred to these aspects. In particular: the first property is related to the ability of establishing priorities and mobilizing the necessary monetary, technological, and informational resources; the latter is intended as the capacity to meet the established goals in a timely manner.

From the definition of resilience it is clear that several different sectors need to co-operate in order to improve the resilience of a system. Depending on the nature and extension of the system taken into consideration, the technological and social disciplines that are expected to play a role in resilience-based design include (but are not limited to): social and political science, economics, system and management engineering, construction industry, urban planning, computer science. Even for a relatively small system (the example of a hospital is presented by Cimellaro et al. (2010)), the number and distance of the fields involved in the assessment and design of the resilience of the system can be extremely large.

The identification of the main problems to face in interdisciplinary working and the development of good practices aiming at solving them are therefore aspects of utmost importance within the framework of resilient design (Faber, 2011) and have been considered as main objective of this survey

## 2. Survey

The survey has been carried out by means of a questionnaire on “Interdisciplinary Working in Disaster Resilience”, which has been distributed through the ANDROID Network- In addition to the main purpose stated above, the following goals have been kept in mind in the choice of the form and length of the questionnaire:

- **Archive:** information on disaster resilience projects should be gathered in a form suitable for archiving in the online repository and the projects should be easily found by means of relevant keywords or searching criteria including country, hazards, disciplines and areas of expertise; this has influenced the conceptual organization of the questionnaire and the content and type of questions.
- **Statistic:** the survey should collect data that could be used in an aggregate form, so to be easily analyzed and interpreted; for this reason, the form of pre-defined multiple choice answers have been preferred; each answer can be seen as a binary aleatory variable associated to the event (occurred or not occurred) and, for all questions, the union of these variables covers the domain of the answers (the choice “other” has been foreseen when needed for closing the universe)
- **Insights:** the survey should provide information on the main characteristic of the projects, such as country of reference and scale of the project, type of hazards and main aspect of resilience considered, professional figures collaborating, number and type of disciplines involved, as well as major barriers encountered in developing the project and actions taken to overcome them; in order to get a better insights on the latter aspects in particular, spaces for comments and for a brief description of the project have been foreseen in the survey in addition to the other multiple choice answers.
- **Diffusion:** the survey should be short and easy to answer, so to get the highest number of respondents among the persons contacted through the ANDROID network: for this reason, the number of questions has been limited to a minimum and multiple choice questions have been preferred, whenever possible, for the sake of brevity and simplicity of the answers. In this way, the time required to complete the questionnaire could be limited to 10-15 min as an average.

The questionnaire has been conceptually divided in 4 parts: i) an introductory part with 7 questions gathering general information on the project (name, leading institute, country, etc.); ii) a core part with 10 questions on the content and characteristics of the projects (topics, purpose, etc.); iii) a follow-up part with 2 questions focused on challenges of interdisciplinary work carried out during the project; iv) and a conclusive part aimed at indexing the project and the publications and reports the project produced.

In this paper, the outcomes of the questionnaire are presented with particular reference to the third part of the questionnaire, which is focused on interdisciplinary aspects of the projects. Specifically, the answers to the following questions are presented and discussed: i) categories of people and areas of expertise involved in the projects; ii) what are the main barriers encountered in interdisciplinary work and the actions taken to overcome these barriers.

It should be noted that the results presented below are reliable only if the statistical sample is sufficiently representative of the population. For being such, the size of the sample should be appropriate with respect to the size of the population, and the element of the sample should be uniformly distributed in the categories the population is divided into.

With respect to the first aspect, the questionnaire has and has gathered 57 answers from 55 different respondents (it was possible for a respondent to participate more than once to the questionnaire with different projects). However, being the total number of European projects on disaster resilience unknown, it is difficult to evaluate whether the size of the sample is appropriate with respect to the population. For the purpose of this survey, the sample has considered to be sufficiently representative for all those questions where a uniform distribution of the elements of the sample can be supposed. This seems to be the case for most of the questions asked in the questionnaire, except few cases where a biased distribution of the questionnaire to certain categories of people could be envisaged or the number of possible answers to a question was close to the number of elements in the sample. In these cases, highlighted and discussed in detail the report that reports all the results of the questionnaire (Faber, et al., 2014), the statistical outcomes should be handled carefully and interpreted as qualitative indications of the answers.

## 2.1. Categories and disciplines

Respondents were asked to indicate the people involved in the project by choosing from the following categories: academics, citizens, decision makers, stakeholders, opinion groups, volunteers, private enterprises, and others. The outcomes to this question are reported in the left chart of Fig. 1 and give an insight on the expertise and roles required in disaster resilience projects. By observing the figure, it is seen that academics are by far the professional figures most involved in the projects. However, this datum could also be biased by the fact that ANDROID network is mostly composed by academics and a privileged distribution of the questionnaire to academics could be argued. The results should be therefore regarded as indicative of a significant numbers of different professions involved in resilience-related projects, as all suggested categories got at least 10 answers.

The chart on the right side of Fig. 1 shows instead the results related to the different areas of expertise of the people involved in the projects. In the attempt of covering all possible area of expertise, 24 different disciplines have been indicated as possible answers to the question, according to the classification of disciplines proposed by the Simple Knowledge Organization System (SKOS) of UNESCO (SKOS Reference, 2009). In addition, the field “other” was also included in case other relevant disciplines had possibly been neglected. The number of the classes may seem quite high if in comparison with the size of the sample. However, being possible select multiple answer to this question, the total number of answers was 289 and the results can be regarded as sufficiently representative of the status quo. Technology, geography, earth and space, and sociology seem to be the most required area of expertise in resilience-related projects. All disciplines indicated are represented in at least one project, with the sole exception of astrophysics. In addition to this, 18 projects indicated additional areas of expertise such as: geology, urban planning, risk management, climate science, architecture and civil engineering, and others.

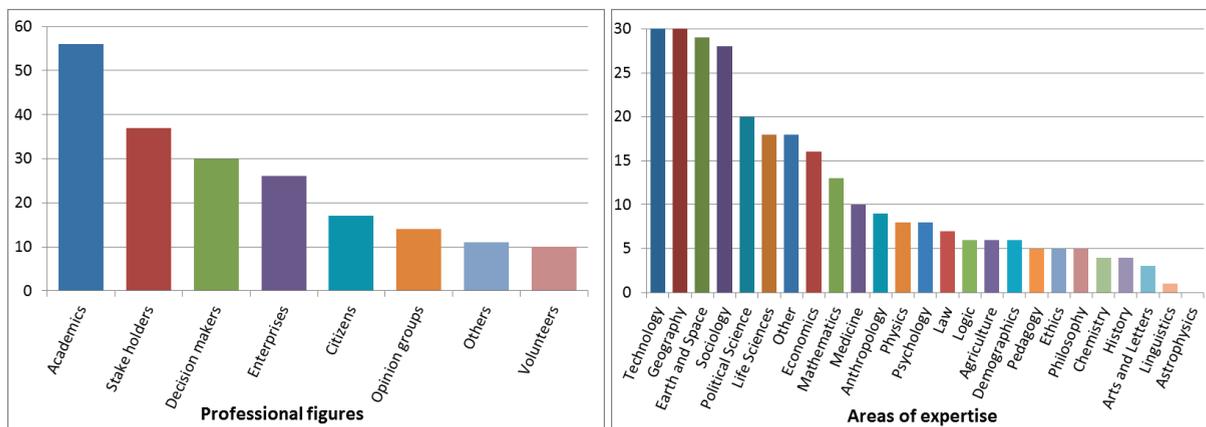


Fig. 1: Number of projects involving different categories of people (left) and different disciplines (right).

When looking not at the frequency of each discipline, but at the frequency of the number of disciplines involved in the project, it can be calculated that 5 is the most frequent value (mode) of disciplines involved in one single project. In particular a minimum of 5 different disciplines has been reported in 12 projects out of 57. The maximum number of disciplines in a project corresponds to 16 and has been reported by one project only. The minimum number corresponds to the least possible number of disciplines, i.e. 1, and it has been reported by three projects, meaning that no interdisciplinary work was in facts present in 3 out of 57 projects.

The information provided above gives an overview of the level of multidisciplinary work present in the various projects, disregarding from the type and distance of the areas of knowledge interacting with one another. In order to appreciate this aspect, an incidence matrix is shown in Fig. 2, which has been built as follows:

- the first area of expertise foreseen in the multiple-choice answers of questionnaire, i.e. logic, is considered and assigned to the name of the first row of the matrix; the number of projects where logic is present (6) are reported in the first column of the matrix with the same name of the row;

- then the incidence of each other areas of expertise among the considered projects is sought and reported in the following columns, under the respective labels;
- when all disciplines have been considered, the first row of the matrix has been filled and the procedure can be repeated for the following rows, by selecting the projects (5) where the second discipline (mathematics) has been reported and looking at the incidence of all other disciplines.

The matrix is symmetric and presents on the diagonals the number of projects where the discipline identified by the respective identical row and column labels is present. This number coincides with that one reported on the right chart of Fig. 1. By looking at the other elements of a row, new information can be obtained concerning the relations between all considered disciplines. For example, it is observed that sociology and geography have the highest level of concomitant occurrence, being present simultaneously in 17 out of 57 projects. Geography seems also to have a close relationship with Life Science, Earth and Space, and Technology (15 projects each), as well as with Political Science. These data are expected to provide useful information on the level of interrelation between disciplines and identifying the most important area of knowledge needed for resilience-based design.

	Logic	Mathematics	Astrophysics	Physics	Chemistry	Life Sc.	Earth & Space	Agricultural Sc.	Medical Sc.	Technology	Anthropology	Demographics	Economy	Geography	History	Law	Linguistics	Pedagogy	Political Sc.	Psychology	Arts & Letters	Sociology	Ethics	Philosophy	SUM	
Logic	6	5	0	0	1	3	4	1	1	6	3	2	3	4	1	0	1	1	1	1	1	0	5	1	0	50
Mathematics	5	13	0	2	1	5	6	1	3	9	3	3	5	9	1	0	1	2	3	2	0	7	1	0	0	82
Astrophysics	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Physics	0	2	0	8	2	5	7	2	1	4	1	3	4	7	2	1	0	1	5	2	1	3	2	1	0	64
Chemistry	1	1	0	2	4	4	3	2	1	3	1	2	2	3	2	0	0	1	1	0	0	2	1	0	0	36
Life Sc.	3	5	0	5	4	18	15	6	5	10	3	6	9	15	4	3	0	2	8	3	1	10	2	0	0	137
Earth & Space	4	6	0	7	3	15	29	4	3	14	4	6	9	22	3	4	0	1	12	4	1	13	1	1	0	166
Agricultural Sc.	1	1	0	2	2	6	4	6	2	5	3	3	5	5	4	3	0	0	3	1	1	4	1	0	0	62
Medical Sc.	1	3	0	1	1	5	3	2	10	7	1	1	2	3	0	2	0	3	2	4	0	4	1	1	0	57
Technology	6	9	0	4	3	10	14	5	7	29	5	4	9	15	3	4	1	3	10	4	2	12	3	1	0	163
Anthropology	3	3	0	1	1	3	4	3	1	5	9	2	3	5	3	1	1	1	5	4	1	8	3	2	0	72
Demographics	2	3	0	3	2	6	6	3	1	4	2	6	3	6	3	1	0	1	3	1	1	5	1	0	0	63
Economy	3	5	0	4	2	9	9	5	2	9	3	3	16	12	4	3	0	1	8	3	1	9	1	1	0	113
Geography	4	9	0	7	3	15	22	5	3	15	5	6	12	30	4	5	0	1	14	4	1	17	1	1	0	184
History	1	1	0	2	2	4	3	4	0	3	3	3	4	4	4	1	0	0	3	1	1	3	1	0	0	48
Law	0	0	0	1	0	3	4	3	2	4	1	1	3	5	1	7	0	0	3	1	1	6	1	0	0	47
Linguistics	1	1	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1	0	0	0	0	1	1	0	0	7
Pedagogy	1	2	0	1	1	2	1	0	3	3	1	1	1	1	0	0	0	5	0	2	0	2	1	1	0	29
Political Sc.	1	3	0	5	1	8	12	3	2	10	5	3	8	14	3	3	0	0	20	4	2	10	3	3	0	123
Psychology	1	2	0	2	0	3	4	1	4	4	4	1	3	4	1	1	0	2	4	8	1	5	1	1	0	57
Arts & Letters	0	0	0	1	0	1	1	1	0	2	1	1	1	1	1	1	0	0	2	1	3	2	2	1	0	23
Sociology	5	7	0	3	2	10	13	4	4	12	8	5	9	17	3	6	1	2	10	5	2	28	4	4	0	164
Ethics	1	1	0	2	1	2	1	1	1	3	3	1	1	1	1	1	1	1	3	1	2	4	5	2	0	40
Philosophy	0	0	0	1	0	0	1	0	1	1	2	0	1	1	0	0	0	1	3	1	1	4	?	5	0	23
SUM	50	82	0	64	36	137	166	62	57	163	72	63	113	184	48	47	7	29	123	57	23	164	38	25		

Fig. 2. Multidisciplinary: incidence matrix of the different areas of expertise. In order to facilitate the reading of the matrix, graduated shading is used to highlight higher numbers.

2.1.1.1. Barriers to interdisciplinary work

Two different questions have been asked on the barriers encountered in interdisciplinary work: a first multiple-choice question, where the respondents should select one or more barriers among those indicated; and an additional, non-mandatory question on the actions undertaken to overcome the barriers encountered, where the respondents could answer freely, by inserting a short text in a textbox.

A first analysis of the results of the two questions is provided by considering the relative frequency of projects where any kind of barrier was encountered and the relative frequency of projects where any type of countermeasure was undertaken to overcome the barriers. It interesting to observe that, while problems related to interdisciplinary work have been reported in more than 90% of the projects, countermeasures were taken in less than three quarter of

the projects. This could either indicate a limited understanding of the core of the problem, or an intrinsic difficulty in finding solutions for the problem. The two charts shown in

Fig. 3 provide more information in this respect.

The histogram on the left part of the figure shows the outcomes of the first question in term of absolute frequency of the pre-defined answers indicated in the questionnaire, ordered in descendent order. In more than half of the projects the presence of different conceptual frameworks (synthetically indicated as “Different framework” in the figure) has been indicated as first barrier to interdisciplinary work. Different methodologies and conflicting terminologies closely follow in term of frequency of occurrence in the projects. Lack of resources, different work practice (synthetically indicated as “Different practices” in the figure), and communication barriers were indicated in ca. one third of the projects. Administrative obstacles and access to people are less common problems, even if present in ca. one sixth of the projects. Very few projects instead indicated the problem of contrasting techniques as barrier encountered during the interdisciplinary work. Few additional barriers were also specified in the field “other”, such as: conflicting objectives, lack of interest in interdisciplinary work, limited access to data, limited time.

The answers to the second questions were read and organized in few common countermeasures that could be identified in the comments indicated by most respondents. The results of this analysis, which is however subjected to interpretation, are shown on the right chart

Fig. 3. The histograms reports the absolute frequency of the categories ordered according a criterion of similarities between the main aims of the countermeasures.

By looking at the figure, it can be observed that, in the vast majority of the projects, problems have been overcome by means of meeting and discussion among the project participants (abbreviated as “Int. discussion” in the figure). This result seems consistent with the outcomes of the first question, where the high number of projects reporting problems related to differences in the framework, methods and terminology could suggest a general problem of understanding among different disciplines. Other countermeasures that seem oriented to favor a better understanding among experts of different areas are the definition of a new terminology and personal study aimed at expanding individual knowledge in other areas. Among the categories identified, there are other countermeasures that seem aimed at the same purpose. For example, external dissemination and meeting with stakeholders are both aimed at spreading the new knowledge gained with interdisciplinary work to parties external to the project. On the other side, meetings with stakeholders have also been scheduled in case of problems with the budget. Projects where lack of resources where indicated as barriers, also indicated cut in the expenses and applications for funds as possible solutions. Hence, the three categories can be grouped under the aim of solving problems related to budget. A final datum concerns a single project where the collection of data was indicated as solution to limited access to data.

When organized by the macro-categories defined on the basis of a common aim, the answers to the question provides the following results: measure aimed at improving understanding were reported by 61% of the projects; measures aimed at overcoming budget problems were indicated in 19% of the projects; measures aimed at promoting and advertising the information were undertaken in 16% of the projects; measures aimed at solving problems related to lack of data were reported by 4% of the projects.

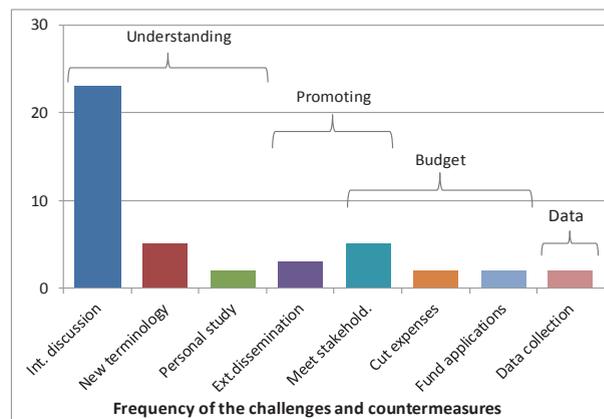
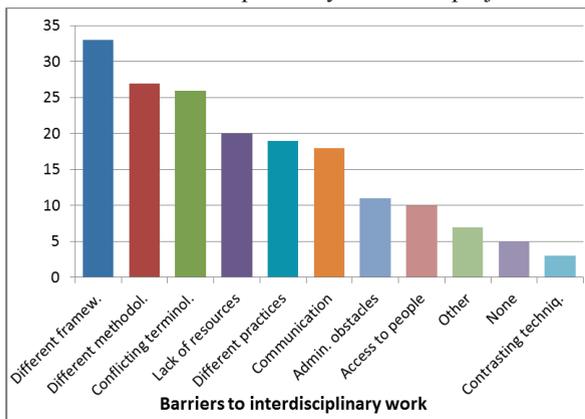


Fig. 3: Barriers encountered in disaster resilience projects in descent order of frequency (left) and actions undertaken to solve them (right), organized in macro-categories aimed at solving problems of: understanding (60%); promotion (26%); budget (19%); lack of data (4%).

### 3. Good practice

The advancement of technology over the last century has required a higher and higher level of specialization in a single discipline. The high specialization helps researchers to push further the boundaries of a discipline, but is also a desire of the industry that should otherwise train professionals before they could be fully operative in a specific sector. The consequence of a higher sectorial specialization is a more limited knowledge of other disciplines and a great need of collaboration between several high specialized professionals, in order to solve problems. This is especially true in case of complex, large-scale problems, such as the resilience-based design of urban areas against natural and human-made disasters and, as a matter of fact, a general lack of understanding is the problem that has been most frequently reported in the projects that have participated to the questionnaire.

In particular, the lack of a common framework and terminology, reported as barrier in most of the projects, is an aspect that deserves particular attention, as it can be directly referred to the absence of an education in resilience design. A specific, consistent terminology can be considered, as a matter of fact, one of the aspects that distinguish a set of notions and tools as a discipline. This consistent organization of terms and knowledge can only be established within educational institutes, as research papers and other dissemination means rarely address a very broad public in different fields. In this respect, the incidence matrix reported in Fig. 2 may represent a useful tool for selecting the most important area of knowledge that should be included in educational programs on resilience design.

With respect to the problems related to interdisciplinary work and the benefit of a targeted education on resilience design, few considerations on the grade of interaction required among different disciplines seem relevant. Even if an increasing research and literature has developed since the '70ies on especially (OECD, 1972) (Chettiparamb, 2007) in the area of multidisciplinary teaching, existing multidisciplinary programs don't necessarily ensure that students can benefit of a full integration of tools and methods between different areas of knowledge. In this respect, the terms: i) pluridisciplinary, ii) interdisciplinary, iii) and transdisciplinary are found in literature (OECD, 1972) (Jacobs & Frickel, 2009) (Klein, 1996) (Nicolescu, 2002) for describing an increasing level of interaction between disciplines. Choi and Pak (2006) synthetically define the three terms by means of the adjectives: i) additive, ii) interactive, ii) and holistic, respectively.

A multidisciplinary approach can be sufficient for a problem that can be decomposed in a sequence of simpler problems solved by means of expertise in one discipline at a time. An example is a thermo-mechanic problem that can be decoupled in a thermal problem (e.g. the analysis of temperature of a beam exposed to a heat source) and in a subsequent mechanical problem (e.g. the calculation of the thermal expansion of the beam given by the temperature variation). However, if the problem cannot be decoupled (e.g. if the beam, expanding, gets closer to the heat source, so that not only the displacements depends on the temperatures, but also the temperatures depends on the displacements), an interaction between the two areas of knowledge is required, in order to develop a new procedure based on the theoretical tools of both thermodynamics and continuous mechanics for solving the uncoupled problem.

The close collaboration and interaction between experts of different disciplines is often sufficient for solving most specific problems and an interdisciplinary approach to problem-solving has therefore the focus of this survey. However, there are cases where a broader perspective of the problem and innovative solutions can only be reached by availing a more holistic design approach that overcomes the discipline boundaries. In the previous example, a more holistic approach to the problem would question the usual design procedure, where the beam is optimized for mechanical loads and then verified in presence of a heat source (such as e.g. a fire) and seek e.g. for a different design procedure capable of accounting both aspects in the design optimization. This could lead to a new and quite different shape of the constructive elements and, ultimately, to a novel construction technology.

It should be pointed out, that a pure holistic approach to problems that encompass several and very different disciplines may be very difficult and, in some cases, hinder the simplification of the problem into smaller and more understandable problems, which could have been instead obtained by following a reductionist approach. In this respect, it is worth recalling that one of the simplest and most effective way of identify limit of current design practices and improving them is to learn from previous disaster. However, this has been often hindered by the scarcity of data on the occurrences of disaster and analysis of the consequences on urban systems.

The lack of sufficient statistical data has often favored a pragmatic selection of the design scenarios over a more consistent probabilistic design, usual instead when frequent or recurrent actions are involved. It seems therefore important to promote the development of an organized database of information on disasters that could be available and freely used by designers and decision makers. If not for the case of man-made hazards, which are hardly recurrent, the database could at least serve to natural hazards, as well as accidents like compartment fires and gas explosions. These events are nowadays considered in building regulations (EN 1991-1-7: 2006, 2006) as exceptional actions together with arsons, malevolent explosions, and impacts, for which a lower level of safety is accepted. However, they are in fact not rarer than other natural hazards, such as e.g. earthquakes, which are instead typically treated in a probabilistic way. Fires are in fact often a consequence of earthquake and represent therefore a typical action to account for when design for multiple-hazard is of interest, as typically the case of disaster resilient infrastructures. Concurrent and cascade events are other actions that could greatly benefit from the gathering and dissemination of data on disaster, as this could give more information on the level of correlation between events that are currently non-conservatively treated as independent ones.

#### 4. Conclusion

The survey described in this paper represents one of the first attempts to collect data on the status of art and practice on interdisciplinary work on resilience to natural and human-made disaster. The review of the answers to the questionnaire has highlighted three main aspects of disaster resilience projects:

- Projects on disaster resilience involve 5 different disciplines as an average and geography and sociology as most frequent disciplines. The latter aspect highlights the importance of social and cultural aspects in disaster-resilience design, which are instead not often considered in current studies on the topic.
- The level of interconnection between disciplines seems intermediate, meaning that information and methods are exchanged, but a full integration into a common shared language and system of axioms is missing.
- The lack of a common framework and common terminology represents a major barrier to interdisciplinary work.

The questionnaire has also inquired on measures undertaken to overcome the main barriers encountered in interdisciplinary work. With respect to the limited understanding due to the lack of a common framework and terminology among different disciplines, the problem has been mostly addressed by increasing the number of meetings and discussions between experts of different disciplines. However, this solution is very time consuming and the efficacy of a better communication among partners is limited to one specific project and won't improve the level of understanding in future projects, where different partners may be involved.

In order to overcome this problem in a more effective way, the establishment of an education on resilient design of urban system is suggested. This would favor the development of resilience-based design as a discipline with its own framework of knowledge and terminology and enhance the design approach from an interdisciplinary level to a transdisciplinary one. For this aim to be achieved, efforts on development of new courses and establishment of new education lines are required from universities and HEIs. In this respect, the implementation of doctoral schools and PhD courses on the topic of disaster resilience carried out by within the framework of the ANDROID project represents a good starting point to broaden the education in the field.

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