



KNOW4DRR
Disaster Risk Reduction Knowledge



Enabling knowledge for disaster risk reduction in integration to climate change adaptation

**Deliverable 3.3. Summary of the main findings of
the four living labs**

DWF, CSIC & POLIMI

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Executive summary

Innovation in knowledge management : the Living Labs

The KNOW-4-DRR project explores and maps the complex interaction between knowledge creation, decision making and action at all stakeholder levels in the field of DRR and CCA. We recognize that there are barriers and fragmentation in the way that information is generated and sent, for example by government agencies and scientists, to those that need it; and how for the targeted receivers - often the 'key' end user stakeholders - the information they receive does not always enable an understanding of the information sent, nor then allow people to transform information into useful knowledge that leads to action for better DRR and CCA.

In the KNOW-4-DRR project we see that 'Enabling knowledge for disaster risk reduction (DRR)' requires more collaborative effort between different stakeholders - government, scientists, practitioners, decisions makers, educational and all civil society actors - in order to optimize the use of information generating better DRR and, progressively, actions for CCA.

To understand this task we have considered what has hampered the use of information and the development of knowledge amongst different stakeholders so as to improve decision making for risk reduction and for enhanced resilience and adaptation to known and emerging hazards including climate change. Through this process, the project has sought to define how to make better use of information exchange and communication systems and tools, and to see how this further develops knowledge in the hands of the people who most need it.

Within the KNOW-4-DRR project, there has been an ongoing component leading to Deliverable 3.3. under the title "Living Lab" or 'living laboratories', where three of the project partners, with their communities and many different stakeholders engaged in DRR and CCA, have the opportunity to do real-time studies in communities addressing DRR and Climate Change issues, and importantly, have been able to interact with various involved stakeholder groups, thanks to their good long term relations with these different actors.

The Living Lab is a conceptual research and development approach, and has its origins in the development of computer science in the 1980's. Today many Living Lab activities exist, addressing a broad range of ideas and goals, but with the common base that they are interactive systems where innovation takes place in real life contexts with many stakeholders through knowledge sharing, collaboration and experiments in open environments (Concilio et al 2015).

The Living Lab concept lends itself to the complexity of physical and human interaction implicit in disaster risk environments with high uncertainties (De Marchi 1995). However, there are not a great number of examples of Living Labs specifically oriented towards disaster risk management.

Four living labs at different scales (national, interregional, and local) have been developed in the project: in central Vietnam, Spain (Lorca) and Italy (Po River basin and Umbria Region). They all involved enquiry and consideration of how the exchange of information, and also the co-production of knowledge between various social/institutional groups might more successfully take place or, alternatively, might be hampered under differing circumstances.

Central Vietnam Living Lab: The living lab activity- which focused on the work undertaken to achieve safer housing amongst vulnerable communities in coastal areas prone to floods and typhoons- underlines that many of the initiatives and actions related to knowledge for safer housing involve the successful collaboration between public sector officials and technicians, households, local stakeholders, schools, etc. in an effort to strengthen interaction between different stakeholders and to generate multi directional learning.

Lorca (Spain) Living Lab: The collaboration of researchers, local authorities and high schools fostered risk awareness through wide ranging reporting, including scientific papers, technical reports, media reports or press releases, on two recent earthquakes. The activities showed that flows of information are one way, the intended outcome was only partially achieved and feedback from targeted audiences/stakeholder groups was insufficient. This underlines weaknesses in the communication to the general public of the acquired knowledge on risk and the lack of integrating local knowledge in planning activities.

Umbria (Italy) Living Lab: The living lab joined a wide range of actors, including researchers, students, public officials, and volunteers to develop and test new, enhanced tools for collecting and analysing post-flood damage data. They combined both reconstruction and prevention by establishing a post-flood damage knowledge database. Stressing to citizens the importance of sounder efforts for the recovery and reconstruction phase as part of the post-flood damage assessment has proved relevant and was used in preparing regarding video material. Through learning from others, the lab helped to raise awareness of stakeholders, some of which are commonly reluctant to share information external to their institution, and achieved common strategies and willingness to collaborate.

Po River basin (Italy) Living Lab: The Po River basin community of practice is made by two components: The core group represented by the Po River Basin Authority, its staff and a group of researchers. The second group comprises the representatives of different regional and provincial administration authorities that are geographically included in the Po River basin. This distinction was of relevance as the core group actually developed a knowledge asset, and the second group provided inputs and ideas without direct contribution. The continuous participation of the authority provided a special impulse to the living lab activity and permitted to introduce ideas that were also discussed in the project directly into the flood risk management plan as required by the Floods Directive.

The four Living Laboratories experiences have reflected both the findings and the outputs of the KNOW-4-DRR project.

The recognition that multi-stakeholder collaboration improves the development of knowledge for DRR and CCA, and should be encouraged (Deliverable 2.1.) is clearly evident in the four Living Lab experiences. The Living Lab experience changes the classic perceptions of some stakeholders, for example shifting civil society stakeholders from being passive participants to active sources of data and ideas. In the Po River Basin living lab the collaborative experience with various stakeholders allowed the researchers of the Politecnico di Milano the opportunity to participate to meetings that are usually closed, to follow the implementation of a policy in its making, and above all to contribute directly in the decision making process, rather than being external observers. All stakeholders learnt and profited from this enriched exchange process.

In addition the living labs have revealed opinions and facts that would not necessarily have come to light otherwise. They changed the perception of what to focus on in damage assessments, for example prioritizing attention to damage to industry and lifeline services as well as residential buildings since the former have a very direct impact across the board on income generating capacity resilience and the quality of life. In the Lorca living lab, the population in Lorca was found to be most concerned about earthquake risk even though statistics clearly show that the risks associated with flooding is higher, suggesting opinions based on emotional response to unpredictable risk.

One concludes that the cross stakeholder collaborative nature of these experiences is rich and is to be encouraged as good working practice to better understand perceptions of risks and measures to reduce them, and through this collaboration, to greatly facilitate the sharing and communication of information and the development of knowledge, and an improvement in feedback between stakeholders which otherwise tends to be insufficient.

Outside the KNOW-4-DRR project eligibility period, the living lab experiences are continuing, and from this perspective the project has had a positive impact on the working practice of scientists and has demonstrated one of the ways in which better exchange of information and the development of knowledge for DRR and CCA can be achieved between stakeholders. The Living Lab experiences also largely mirror the KNOW-4-DRR

work and objectives reported in the Deliverable 3.1 on the development of a Knowledge Management system for the DRR and CCA arena.

The living labs approach experimented in the Know-4-drr project responds to a more general demand for innovation in the field of risk management as a response to the dissatisfaction with growing damage and losses, and in some countries even victims, due to natural hazards. In parallel to technological and IT advancement, they highlight that social and cultural issues need to be given greater consideration in addressing DRR and CCA.

A conclusion from the Living Labs is the need to change the way risk governance is conceived, emphasizing the idea of moving towards a “multi-objective approach”. For example, one way to introduce change in risk governance is to increase opportunities for representatives of state agencies and bureaucracies and indeed civil society, who generally operate separately from each other, to meet and discuss the merit of issues they are generally dealing with independently, but which instead are strongly interconnected. The living labs that have been developed within and beyond the Know-4-drr project have created such an opportunity, leading in some cases to the development of what Wynne (EC, 2007) indicated as “distributed innovation, that is observed in situations where heterogeneous actors who hold complementary pieces of knowledge interact, form networks or creative communities”. The living labs of the project represent an example of innovation intended as an effort to develop institutional capacity and aptitude for resilience, in which the focus is on engaging all participating stakeholders in a process of knowledge co-creation and learning.

Contents

1. The Research Coordination project “Enabling knowledge for disaster risk reduction in integration to climate change adaptation” KNOW-4-DRR	1
1.1. Deliverable 3.3: Summary of the main findings of the Living Labs	1
2. The “Living Labs”	3
2.1. KNOW-4-DRR LL1. THE DWF Vietnam Living Lab	3
2.1.1. Context	3
2.1.2. The surveys	3
2.1.3. The Vietnam Living Lab: Overall Findings	4
2.1.4. Actions and tools related to knowledge development for safer housing	5
2.1.5. Outputs	7
2.1.6. Conclusions	8
2.2. KNOW-4-DRR LL2. The CSIC Lorca Living Lab	10
2.2.1. The Lorca living lab	10
2.2.2. The Lorca Living Lab: Overall Findings	11
2.2.3. Conclusions	12
2.3. KNOW-4-DRR LL3. The Po River Basin Living Lab	13
2.3.1. The Po River Basin living lab	13
2.3.2. The Po River Basin Living Lab: Overall Findings	14
2.3.3. Conclusions	16
2.4. KNOW-4-DRR LL4. The Umbria Civil Protection Living Lab	18
2.4.1. The Umbria Region living lab	18
2.4.2. Conclusions	21
3. Overall conclusions	22
Bibliographical references	24

1. The Research Coordination project “Enabling knowledge for disaster risk reduction in integration to climate change adaptation” KNOW-4-DRR

1.1. Deliverable 3.3: Summary of the main findings of the Living Labs

The KNOW-4-DRR project explores and maps the complex interaction between knowledge creation, decision making and action at all stakeholder levels in the field of DRR and CCA.

We recognize that there are barriers and fragmentation in the way that information is generated and sent, for example by government agencies and scientists, to those that need it; and how for the targeted receivers - often the ‘key’ end user stakeholders - the information they receive does not always enable an understanding of the information sent, nor then allow people to transform information into useful knowledge that leads to action for better DRR and CCA.

In the KNOW-4-DRR project we see that ‘Enabling knowledge for disaster risk reduction (DRR)’ requires more collaborative effort between different stakeholders - government, scientists, practitioners, decisions makers, educational and all civil society actors - in order to optimize the use of information generating better DRR and, progressively, actions for CCA.

To understand this task we have considered what has hampered the use of information and the development of knowledge amongst different stakeholders so as to improve decision making for risk reduction and for enhanced resilience and adaptation to known and emerging hazards including climate change. Through this process, the project has sought to define how to make better use of information exchange and communication systems and tools, and to see how this further develops knowledge in the hands of the people who most need it.

Within the KNOW-4-DRR project, there has been an ongoing component leading to Deliverable 3.3. under the title “Living Lab” or ‘living laboratories’, where three of the project partners have the opportunity to do real-time studies in communities addressing DRR and Climate Change issues, and importantly, have been able to interact with various involved stakeholder groups.

The Living Lab is a conceptual research and development approach, and has its origins in the development of computer science in the 1980’s. Today many Living Lab activities exist, addressing a broad range of ideas and goals, but with the common base that they are interactive systems where innovation takes place in real life contexts with many stakeholders through knowledge sharing, collaboration and experiments in open environments (Concilio et al 2015).

The Living Lab concept lends itself to the complexity of physical and human interaction implicit in disaster risk environments with high uncertainties (De Marchi 1995). However, there are not a great number of examples of Living Labs specifically oriented towards disaster risk management. Some examples are

- the Disaster Proactive Human Lab focused on Earthquakes, (DPHL)
- the LiveWithRisk Living Lab focused on providing local tools for risk information management
- The Kathmandu Living lab, now oriented towards post-earthquake work in Nepal

Living Labs are often described as open innovation systems. When referring to innovation processes the concept of openness is intuitive and thus hard to define. Urban or territorial living labs (see the concept of Territorial or Urban Living Labs in: Marsh, 2008; Concilio and Celino, 2012; Concilio and Molinari, 2014) are context-driven environments where user-centered research and development activities are carried out in an open-innovation ecosystem rooted in a territorial context (e.g. city, agglomeration, region). Such territorial living labs seem to be able to activate and keep alive concurrent research and innovation processes within a public-private-people partnership (Von Hippel, 1986; Chesbrough, 2003; Pallot, 2009).

In a recent review literature on urban and territorial Living Labs, Wallin (2015) identifies three types of Living Labs in socio-spatial environments:

- Living Lab as a technology-driven research environment
- Living Lab as a testing environments for knowhow and tools
- Living Lab as arena for self-organizing groups

The first kind is the one mostly related to the original idea and definition; it is a research environment developed in real life context to co-design, prototype and test new technologies. In this type of Living Labs, the role of the users is that of an observed subject and not an engaged citizen in the co-creation of ideas and breakthrough scenarios. In the second type of Living Lab, methodologies and technologies are tools for reaching the users and, together with them, transforming the real urban environment. The goal of such a living lab is to encourage the users to develop and produce urban/territorial artefacts, co-create urban/territorial spaces. The third type of urban Living Lab is also an approach aimed at developing urban/territorial systems but is not created under a planning/design intention of an external actor, but by a self-organized community that wants to solve collective problems in its everyday life condition (Wallin & Horelli, 2010; Wallin & Horelli 2012).

Even though the Know-4-drr is a coordination activity, it seemed important to ground some of the reflections and suggestions regarding the improvement of knowledge management in the field of disaster risk in living labs. The latter were chosen based on the special links partners had with local stakeholders permitting not only to get information and insight but actually collaborate together and test some of the ideas that were coming out from the various project's activities. They have provided an opportunity to explore various issues and ideas about the improvement of knowledge management in the field of disaster risk reduction

The four Living Lab studies are:

- LL1/Vietnam : DWF – ongoing actions over years to reduce risk and vulnerability with various local stakeholder partners faced with and suffering from the impact of frequent floods and typhoons.
- LL2/ Spain: CISC & the Lorca Municipality. Reporting on events related to two recent natural disasters affecting the Lorca municipality in Spain.
- LL3/Italy: Polimi & Po River Basin Authority. Researchers and the Umbria Region cooperating at developing enhanced tools of floods risk assessment to support flood risk management plans.
- LL4/Italy : Polimi & the Umbria Region Civil Protection Authority, Researchers and the Umbria Region came together to assist both reconstruction and prevention by establishing a post-flood damage knowledge database.

The living labs of the Know-4-drr project seem to converge to the second type of living labs described above, that is creating a testing and production environment for knowhow and tools. Such environment has a varied amplitude in the four living labs, ranging from the Po River Basin case, where the environment is rather restricted to a limited and selected number of stakeholders, to the Umbria case, more open to a variety of mixed stakeholders and virtually reaching also citizens (at least those affected by the floods), to the Vietnam case, ranging from local communities to Ministries. It seems that the amplitude also depends on the time and the duration of the experience but also on how such experiences interacted with real disasters (larger or smaller). In fact, disasters are important turning points that offer the opportunity to make various stakeholders converge on common goals and trigger interest and willingness to test innovation that can facilitate and ameliorate working conditions and outputs in times of particular load and stress.

Somehow disasters create the occasion for the convergence, yet without previous agreements, cooperation and trust, the living labs would have never been initiated. In this respect, living labs are long term, long lasting endeavours that are not likely to start in the time of crisis. In the latter people will not test new forms of cooperation or new technologies, unless the latter have not been already pre-tested, initiated and somehow made familiar in ordinary times. It seems a contradiction, but it is not: disasters offer the opportunity to change and to be innovative, but conditions for such innovation must have been planted before the crisis. These characteristics distinguished perhaps living labs in the risk management domain from others that are more embedded in everyday, ordinary people's and communities' life and activities. They provide the very

valuable opportunity for different stakeholders to learn from and appreciate different concerns, viewpoints and ideas that might not otherwise be possible in more classic pre or post disaster interventions.

2. The “Living Labs”

2.1. KNOW-4-DRR LL1. THE DWF Vietnam Living Lab

In an area where DWF has been working for 26 years, to undertake the Vietnam "Living Lab" exercise since mid-2013 DWF has revisited areas affected by both previous and recent disaster events in the highly risk-exposed environment of central Vietnam, affected by floods and typhoons. Considering several disaster events since 2006 and using surveys, interviews, workshops and case studies, we have built a picture of the development and transmission of information and communication for DRR in central Vietnam, (and, gradually, for CCA), to see how this has been evolving over the past 8 years. In what way has communication and knowledge about DRR and CCA helped to develop a safer environment? What still hinders the development of safer conditions for vulnerable communities in central Vietnam? And finally, we consider what is being done to address the issues that have emerged. A full report on the Vietnam Living Lab has been prepared for the KNOW-4-DRR project and posted on the KNOW-4-DRR Box. (DWF, 2015)

2.1.1. Context

DWF's work has promoted the concept and practice of preventive strengthening of houses and small public buildings so that they can resist the impact of typhoons, whirlwinds and floods. It encourages national and local authorities, local builders and families to integrate the key principles of safer construction into new building and in the retrofitting of existing buildings especially those of the poor and the very poor. Communication of principles of safe construction and ideas about preventive action to reduce risk and losses is central to this effort. Prevention based on applying generic principles of safety is slightly different from applying regulations and codes for construction, the former encouraging people to apply good and proven practice that can make a large variety of buildings safer against given risks, the latter more often applied to formal sector buildings and less often respected in the informal sector. For the very poor the application of safe construction principles has a greater chance of use compared to building codes.

A large part of this strategy is related to getting people to believe that preventive action is possible and useful. Communication to those who need knowledge of what to do is a key in developing a change in attitudes and ideas about safety. To do this, various stakeholders have participated in ways to communicate ideas about safety in construction and the need for it, and developed concepts using both old and new means that help lodge the idea of prevention better in longer term memory, one of the challenges of encouraging people to undertake prevention work in periods when it may not seem like a priority. Over time, these actions have an effect: starting from a very grass roots community base in 1989, today DWF works with the same communities but also with the Ministry of Construction to integrate the lessons of the DWF programme and local practice into rewriting national policy codes and practice to align to local needs and realities.

The Vietnam "Living Lab" activity has involved enquiry and consideration of how the exchange of information, and also the co-production of knowledge between various social/institutional groups might more successfully take place or, alternatively, might be hampered under differing circumstances.

2.1.2. The surveys

The surveys, community meetings and workshops have been held in the central provinces of Thua Thien Hue and Quang Binh. In this Living Laboratory experience, we have not been specifically testing communication tools and information management systems that can improve the development of knowledge for DRR; although such issue forms part of the body of this work. Rather, in Vietnam, the aim has been to consider and understand the barriers and bridges for information transfer and knowledge development and then how communication systems and their success are evolving. This helps understand how different stakeholders in Vietnam can better engage in the DRR and CCA process. Finally, we have considered what actions and various tools are being used to address the issues raised in the surveys.

The “Laboratory” in four stages:

- a) In **August 2013** a benchmark case study report by DWF set the overall scene before, during and after typhoons in 2006 and 2009: **typhoon Chanchu (May 2006) and typhoons Xangsane (October 2006) and Ketsana (September 2009) that hit central Vietnam and caused much damage** :
 - a. Part 1: The typhoon events
 - b. Part 2: Information flow and knowledge development.
- b) **2013/early 2014**: Survey of recent experience: after typhoons Wutip and Nari (September & October 2013) hit central Vietnam – cases studies in Quang Binh province and Thua Thien Hue provinces (Loc Tri Commune) provided a contemporary view of information flow and knowledge development for DRR and CCA.
- c) **Mid 2014**: Additional surveys with Loc Tri commune inhabitants and builders, in May/June and September 2014, to provide feedback and complementary notes on findings (DWF & partners, 2015);
- d) **The Hue Workshop**, 26th September 2014: A roundtable workshop organised by Development Workshop France on the Vietnamese experience of “Enabling knowledge for disaster risk reduction and its integration into climate change adaptation”. This involved 35 participants from ministry level down to commune representatives. Their observations not only aligned with the findings from DWF surveys, but interestingly, with many of the case study materials provided in the overall KNOW-4-DRR project.

2.1.3. The Vietnam Living Lab: Overall Findings

From the surveys we reached the following conclusions.

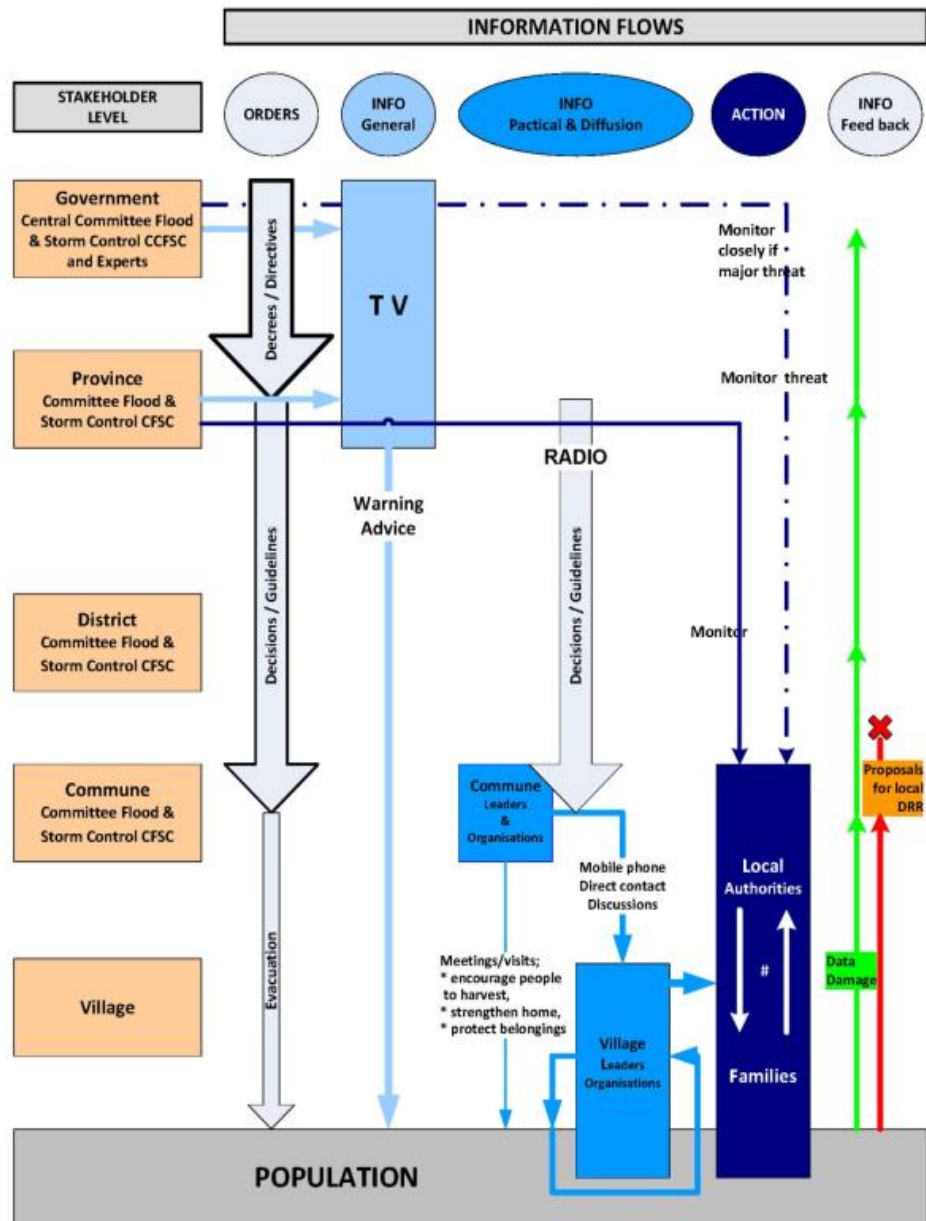
1. As was the case in 2006 and 2009, the Vietnam approach is still "top down" from central government to villages, but local experience is great - people are well prepared, and also provide proposals for DRR even if these do not get implemented because of lack of resources;
2. The greater the hazard threat, the higher is the level of authorities directly giving orders; for a very large threat, central government intervenes and very senior government officials may visit;
3. Committees for Flood and Storm Control¹ at all levels (central, provincial, district and commune), develop annual plans, but these are mainly for preparation, response... and little on DRR and prevention;
4. General information now comes mainly from TV; information and/or orders on what to do practically comes at the local level in the Commune and its villages;
5. But at commune and village level, there is effective mobilization both through direct contact (house to house visits/meetings), through the use of mobile phones and through mutual help;
6. Prevention is progressing (agriculture, housing) at local level; local builders play a bigger role after training;

¹ Now renamed “The Committee for Natural Disaster and Control” (and includes search and rescue at local level)

7. General information is not easy to understand (for example people don't understand terminology used or some information is hidden as there is a risk that such information can be a source of 'conflict' (dams, real estate...);

Now: not only is more information about DRR needed locally, but this has to be supported by budgets and investment at local level for DRR!

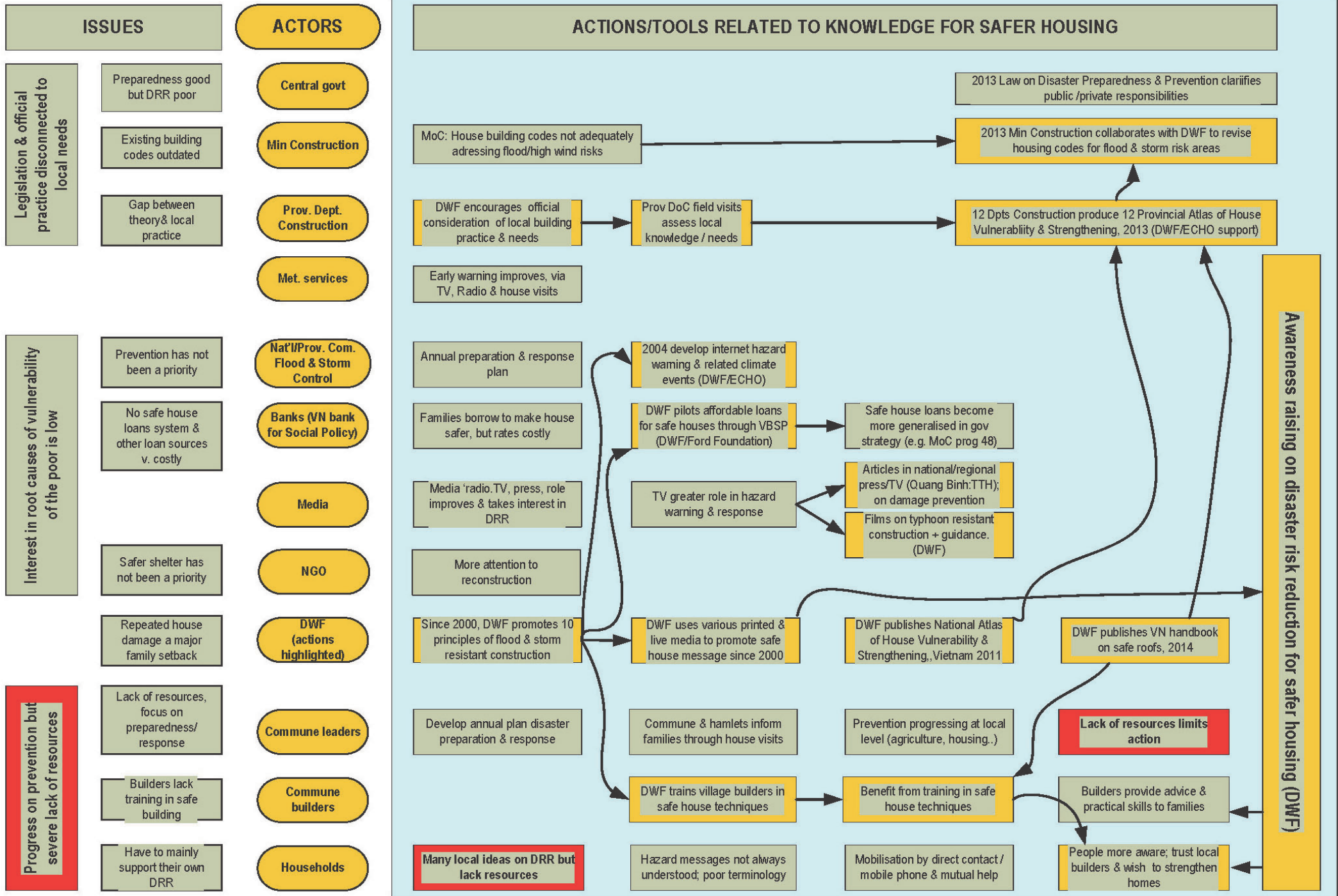
Information flow chart (Source, community workshops in 2014)



2.1.4. Actions and tools related to knowledge development for safer housing

In November 2014, we juxtaposed the findings with various actions and tools that have been developed over the past decade by stakeholders, DWF and DWF's partners in Vietnam, specifically addressing achieving safer housing amongst vulnerable communities in the coastal areas of Vietnam. This information has been developed as a table, shown on the next page, which summarizes the issues that were raised by or for different actors or stakeholder groups, and then on the right illustrates what initiatives and actions have been developed by different stakeholders to address the issues over the past decade, and as an ongoing process. This is an ongoing process.

Many of the initiatives and actions involve collaboration between public sector officials and technicians, households, local builders, schools, children, actors and singer in an effort to strengthen interaction between different stakeholders and to generate multi directional learning.



2.1.5. Outputs

These actions can be considered in Data/Information/Knowledge and Wisdom (DIKW) terms as follows in the *right* hand column.

What?	How?	DIKW Pyramid outputs
Legislation changes	New laws & revised codes reflect changing risk environment & the recognition of the need to adapt to coastal risks, realities and vulnerability; New construction codes implicate local practice and knowledge, technicians interact with households to develop new locally adapted construction practice	Better information > new knowledge; Lessons being learned > wisdom feeds back to improve information
Information delivery	Increased use of TV provides hazard warning information + films on safer houses; Mobile phone messages also used; But, locally, loudspeakers & visits still important	More varied delivery: Information delivery precision improves > helps build knowledge Traditional knowledge > wisdom in doubt!
Capacity building	Various forms of training and information provision, addressing : <ul style="list-style-type: none"> • Technical skills (national/provincial); • Financial services (new safe house loans package); • Flood & storm control committees : test internet & real time weather data; • Local builders & leaders: fast 1 day safer house theory + practice training; Publications national & provincial: (“Atlas of house vulnerability & strengthening”) + handbooks	Information provided > generates knowledge through seeing & doing: <ul style="list-style-type: none"> • In formal training • In collaborative work experience
Awareness raising campaigns	<ul style="list-style-type: none"> • Simple messages (e.g. prevent typhoon damage); • Engagement of local/non local artists + actors & children; • Use/develop a variety of local, traditional, theatre & concert based communication, and TV, Radio and press nationally and locally to deliver messages (ex. Film by child actors: “the stubborn builder” http://www.dwf.org/en/media-gallery/detail/1326/1996) • Cartoon strips; mobile street displays • Crowd pulling events (sport etc.) 	Clearer Information delivered; impact studies indicate this leads to knowledge followed by action Uncertain impact Large audiences/some generate memorable knowledge
Awareness & application	<ul style="list-style-type: none"> • Provinces/Commune know that preventive strengthening is viable • Poor families see, experience & believe that safer houses are possible • Families borrow to strengthen (targeted loans); but lack of budget a brake on achieving greater safety • Convinced families strengthen house spontaneously • Commune/Province & GOVT acceptance - shift from ridicule to conviction. 	Knowledge; Knowledge > some wisdom Knowledge, leads to action & some wisdom (experience) Knowledge
Early warning	Alerts achieve improved precision and delivery; but message not always understood; and door to door visits still important	Better information, at local level not always producing knowledge

2.1.6. Conclusions

The Living Lab survey suggests that the overall Vietnam DRR environment and recognition of the need for adaptation to Climate Change are evolving, mostly positively. However, there is concern that the risks and the impact of hazards are both increasing and becoming more uncertain (for example, putting old knowledge into question). On the other hand, there are positive measures already in place or being put in place at different levels within the Vietnamese disaster management hierarchy. Examples include new legislation related to DRR, the revision of construction codes, the development of a Disaster Prevention Fund², and the greater availability of technical information about safe building adapted to local risks and realities (e.g. The Atlas of House vulnerability and strengthening (DWF National version 2011 and 12 provincial versions (DWF 2012)), that can be used by technicians and delivered to and by local builders and then to households.

The use of modern media including TV and mobile phones has greatly increased over the past ten years, and can deliver better quality information including early warning and many households have access to these services. Against this, the gaps between the rich and the poor and between urban and rural areas are getting greater. These impact on safety and how information about action about preparedness and prevention can be delivered efficiently to vulnerable poor families. The surveys shows that delivering information especially to poor and vulnerable families still relies very much on direct contact and house to house visits, and for example, on the use of commune/village level loudspeaker systems. For safer housing, as well, local builders are an important for providing advice about making homes more resistant.

Delivering good information to the vulnerable poor remains problematic and particularly so in relation to preventive actions that need to happen in advance of a hazard event, where the target information receivers may have their minds on other more pressing needs.

In addition, the table on “Actions & tools related to knowledge for safer housing” suggests knowledge to act for DRR **requires a multi stakeholder and multi task approach that addresses action on many fronts and combines many different communication approaches and related activities**. Thus, useful information for DRR action needs to be available, understood and advance action encouraged in a context where there is a conducive financial, legislative and institutional environment.

Overall, placing the Vietnam Living Lab experience alongside the European context that is the prime focus of the “KNOW-4-DRR” project, we can initially consider the differences in the socio-economic and political systems that variously condition DRR in Europe and in Vietnam:

Europe: democracy, freedom of speech, etc. suggests greater opportunities for more stakeholder engagement across the board for change and better DRR. But the disaster environment is increasingly complex and compound risks and vulnerability - Mobilizing social engagement in bringing about better safety could still be considered poor in many instances.

Vietnam: an authoritarian political system with low potential for political and social expression; but very considerable experience and concern about the protection of all members of society with an excellent preparedness record. But overall, there remains a separation between instructions on what to do and the means to do them on the one hand, and still insufficient lessons that could be learnt from what people at the frontline of risk actually do to protect themselves.

Between these two different contexts, the findings of the “KNOW-4-DRR” project suggest that there are actually strong similarities about the delivery of information on DRR and CCA and the development

² Decree N° 94/ND-CP establishing a Disaster Prevention Fund, enacted 8/12/2014.

of viable knowledge across most cases – and the mapping of the exchange of knowledge to support DRR (DWF Deliverable 2.1, 2014) supports this conclusion.

Some key points aligning Vietnam and Europe:

- Too many agencies with different responsibilities and aims do not always contribute to well-coordinated and clear decisions about DRR and emergency actions; there signs of rationalization but more to be done; communication is still often poor and does not enhance knowledge development;
- Top down strategies criticized as being too theoretical, at times difficult to implement locally;
- Information on extreme weather events criticized for not always being accurate or timely enough; information sent out is not always understood by the local stakeholder;
- Terminology problems; scientific and even weather warning information not always understood;
- Insufficient community feedback;
- Loss of local and indigenous knowledge;
- Divergent objectives and priorities:
- Need to enhance the role of social media in delivering information; progress being made.
- Slowness in knowledge sharing and interdisciplinary work.. getting better
- Lack of resources for local action

2.2. KNOW-4-DRR LL2. The CSIC Lorca Living Lab

2.2.1. The Lorca living lab

The Living Laboratory “**Living Lab.2**” of the EU-FP7 “KNOW-4-DRR” project has been conducted in Lorca (SE-Spain) by CSIC in collaboration with the municipality of Lorca and the Secondary School “Arcas-Meca” as local partners.

The Living Laboratory in Lorca has dealt with the situation and the response to two recent natural disasters affecting the town: a magnitude 5.2 earthquake which occurred in 2011 and the subsequent flooding which occurred in 2012. The objective has been to analyse DRR and CCA general context in Spain and also the specific issues emerged during the two situations to support and provide feedback to government authorities and responsible decision makers in all levels of administration (including higher levels).

The research and activities in Lorca build on the established links with Lorca municipality and Lorca society after 2011 earthquake and subsequent flooding in 2012.

The information was collected during the laboratory activities that have been carried out both in Madrid and Lorca. The activities have involved stakeholders at all levels, ranging from the more general framework of DRR and CCA in Spain at country level to the more specifically regional and local levels in Murcia and Lorca.

The investigations were developed in three phases. The first phase focused on the more general framework by analysing Scientific Knowledge, DRR and CCA and the problems and opportunities in Spain through a one-day workshop in Madrid and a survey of exploratory nature. Three interdisciplinary discussion panels were formed with the participation of experts from a variety of fields, institutions and regional areas in Spain. Members of the scientific community, decision makers and administration officers, as well as representatives of the private sector participated in the workshop.

A second event “*Lorca Resiliente-Lecciones aprendidas tras el terremoto*” (Resilient Lorca-Lessons learnt after the earthquake) took place in Lorca in November 2014 where multiple regional (Region of Murcia) and local (Town of Lorca) stakeholders involving the different sectors (public sector, scientists, private sector, NGO’s, and civil society) together with central government administration officers could share and exchange their views through short communications (15’) and roundtables discussions. During the three days of the event outdoors activities were scheduled for the students’ community as a kind of Open Doors where members of Civil Protection (Region of Murcia and Lorca) and the Red Cross deployed typical resources for response in emergency for the students’ community to explore and meet professionals responsible for emergency operations.

A third action consisting in several workshops was carried out in Lorca at Secondary School level. During the sessions in the workshops the students contributed to discussions on perception, awareness, knowledge and information on their exposure to natural hazards. At the same time, additional surveys were carried out in Lorca and neighbouring localities. This activity was led by the Secondary School in Lorca “Ramón Arcas Meca” in coordination with CSIC and has involved students and educators and also the population in Lorca. *It reversed the usual role of researchers and academics.* The surveys have provided valuable complementary information on awareness and knowledge on the exposure to risks and preparedness in the local context.

2.2.2. *The Lorca Living Lab: Overall Findings*

The Living Lab has tried to track the actual situation on the development and framework for DRR and CCA first in its general context in Spain and the possible effects on the consequences, response, and recovery in the case of two disaster situations in Lorca at regional and local level. (CSIC, 2015)

The activities within the framework of the Lorca Living Lab have provided insights on the barriers that need to be addressed and the opportunities to improve knowledge management in DRR and CCA.

A number of actions could be recommended to deal with the identified barriers which can result on relevant improvements for a more efficient DRR and CCA in the general context level in Spain. These are summarized here.

- Effective implementation of Risk Reduction and Climate Change Adaptation in Land Use Planning (unresolved matter at present)
- Encourage social awareness and involvement
- Improve the quality of the information on disaster risk and CCA and promote a culture of prevention
- Encourage team work between scientists and technicians at public administrations. Focus- and problem-oriented research in cooperation with public administrations is to be promoted to provide the information and knowledge for preventive actions to be taken
- Promote a stronger collaboration and coordination of Civil Protection with all institutions and resources in the public administrations involved in emergency management at all administrative levels (national, regional, local, UME-Military Emergency Unit)
- Improve management in the emergency phase. Optimization of the interventions of the different actors during the emergency phase. To perform rigorous and precise data compilation and reports on the intervention, effects, and damage is essential together with the command and organizational structure
- Lessons from past disasters. Recovery and reconstruction phase is long in time requiring political and social will to complete it in every aspect. Regulations should be reviewed according the new information and knowledge acquired during the experienced event
- Promote educational programs and encourage self-protection measures so that society accepts tolerable levels of risk
- Promote Insurance as one of the essential instruments for resilience
- Investments on prevention policies. Incorporate DRR and CCA as a priority in public administrations so to establish the agenda on urban and land use, economic, and social planning based on cost-benefit analysis (due to the long lasting financial crisis period the cuts on spending have directly affected the investments on prevention policies)

The main findings resulting from the attempt to track the knowledge and the information management based on the analysis of the surveyed stakeholders having been involved in dealing with the Lorca situation mostly at regional and local level are summarized here.

- Improvement on quality of data/information in recent years
- Still, information flow is one-way. Insufficient feedback from targeted group
- Lack of systems for real-time knowledge sharing for prompt decisions during response
- Long delays on implementation of results from DRR studies
- Knowledge/experience often lost. Lack of sharing/implementation
- Weaknesses in communication to general public
- Local knowledge not considered in DRR planning
- Difficulties to recognize DRR problems by stakeholders
- Need for interdisciplinary collaboration
- Lack of shared objectives among stakeholders prevents effective DRR

- Multiplicity of involved organizations is a strong barrier for implementing DRR policies
- Too top-down DRR policies. Not grounded on real needs
- Other priorities/constraints influence DRR decisions
- Still, awareness on DRR importance is rising amongst stakeholders
- Information on DRR poorly understood by targeted stakeholders
- Risk of inaccurate DRR information when passed on by intermediary communicators (e.g., media)

The main findings from the surveys in Lorca (students and general population) on information and knowledge on natural risks through aspects related to awareness, perception, and preparedness are summarized here.

- Population in Lorca of all ages is most concerned about earthquakes although statistics clearly evidence that the frequency and risks associated to flooding is higher
- Younger generations seem to have an increased knowledge and information on natural hazards and CC as compared to the general population. Their main source of information been school
- Risk perception and awareness are very much influenced by the personal experience of the last event (11th may 2011 earthquake)
- In general, population in Lorca believe they are informed on protection measures but they over-estimate this information, since at the same time they feel don't have good understanding of the options to take for protection

2.2.3. Conclusions

Our Living Lab survey has tracked a number of aspects on DRR and CCA, decision making, implementation and information and knowledge flows as applied principally to the Lorca case within the general context in Spain.

The activities conducted have involved different stakeholders ranging from the more general framework of DRR and CCA in Spain to the more specifically regional and local levels in Murcia and Lorca and have been developed in three phases.

Although the general feeling is that there has been an improvement on the data information and knowledge regarding DRR and CCA there are still a number of issues that deserve special attention.

Among these, experts and stakeholders state that the scientific products are not adapted to the needs of decision makers. Even that legislation is considered to be adequate, problems arise in its correct application (the scales of the risk mapping for the urban level seem not to be usually incorporated in regulations).

Other findings point to the role of public administrations. DRR and CCA seem not to be in the administration agendas on a long term basis. Instead, immediate structural measures implying short political pay-offs are usually the response to disasters.

Another outcome of the Living Lab refers to the social dimension. It is felt that there is not enough social involvement. Knowing and accepting risk eases the capacity to cope but this not usually the case. Efficient communication strategies should be developed with a strong local dimension of risk.

CCA measures have not yet been clearly developed. This issue is even more complex and challenging because of the administrative structure in Spain with different Ministries, Agencies and Departments dealing with the different aspects of CC.

Main findings from the exploratory survey on knowledge fragmentation among the stakeholders' groups (scientists, public sector, private sector, civil society) in the Lorca case appear to show strong similarities with those from other European and non-European cases. Those common findings are related to the multiplicity of organizations involved increasing complexity of implementation. DRR policies been top-down and not grounded on real needs with one-way information flows. Although the improvements on the quality of data and information and the rise on the awareness on the importance on DRR among actors, knowledge is often lost because of lack of sharing and implementation.

Specific to the Lorca case in Spain, a number of problems have been identified in dissemination/ communication, cooperation and implementation. Weaknesses in communication to the general public and risk of inaccurate information when passed by intermediary communicators are identified. Stakeholders have difficulties to recognize DRR problems and poorly understand the information on DRR, and at the same time the lack of shared objectives among stakeholders prevents effective DRR. Problems in implementation arise from the long delays on incorporating the results on DRR and the influence of other priorities on DRR decisions.

At the political level, the very recent 2013 National Security Strategy (Spain) includes the establishment of a national protection system for citizens that guarantees a suitable response to different types of emergencies and disasters from natural causes or human action. It promotes an approach that integrates and strengthens the actions of the central government, autonomous regions and local authorities in order to ensure preventive action, an appropriate response and an efficient use of the limited resources available. The further development of the strategy will certainly imply a pathway towards more efficient use and share of knowledge and information on DRR and CCA at all levels in Spain.

2.3. KNOW-4-DRR LL3. The Po River Basin Living Lab

2.3.1. *The Po River Basin living lab*

The Po River Basin Living Lab has been one of the four living lab activities in the Know-4-DRR project and had in fact already started when the Politecnico di Milano - Department of Architecture and Urban Studies established a program of cooperation activities with the Po River Basin Authority in June 2012. The PO river basin is the largest in Italy, and floods frequently. The cooperation aimed at developing enhanced tools of floods risk assessment to support flood risk management plans according to the Floods Directive. The Po River Basin Authority was established according to one of the most relevant laws in Italy addressing risk prevention and integrated water and rivers management: the law n° 183/1989. Plans developed by the Authority included the Water Framework Directive (2000/60/EC), and more recently by the Floods Directive (2007/60/EC).

The collaboration was aimed not so much at consulting in the traditional way regarding a specific issue, but rather at co-designing methodologies and tools together with the Po River Basin Authority to accomplish the very complex task of implementing the Flood Directive. The group of Politecnico di Milano together with personnel of the River Basin Authorities has developed an enhanced risk assessment methodology consistent with the Floods Directive. It is structured into individual blocks with well-specified interfaces allowing evaluating (individually) damages, aggregated damage, and population at risk (Figure 1a, 1b, 1c). Further, it is feasible over the whole Italian territory and it is flexible to be updated once new data are available.

Thanks to this cooperation, the researchers were invited to several internal meetings where crucial issues related to the implementation of the Directive were discussed not only from a scientific point of view but also in terms of administrative processes and procedures. The Po River Basin Authority

allowed open and free access to information concerning the Flood Risk Management Plan in November 2011 and it will continue until the end of the plan design process and planned activities for public participation and involvement. Researchers were also invited to contribute to the so called “Po participatory public forums” aimed at guaranteeing the level of participation which is also a requirement of the Floods Directive. Along this process, the group of Politecnico di Milano had the opportunity to participate actively in a number of meetings and open forums of public participation. Meetings are organised on an ordinary basis by the River Basin Authority with all the relevant stakeholders that have a mandate for both the development of risk assessments and the Flood Risk Management Plan.

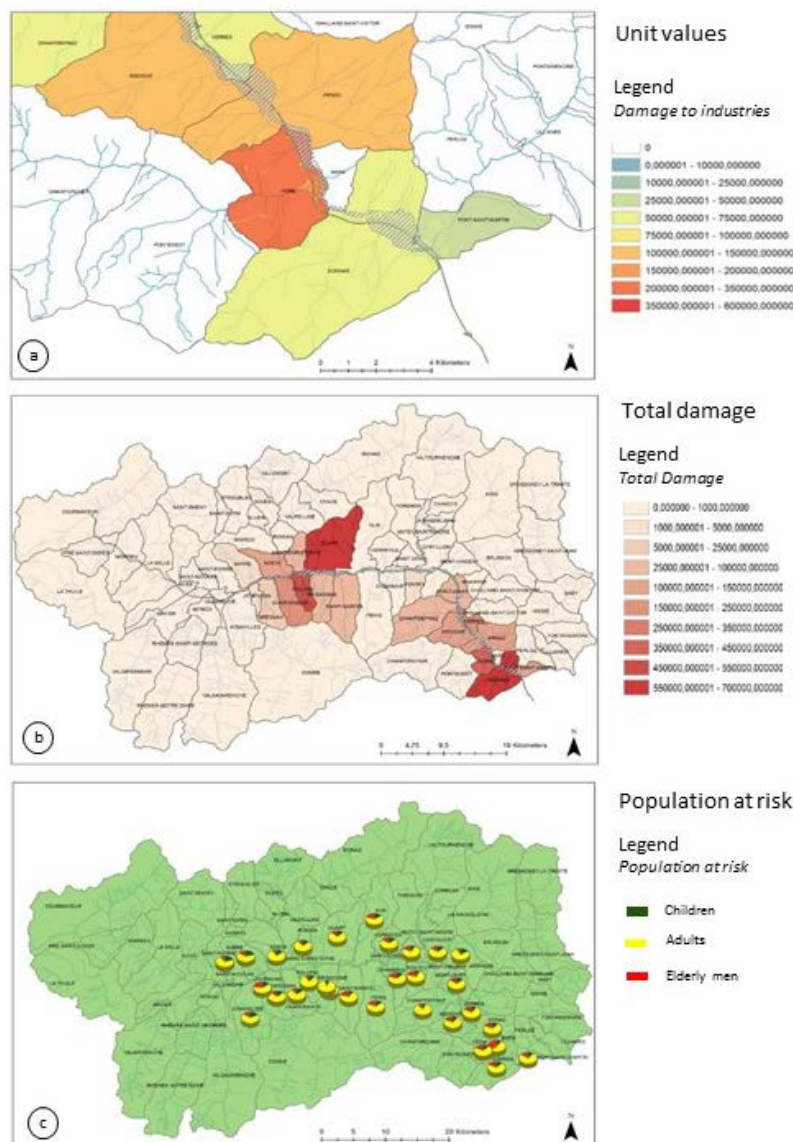


Figure 3: Application of the developed methodology in the Valle d’Aosta Region belonging to the Po River Basin: (a) damages to industries; (b) total damage; (c) population at risk according to a given scenario with a water depth of 1 meter.

2.3.2. The Po River Basin Living Lab: Overall Findings

In the context of this important cooperation, the group of Politecnico di Milano researchers have been able to understand the limitations and constraints of public authorities, but also their richness in terms of scientific and technical expertise. In the meantime the River Basin Authority could appreciate the contribution of researchers in the development of advanced tools and in updating models and

methods to the most recent and state of art scientific achievements. In line with this, the Politecnico di Milano together with other institutions belonging to the academia and research institutes were asked to respond to a questionnaire. The questionnaire composed by five main sections (1. improving knowledge of risk; 2. improving the performance of existing defensive system; 3. reducing exposure to risk; 4. ensure more space for rivers; 5. defense of the city and metropolitan areas) aims at collecting ideas and suggestions both for building a network for knowledge sharing and integrating disciplines to contribute to the design of the flood risk management plan in order to reduce the flood risk. According to this, several strategic priorities have emerged:

- Improve knowledge of risk
 - Deal with differences in available knowledge and needed knowledge for the application of the Flood Directive
 - Deal with uncertainty related to knowledge
 - Create a permanent system of relations between experts, researchers, planners, decision makers and citizens in order to produce, disseminate and apply the knowledge to the flood risk management.
 - Create a permanent system of relationships between risk managers and operators of communication.
 - Help mayors to exercise their task of informing citizens about the conditions of risk existing in the municipality.
 - Promote permanent information of citizens about the risks existing.
 - Involve economic operators in risk management and risk awareness rising campaign.
 - Developing the provision of training on flood risk.
 - Make flood risk component of local knowledge.
- Improve the performance of the defensive systems existing
 - Knowing and managing the hydraulic defense works.
 - Prepare maintenance plans of the river.
 - Protect areas of natural floodplains.
 - Include structural measures in an integrated approach to managing flood risk.
 - Control the formation of floods in the mountain part of basin.
 - Slowing the flow of rainwater in urban areas.
 - Face the danger of floods from the sea.
- Reduce exposure to risk
 - Produce analysis of vulnerability of territories.
 - Promote analysis of vulnerability of buildings and infrastructures.
 - Promote vulnerability analysis of economic activities.
 - Enhance and share knowledge about the actions for reduce vulnerability
- Provide greater space to the rivers
 - Mitigate and prevent the risk of flooding through redevelopment and restoration of environmental and hydraulics functions of river areas.
 - Maintain or restore the natural hydro-morphological features of rivers.
 - Restore forms and morphological structures on rivers heavily impacted with morphological quality poor or very poor.
 - Demolish, adapt and manage the works to improve processes and hydro-morphological forms of the rivers.
 - Promote a land use compatible with the hydro-morphological processes in the fluvial areas.
 - Learn and disseminate the knowledge about the importance of the fluvial forms and the morphological processes of rivers.
- Defense of cities and metropolitan areas 1
 - Promote permanent actions to develop an appropriate risk culture.

- Promoting governance appropriate for a comprehensive management of the basin in relation with risk urban flooding exposition.
- Reducing the vulnerability of the functions structuring the urban area.
- Integrate flood planning with plans for relocate infrastructures at risk and plans for restore rivers in metropolitan areas.

The KNOW-4-DRR has provided an important opportunity to test new forms of participation, for example, participatory mapping that attempts building on the experience of other project's partners. The strong connection between the River Basin Authority and the researchers has facilitated and actually encouraged the adoption of innovative ways to co-produce and share knowledge. This has occurred not only within the group of public officials on the one hand and researchers on the other but also with a wider audience, constituted by a variety of stakeholders of regional to municipal authorities that have to be involved in the development of both risk assessments and the implementation of the risk management plan.

2.3.3. Conclusions

The living lab is therefore constituted by a number of stakeholders that share a common goal (developing the assessment and the plan) but who need also to pursue the interests of the level of government and agencies they represent (for example, various Regional Directorates and Civil protection agency). This experience has certainly been very valuable for researchers of the Politecnico di Milano, providing the opportunity to participate to meetings that are somehow closed and to follow the implementation of a policy in its making, having the possibility to even interact and interfere with it. For the stakeholders this interaction permitted to confront with the research environment, getting information and knowledge regarding state of the art modelling techniques, about policies that are programmed now at the European level and examples of Flood Directive implementation in other European countries.

There have however been some limitations in the participative nature of the program: interaction has been confined to the official representatives of agencies, and levels of government that are in charge of the implementation of the Flood Directive. There were very few opportunities to meet with local stakeholders, such as the mayors of municipalities at risk, except for the public forums, to which only a limited number of local stakeholders actually participated, even though strong efforts in addressing such issue were done by the Po River Basin Authority. Some others constraints are related to:

- lack of awareness about the conditions of risk existing in the territory.
- lack of knowledge regarding climate change and residual risk in the territory.
- high fragmentation of responsibilities.
- separation of the planning, programming and implementation of the measures.
- focus mainly on aspects of hazard and implementation of measures mainly of a structural nature.
- lack of attention to human resources.

While several challenges are identified, such as:

- The flood management plan focuses on those aspects that are almost always neglected - but which are important in order to achieve the safety objectives set by flood directive.
- Most of the measures are non-structural, organized according to five objectives.
- Meanwhile, the national policy still gives preference to the realization of defense works. In fact, over the next 7 years Italy is expected to invest EUR 7 billion in defense works, while it is not yet known what will be the investment in non-structural interventions.

In conclusion, the willingness of people and organizations to be part of a collaborative process together with a continuous and participated communication have enabled a process of learning and innovation. As results of this process, it is possible to point out how having a knowledge management system cannot be consider a *una tantum* tool but it is needed so that such sharing and managing knowledge system is included in the routine of the different organizations working within the Po River Basin. Concerning the improvement of the knowledge of risk, a broader involvement of actors should be achieved in order to react a larger community, in particular at local scale (e.g. mayors and citizens), to enrich the capacity of the entire flood management system and to better integrate flood management and civil protection systems. Although, such kind of interaction and integration between systems and knowledge have both to face a rising dilemma: consider a political view - technically and economically feasible /politically advantageous? Or a scientific view: scientifically and socially founded?

2.4. KNOW-4-DRR LL4. The Umbria Civil Protection Living Lab

2.4.1. *The Umbria Region living lab*

The Umbria Region living lab was added to the Know-4-DRR project after the start of the project. The event that made it a very relevant laboratory for the project was the flood that occurred in November 2012 in the region and that severely affected several municipalities, critical infrastructures, and economic activities. The collaboration between the Politecnico di Milano and the Umbria Region and officials of the Umbria Civil Protection was already ongoing.

The flood had become the occasion for testing and applying in a real life condition the tools that had been developed insofar for post-flood damage assessment. First on modelling flood damage using data from previous local events since October 2011. Since June 2012, the joint activity focused on the development of new, enhanced tools for assessing post-flood damage. Then a series of floods hit different towns and areas of the Region in November 2012, November 2013, February and November 2014. These events, although differing in severity and extent, in a small region of 900.000 inhabitants they provoked significant distress amongst the population and on the civil protection services. But, these same unfortunate events constituted the “fortunate” opportunity to test, refine and consolidate the tools, methods and procedures that have been developed and re-developed several times. Full events reports were produced, providing a picture of the physical features of the flood at both the regional and the local level, and of the damage to multiple sectors, including businesses, agriculture, infrastructures, and cultural heritage (Figure 1a, 1b and 1c).

Activities were partially carried out in the emergency center of the Region, but in most part implied direct surveys in the flooded zones at different times. So for example, some areas were visited and surveyed more than once and even one year after the 2012 flood to get insight about indirect damage that was impossible to assess a few days after the event.

Furthermore, a number of meetings and visits to critical facilities managing companies have been organized to involve them further in the emergency preparedness process as well as asking their contribution in the damage assessment phase, providing in exchange information systems that may be extremely helpful in reducing the time they spend on inputting data and in permitting much faster and easier updating of data. Even in a small region and with floods that even though severe in some occasions (in particular the 2012 flood) were not catastrophic, significant damage to infrastructures has been recorded.

Differently from the living lab of the Po River Basin Authority, the Umbria case has been open to a variety of stakeholders; virtually all officials of the Regional Civil Protection have been involved, different groups of volunteers have participated in the surveys and to the testing of forms and methods to survey both the flooded surface and the buildings. Volunteers are professionals with expertise in geology, architecture, engineering, planning, who participate to the civil protection activities on an ordinary basis and contribute in large earthquakes for example to compile usability forms.

To a certain extent, the laboratory has also reached the citizens who were visited by the mixed teams of volunteers, regional officers and Politecnico researchers, some more than once, and the effort became part of a video explaining the relevance of post-flood damage assessment not just to get data for improving pre-event risk modelling, but also or mainly to support sounder recovery and reconstruction decisions³.

The new purpose of the joint work between researchers of the Politecnico di Milano and the Umbria Region became to fulfil the need to combine both reconstruction and prevention by establishing a post-flood damage knowledge database. Within the living lab not only direct but also indirect effects of flood events regarding re-opening services and economic activities in the damaged area have been

³ See <http://www.memorisks.org/index.htm>

considered. The main intention of the living lab is to build with and for civil protection a model, tools and advanced technical solutions for collecting, mapping and evaluating post-flood damage.

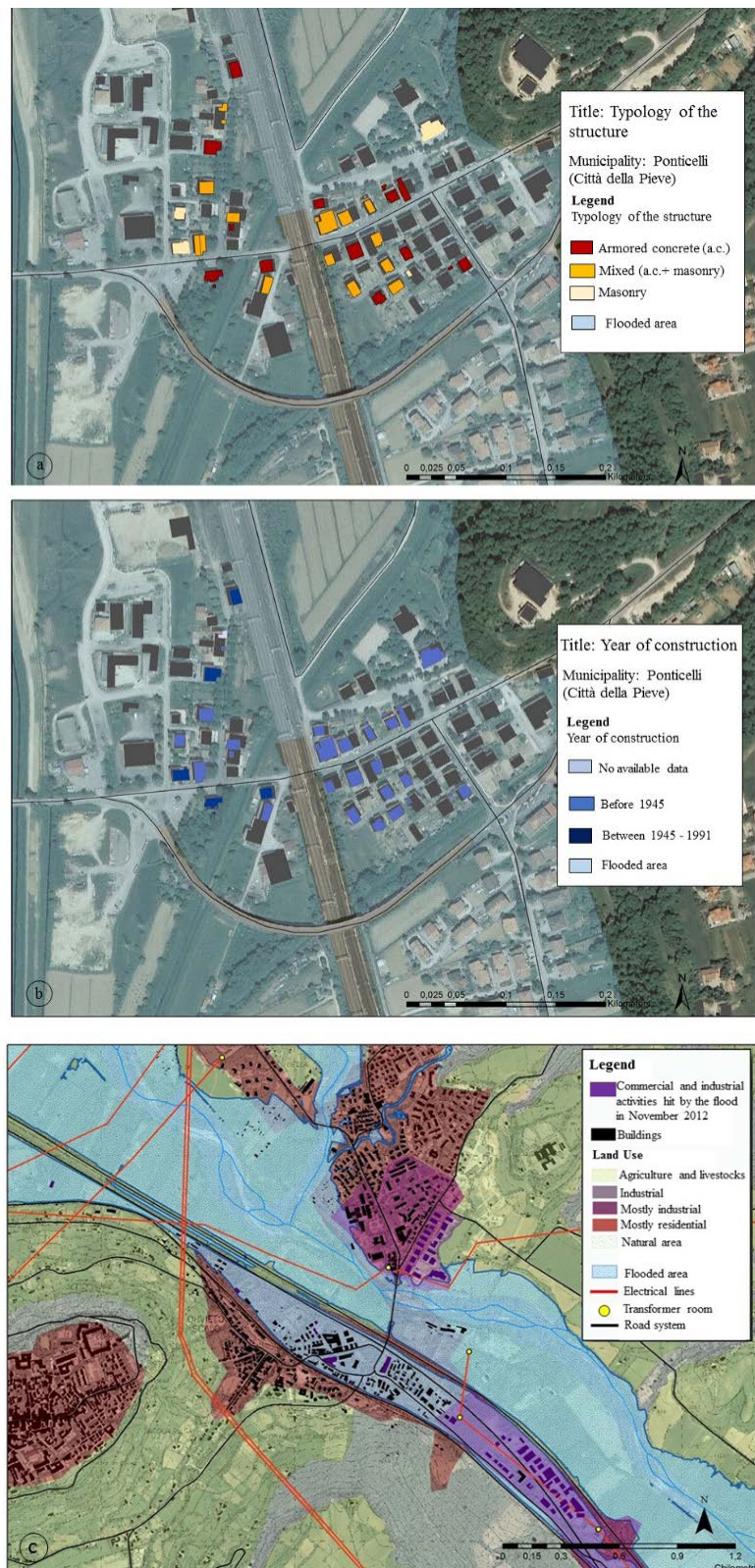


Figure 1: Features of flooded building in Città della Pieve: (a) typology of the structure, (b) year of construction; (c) electrical lines and transformation rooms, economic and industrial activities hit by the November 2012 flood in Orvieto.

The living lab has also stressed the importance of interaction, and involves authorities, Regional and Local, and disaster victims to increase risk awareness and

preparedness for future events. The experience that is carried out in the region aims on the one hand to listen and support the victims while they are trying to recover from damage, on the other hand creates the conditions to fill the information gaps that generally affect post disaster data collection. Without reliable and sufficient data, it is not possible to establish effective preventive measures.

The scientific purpose of the living lab is to build flood damage database to reduce uncertainties of current models in order to support prevention strategies by establishment of shared protocols of intervention. Most specifically, the living lab has aimed to establish a knowledge database to support the multi-disciplinary and multi-agency work needed during the different phases of an event, in order to detect and analyse the consequences of floods and hydrogeological disasters on facilities, infrastructure and assets.

After extensive work considering knowledge management systems, it is possible to say that in Umbria the Living Lab has helped establish a “community of practice” focused on post-flood damage assessment; a community of practice made by stakeholders of different kinds aiming at a common goal of developing post-flood damage data collection and analysis tools. As such, it is about multiple disciplinary expertise, about different responsibilities in the field, about the need to understand better but as well to do useful things to protect communities, make clever decisions on where and how to build and on how to prepare in case of the next flood.

In the development of a toolkit for assessment and analyses, the participants have learnt that a multi-sectorial assessment is essential to get an overall perspective of the damage and failures that contributed to these; as well, that in gathering data regional and local scales are fundamentally different, so that whilst research centers or hydrological centres tend to consider the regional scale, for damage assessment it is essential the local scale that is fundamentally important and such data has to be better connected.

This living lab represents a unique learning experience for all participants; for example even managers of critical facilities, who are generally reluctant to share information outside their company, were willing to collaborate and learned about troubles other lifeline companies may have in the same event and acknowledge the need for a common effort in an emergency where usual ways to fix failures are not likely to work.

Certainly it was for the researchers, confronted with the dynamics of real emergencies and making evident the limitation of “scientific” tools generally used for risk assessment, that focus on sectors that may not be the most relevant in real cases (for example most studies focus on residential buildings but the largest damage is often recorded in industries and especially in lifelines).

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2.4.2. Conclusions

The Umbria Region living lab is still continuing. Actually it provided a unique opportunity for a public administration also involving several volunteers and officials of different governmental levels, both municipal and provincial, from different sectors to work together with researchers and co-develop tools and understandings of how post-flood damage assessment should be carried out to respond different administrative, learning and risk management needs.

Apart from the extraordinary mutual learning experience, apart from the fact knowledge was actually developed jointly, tangible results cannot be neglected either. The latter consist in the following:

- An event report describing and analyzing the damage scenario after the November 2012 flood that was completed in January 2014;
- A procedure report that describes and details the different activities that are necessary to carry out a full and comprehensive damage assessment after flood. A first draft of this report was available in March 2014, a more complete and agreed upon version has been issued in October 2014;
- Two sets of survey forms to estimate the damage including the causes of damage, related to residential and industrial buildings were developed and applied in the events of November 2012 and November 2013.

Also the interaction between the regional officers and the researchers permitted to produce a number of joint publications that were quoted in the Final GAR 2015 General Report and in particular the following:

- Molinari, Daniela, Francesco Ballio, Nicola Berni and Claudia Pandolfo. December 2013. Towards more effective Early Warning Systems: The Italian Experience. Input Paper prepared for the 2015 Global Assessment Report on Disaster Risk Reduction. Geneva, Switzerland: UNISDR.
- Molinari, D., S. Menoni, G.T. Aronica, F. Ballio, N. Berni, C. Pandolfo, M. Stelluti and G. Minucci. 2014. Ex post damage assessment: an Italian experience. *Natural Hazards and Earth System Sciences*, Vol. 14: 901-916.

The work carried out with the Umbria Region was presented in several meetings of the DG-ECHO, and in particular to the Technical Group on Losses Data led by the JRC and more recently in a workshop of the PPRD East Project in Moldavia on the 7th of July 2015.

In a few words we can summarize the Umbria Region living lab as a successful example of how the combined work of enlightened public servants and of researchers who pay much attention also on the application side of their work and do not limit themselves to the theoretical issues to be developed in academia can be very enriching for both. It is actually a new learning experience that produced new type of knowledge, a mix of scientific, organizational and legislative knowledge considering the four typologies that are proposed in the Deliverable 3.1 on the knowledge management system.

The activity carried out in the Umbria Region living labs encompassed several scales (local/municipal, regional, national, due to the interaction with the National Civil Protection for the funding to compensate part of the damage provoked by the floods), several actors, including also stakeholders of the private sector managing lifelines and other services. It showed the very large room for improvement in the modality of implementing risk mitigation policies and proved an excellent opportunity to share knowledge at all levels.

3. Overall conclusions

Four Living Laboratories experiences, four quite different contexts - although floods are in part a common but not sole issue – but in all instances, the living labs have reflected both the findings and the outputs of the KNOW-4-DRR project.

The recognition that multi-stakeholder collaboration improves the development of knowledge for DRR and CCA, and should be encouraged (Deliverable 2.1.) is clearly reflected in the four Living Lab experiences. It is seen that the Living Lab experience changes the classic perceptions of some stakeholders, for example shifting civil society stakeholders from being passive participants to active sources of data and ideas, as is shown by the role of the Secondary School in Lorca “Ramón Arcas Meca” which has involved students and educators and also the population in Lorca in gathering opinions about the disaster events in Lorca, and which in effect, compared to previous roles reversed the usual role of researchers and academics. In Vietnam, during the Hue workshop, individuals from villages included in the Vietnam Living Lab participated not only in local surveys but joined in the subsequent workshop with representatives of ministries, services, NGO and scientists to express their opinions. In the Po River Basin Living Lab the collaborative experience with various stakeholders allowed the researchers of the Politecnico di Milano the opportunity to participate to meetings that are usually closed, to follow the implementation of a policy in its making, and above all to contribute directly in the decision making process, rather than being external observers. All stakeholders learnt and profited from this enriched exchange process. For the stakeholders in the Po River living lab this interaction permitted to better understand the research environment, enabling them to gain information and knowledge about state of the art modelling techniques, and about policies that are programmed now at the European level and examples of Flood Directive implementation in other European countries.

What is perhaps more important is that the living labs revealed opinions and facts that would not necessarily have come to light otherwise. In the Umbria living lab, the researchers came to see that that whilst most studies focused on damage to residential buildings, in reality the largest damage recorded was to industry and lifeline services with a very direct impact on the resilience of income generating capacity and the quality of life. Thus although damage to housing is undeniably important, the ability to protect and assist rapid recovery of income generating activities and services could be considered even more important with a direct impact on the ability of families to repair or restore their homes, which without income could be very difficult. In the Lorca living Lab, the population in Lorca of all ages is most concerned about earthquake risk even though statistics clearly show that the frequency and risks associated to flooding is higher. This can be seen as an emotional response to risk and one where the very unpredictable and frightening nature of the hazard is dominant in people’s feelings.

One concludes from these Living Lab experiences that the cross stakeholder collaborative nature of these experiences is both rich and is to be encouraged as good working practice to better understand perceptions of risks and measures to reduce them, and through this collaboration, to greatly facilitate the sharing and communication of information and the development of knowledge. The criticism that there is insufficiency of feedback from civil society stakeholders and the lack of learning about local and indigenous practice for risk reduction has the potential to be well addressed through the practice of Living Labs. It remains that greater participation of all stakeholder groups in such process is to be encouraged.

In at least three of the living labs, (Po River Basin, Umbria Region and the Vietnam Safer Housing experience), the living lab process is continuing and other partners in the KNOW-4-DRR project have in practice been engaged in similar processes. From this perspective the project has had a positive impact on the working practice of scientists and has demonstrated one of the ways in which better exchange of information and the development of knowledge for DRR and CCA can be achieved between stakeholders. The Living Lab experiences in effect largely mirror the KNOW-4-DRR work and

objectives reported in the Deliverable 3.1 on the development of a Knowledge Management system for the DRR and CCA arena.

The living labs approach experimented in the Know-4-drr project responds to a more general demand for innovation in the field of risk management to respond to the dissatisfaction with the growing damage and losses, and in some countries even victims, due to natural hazards despite the significant advances in scientific understanding of both hazards and vulnerabilities (White et al., 2001). Such innovation cannot be limited to technological advancement, even though recent technologies, particularly advancements in the IT sector, proved already very beneficial to overcome past problems in crisis management for example (see for example Yates and Paquette, 2011).

What is felt to be needed is also a change in the way risk governance is conceived, to overcome the limitations that Handmer correctly highlighted regarding the institutional response to hazards in Sidney in a paper dated back to 1999. Still his comments are relevant for many situations in Europe, but not only. Handmer suggests that while “new policies emphasize compliance with procedure rather than prescription of outcomes” with the idea of moving towards a “multi-objective approach”, we are still unable to shift “the orientation from events and projects to comprehensive and integrated long term programmes”. However, as suggested by Handmer, longer term programmes are needed to deeply intervene on some risk conditions whose roots are to be found in decennial wrong land use planning decisions and lack of compliance or inexistence of building codes. This was mentioned by the Head of the Po River Basin Authority, Mr. Francesco Puma, in one of the meetings. In fact, continues Handmer, “the whole state budgetary process works to reinforce sectorial planning and existing agencies boundaries”. One way to introduce change in risk governance is therefore to provide opportunities for representatives of state agencies and bureaucracies who generally work separately from each other to meet and discuss the merit of issues they are generally dealing with independently from each other, but which instead are strongly interconnected. The living labs that have been developed within and beyond the Know-4-drr project have created such an opportunity, leading in some cases to the development of what Wynne (EC, 2007) indicated as “distributed innovation, that is observed in situations where heterogeneous actors who hold complementary pieces of knowledge interact, form networks or creative communities”. The living labs of the project represent an example of innovation intended as an effort to develop institutional capacity and aptitude for resilience, in which the focus is on engaging all participating stakeholders in a process of knowledge co-creation and learning.

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