Deliverable

D8.3 Update PEDR
(Plan for Exploitation and Dissemination of Results)

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Abstract

PEDR stands for "Plan for Exploitation and Dissemination of Results" and is the master plan of RISE to maximise the demonstrable, long-term, socio-economic impact of the project and to achieve a measurable increase in the resilience of societies against the threat of future earthquakes. The PEDR enables sharing and measuring RISE outputs and deliverables through a range of exploitation, dissemination, and outreach activities targeted at different stakeholders and audiences. To this end, a set of measures, metrics, and formats has been established to promote, define, and measure the success of RISE activities. Whereas the first two PEDR reports mainly focused on quantitatively evaluating the outreach activities, the third report aims to provide an overview of RISE's impact on the scientific, societal, technological, and economic level and derive recommendations for the last phase of the project.

For quantitative measurements, the following metrics are considered: website users, Twitter followers, newsletter subscribers, publications, and the number of participants of stakeholder exchange. They are described in detail in the D8.1 PEDR (M3). The second PEDR (D8.2) deliverable is an updated version of D8.1, including brief descriptions of the individual impact of each WP with regards to science, society, technology, and the economy.

Since the last PEDR update (D8.2), RISE research activities have been advanced, and thus the impact on society, technology, science, and economy should also be increasingly measurable in qualitative terms. To this end, we closely collaborated with the project's work package leaders and task leaders to investigate the overall impact of RISE regarding science, society, technology, and economy through an online questionnaire. We defined indicators to measure the impact for each of these four pillars, covering the four priorities to reduce disaster risk described in the Sendai Framework for Disaster Risk Reduction. Therefore, in the current PEDR update (D8.3), we provide an update of the quantitative measurements and a more detailed summary of RISE's impact on technology, science, society, and economy achieved so far (qualitative measures).

Our evaluation shows that the outreach platforms of RISE (e.g., website, Twitter) are increasingly used, and the RISE community efficiently has shared and discussed its scientific developments and effort at conferences and internal meetings. Further, we illustrate that RISE is interlinked with many other European and national projects/initiatives, also ensuring the long-term sustainability of products and services developed within RISE. The disciplinary collaboration within each WP and the community outside RISE works effectively; however, the cross-WP activities could be improved in the last phase of the project. Further, in particular, WP5 has involved the end-users already in the development process of certain products and services to ensure they meet their needs. Additionally, RISE efforts contribute to preventing economic losses by facilitating rapid decision making, by increasing the efficiency of emergency intervention, by providing rapid information on building damages, and by contributing to insurance models or the establishment of seismic building codes. Moreover, various technologies are in the development phase, and the next effort will be to test and afterwards implement them.

Thanks to the three PEDR deliverables (8.1, 8.2, and 8.3), especially this last one, we are able to address potentials for improvements identified through our impact assessment with the RISE management, work package leaders and task leaders. By doing so, we can improve RISE’s impact in the last phase of RISE and ensure the long-term sustainability of the findings gained and the services and products developed within RISE.

1. Stakeholders and end-users

Exploitation and dissemination are indispensable to enable and ensure knowledge transfer. This includes interaction with industrial partners, governmental organizations, data and services providers, scientific community, general public, and media. Different communication and dissemination measures are used for different target groups. The following Table 1 indicates the relevance of different communication and dissemination measures for the main stakeholders and end-users of RISE outputs.

	INTERNAL COMMUNICATION	INFORMATION ABOUT ACCESS TO DATA & SERVICES	WORKSHOPS	SCIENTIFIC PUBLICATIONS	SCIENTIFIC SUMMARIES	PROJECT NEWS	DELIVERABLES
PROJECT PARTICIPANTS	x	x	x	x	x	x	x
EC		x		x		x	x
DATA AND SERVICE PROVIDERS		x					
GOVERNMENTAL ORGANIZATIONS		x			x		
SCIENTIFIC AND ENGINEERING COMMUNITY		x		x	x	x	
INDUSTRY		x	x		x	x	
GENERAL PUBLIC AND MEDIA		x			x	x	

Table 1. Relevance of different communication measures for main target groups of RISE

According to their needs and interest RISE develops, offers, and promotes different products and services as well as support knowledge exchange.

2. Internal communication activities

The internal communication targets project members and facilitates cooperation as well as organisation. The Alfresco intranet was established to provide a shared workspace and calendar. Another main internal communication tool is the newsletters, which are distributed four times a year. The internal newsletters intend to strengthen RISE internal communication and usually contains information related but not limited to:

- Organisational matters
- WP updates
- Section "People of WP..."
- Past and Upcoming Meetings
- Miscellaneous project information
- Calendar

So far, seven internal newsletters have been released (Figure 1). With an opening rate of 44%, the internal newsletter is read by many project members. Furthermore, all internal newsletters are accessible on the Alfresco Intranet for the project members. The next internal newsletter is planned for March 2022.

Figure 1. Screenshot of the first parts of the seven released internal newsletters

3. External communication activities

We use a number of communication tools targeted at different audiences, such as project website, external newsletter, social media (e.g. Twitter), good practice reports, special issue publications, training workshops. The following subchapters provide an update on the external communication activities and their performance.

Some of RISE's communication tools are already established (project website, newsletters, Twitter account) and regularly updated. Others such as the good practice reports, presentations and publications are ongoing tasks and steadily evolve throughout the project. A first set of three good practice reports (see milestone 61) will be available on the RISE website by the end of February 2022.

An introduction to the RISE website is given in milestone 59 (MS59 RISE website fully operational). More information on the newsletters can be found in the deliverables D8.10 (External newsletter released, M6) and D8.11 (External newsletter released, M12). A description of the good practice reports and the first three reports are available in milestone 61 (MS61: 3rd best practice report online).

3.1 RISE website

RISE website (www.rise-eu.org; Figure 2) was launched in September 2019 by WP8. It is used for sharing relevant project information, dissemination materials and linking to the internal website. In this way, the RISE website promotes visibility and transparency towards stakeholders. It contains a number of sections, including news, events, project results, reports, publications and access to deliverables. The website is regularly updated by WP8. Below is a screenshot of the current RISE homepage.

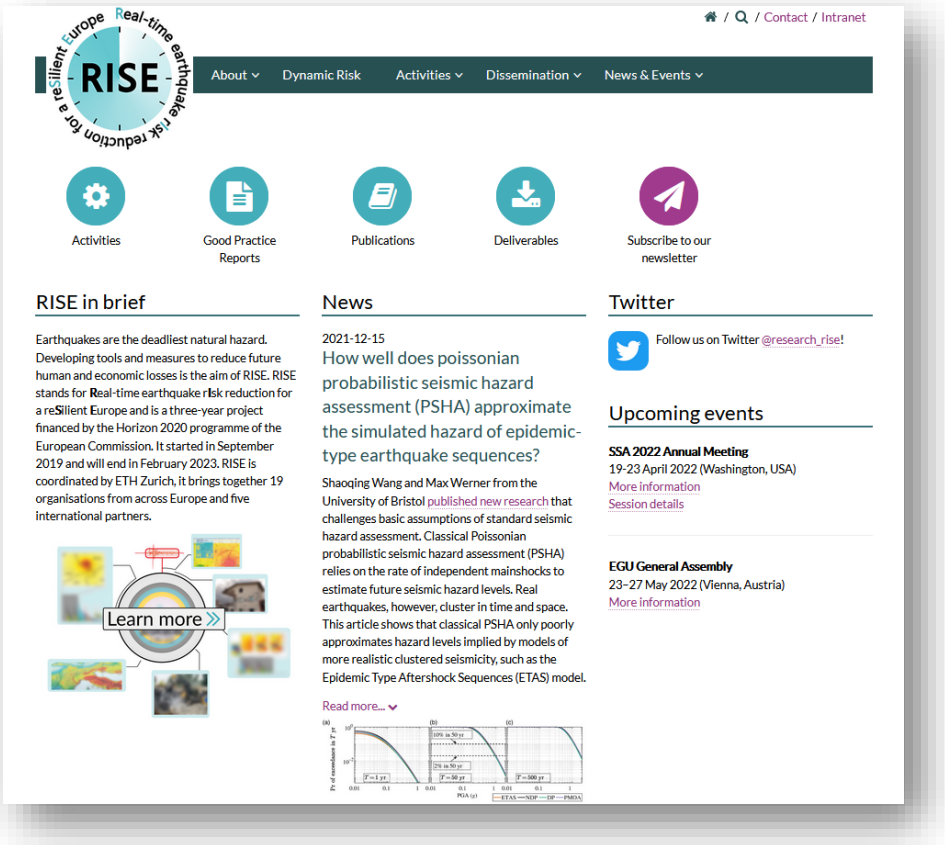


Figure 2. Screenshot of RISE Website

The number of website visitors has risen steadily since the project started. Below you will find an overview of the web statistics (Table 2).

MONTH	NUMBER OF UNIQUE WEBSITE VISITORS
SEPTEMBER 2019	130
OCTOBER 2019	110
NOVEMBER 2019	213
DECEMBER 2019	185
JANUARY 2020	225
FEBRUARY 2020	401
MARCH 2020	378
APRIL 2020	443
MAY 2020	495
JUNE 2020	397
JULY 2020	477
AUGUST 2020	381
SEPTEMBER 2020	474
OCTOBER 2020	471
NOVEMBER 2020	448
DECEMBER 2020	503
JANUARY 2021	878
FEBRUARY 2021	679
MARCH 2021	701
APRIL 2021	770
MAY 2021	659
JUNE 2021	547
JULY 2021	540
AUGUST 2021	518
SEPTEMBER 2021	586
OCTOBER 2021	737
NOVEMBER 2021	656
DECEMBER 2021	708
JANUARY 2022	678
TOTAL	14’370

Table 2. Web statistic RISE website

3.2 RISE Twitter account

Additionally, we created a Twitter account to share project updates, interesting news, available open positions, etc. RISE Twitter account is @research_RISE. The RISE communications team maintains both the website and the Twitter account, gathers the relevant information, and publishes them. Currently[1], we can count about 270 followers on the RISE Twitter account. Until now, 229 tweets (incl. retweets) have been published.

[1] Numbers retrieved on 10 February 2022

The number of "impressions" provided by Twitter indicates how many times users saw a tweet on Twitter. Figure 3 displays the number of impressions for each tweet (tweets and quote tweets).

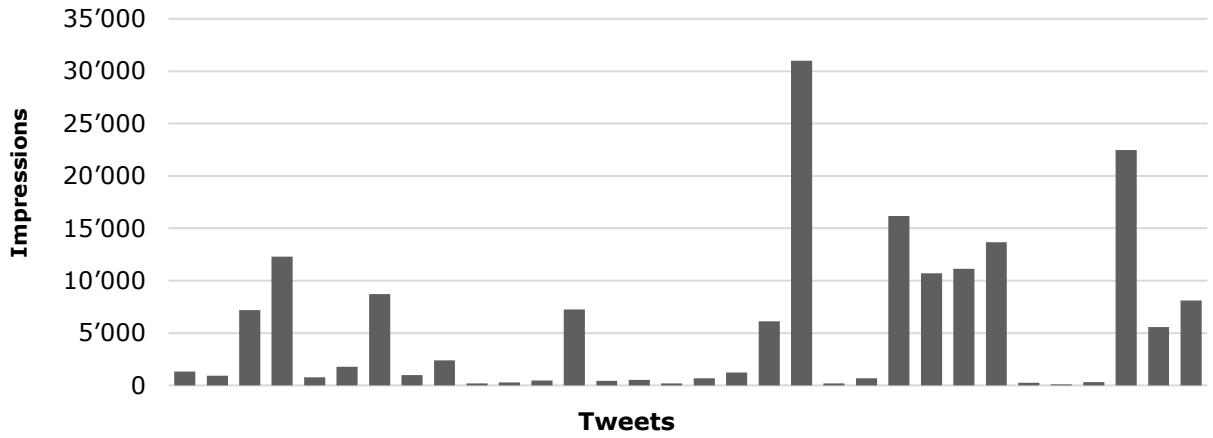


Figure 3. Tweet impressions per tweet and quoted tweet. Impressions are the number of times users saw one of our (quoted) tweets on Twitter.

The two most successful tweets are so-called "quoted tweets". A quote tweet is a retweet with an added comment from us. It is an excellent opportunity to share content from other users, such as other RISE members, while supporting them and using the content for our channel. Therefore, we can exploit synergies and reach a wider audience since the user of the original tweet usually retweets our quoted tweet. Other topics that gain the most interest are tweets or quoted tweets about conferences or other events, as can be seen in Table 3 of the top five RISE tweets so far..

TWEET / QUOTED RETWEET	NUMBER OF IMPRESSIONS
RISE - for a resilient Europe @research_RISE Have a look at @EuTurnkey 's latest newsletter and the interesting article about dynamic seismic risk communication @LastQuake ! It's also published on our website: rise-eu.org/news-and-event... TURNkey Project @EuTurnkey · Feb 2, 2021 Our 6th newsletter is out! This time we collaborated with @research_RISE (see @LastQuake's contribution)... and @BRGM_fr tells more about rapid updating of loss estimates following an earthquake. Enjoy! #earthquake #response #SeismicRisk #H2020 mailchi.mp/156d7f0a2963/t...	31,069
RISE - for a resilient Europe @research_RISE Have a look at this new research paper about the smartphone-based public earthquake early warning system "Earthquake Network" @SismoDetector ! Laure Fallou @L_Fallou · Sep 30, 2021 Can you beleive your smartphone can warn you about an earthquake BEFORE you actually feel it ? We tell you all about it in our new research paper: pubs.geoscienceworld.org/ssa/srl/articl... Show this thread RESEARCH ARTICLE | SEPTEMBER 29, 2021 "Shaking in 5 Seconds!"—Performance and User Appreciation Assessment of the Earthquake Network Smartphone-Based Public Earthquake Early Warning System Rémy Bossu; Francesco Finazzi; Robert Steed; Laure Fallou; István Bondár Seismological Research Letters (2021) https://doi.org/10.1785/0220210180 Article history Cite Share Tools	22,534

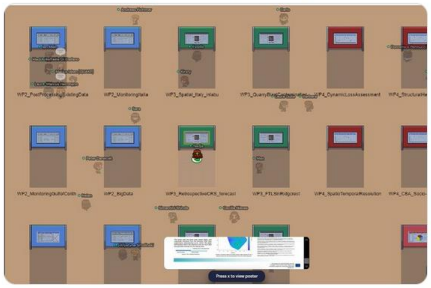
RISE - for a resilient Europe @research_RISE ⏰Don't miss today's #vEGU21 session "Science to Action: Communication of Science and strategies to fight #misinformation - Practice, Research and Reflection?" ⬇️ meetingorganizer.copernicus.org/EGU21/session/... Laure Fallou @L_Fallou · Apr 26, 2021 Last week at #vEGU21 we heard a lot about #misinformation and it seemed to be a real concern for many of us. We'll be tackling this issue in the second part of our #sciCom session 😎 so come and join us! 📅Tue, 27 Apr, 13:30–15:00 (CEST) meetingorganizer.copernicus.org/EGU21/session/... Show this thread  	16,180
RISE - for a resilient Europe @research_RISE It was a successful first half-day of the @research_RISE mid-term #conference! Besides joint work package meetings, there were poster sessions & enough time for coffee breaks – a lot of fun included! Thanks @EuTurnkey for joining us today! 	13,835
RISE - for a resilient Europe @research_RISE The last day of the RISE kick-off meeting provided again fascinating insights into related projects and provoked many lively discussions. Thank you to everyone who contributed during the last three days! We are looking forward to the collaboration! 	12,294

Table 3. Most successful tweets or quoted retweets according to the number of impressions.

3.3 RISE external newsletters

RISE external newsletters target all interested stakeholders and aim at communicating project updates and progress. They cover information on WPs, meetings, event invitations, and any miscellaneous topics that RISE community wants to share with the public. Each issue deals with a different research topic addressed within RISE and shares information suitable for non-expert readers. An external newsletter is published once a year during RISE project by WP8. So far, three external newsletters have been sent out to the newsletter subscribers.

All external newsletters can be found on the RISE website: http://rise-eu.org/dissemination/newsletter/. Since the beginning of RISE, the number of subscribers has been continuously increased (see Table 4). On average, 54% of the recipients opened the newsletters, which is a relatively high opening rate.

NEWSLETTER ISSUE	NUMBER OF SUBSCRIBERS	OPENING RATE
EXTERNAL NEWSLETTER #1	129	55.9%
EXTERNAL NEWSLETTER #2	150	66.2%
EXTERNAL NEWSLETTER #3	216	45.5%

Table 4. Number of subscribers and opening rate for each RISE external newsletter

3.4 Good practices

RISE has to compile a series of at least five good practice reports. Each good practice report will undergo an internal peer review. The reports will be written with an end-user perspective in mind. In addition, brief informative documentations of good practices are available on the RISE website provide access to the specific reports and publications for further reading. Currently, the following three good practices are published:

- How can we fight earthquake misinformation? A Communication Guide
- New developments in physics and statistics based earthquake forecasting
- European rapid loss assessment

3.5 Publications

Publications in high-quality peer-reviewed international journals or conference proceedings remain a major output of RISE that will have a lasting impact on the physical sciences, engineering and social science communities. RISE brings together many of the most productive and most-cited scientists in their respective domains, and we anticipate that no less than 100 publications will result from the RISE activities. Until M30, more than 40 publications have been released. An up-to-date list of publication is available on the RISE website[2] and on Zenodo[3]:

- Bayliss, K., Naylor, M., Illian, J., and Main, I. (2020), "Data-Driven Optimization of Seismicity Models Using Diverse Data Sets: Generation, Evaluation, and Ranking Using Inlabru", JGR Solid Earth (125), doi: 10.1029/2020JB020226
- Bayona, J.A., Savran, W.H., Rhoades, D.A. and Werner, M.J. (2022). "Prospective evaluation of multiplicative hybrid earthquake forecasting models in California". Geophysical Journal International. doi: https://doi.org/10.1093/gji/ggac018
- Bodenmann, L., Reuland Y. & Stojadinovic, B. (2021, March 24) "Using regional earthquake risk models as priors to dynamically assess the impact on residential buildings after an event" 1st Croatian Conference on Earthquake Engineering (2021) (CroCEE), Zagreb, Croatia. doi: https://doi.org/10.5592/CO/1CroCEE.2021.71

[2] http://rise-eu.org/dissemination/publications/

[3] https://zenodo.org/communities/rise-h2020/?page=1&size=20

- Bondár, I., Steed, R., Roch, J., Bossu, R., Heinloo, A., Saul, J., and Strollo, A. (2020), "Accurate locations of felt earthquakes using crowdsource detections", Front. Earth Sci., 8, 272, doi: 10.3389/feart.2020.00272
- Bossu, R., Fallou, L., Landès, M., Roussel, F., Julien-Laferrière, S., Roch, J. and Robert Steed. (2020), "Rapid Public Information and Situational Awareness After the November 26, 2019, Albania Earthquake: Lessons Learned from the LastQuake System", Front. Earth Sci., doi: 10.3389/feart.2020.00235
- Bossu, R., Finazzi, F., Steed, R., Fallou, L., Bondár, I. (2021) "'Shaking in 5 seconds!' Performance and user appreciation assessment of the earthquake network smartphone-based public earthquake early warning" system. Seismological Research Letters; https://doi.org/10.1785/0220210180
- Böse, M., Julien-Laferrière, S., Bossu, R. & Massin, F. (2021) "Near Real-Time Earthquake Line-Source Models Derived from Felt Reports". Seismological Research Letters 2021; 92 (3): 1961–1978. doi: https://doi.org/10.1785/0220200244
- Chioccarelli, E. and Iervolino, I. (2021) "Comparing Short-Term Seismic and COVID-19 Fatality Risks in Italy". Seismological Research Letters; doi: https://doi.org/10.1785/0220200368
- Crowley, H., Despotaki, V., Silva, V. et al. (2021) "Model of seismic design lateral force levels for the existing reinforced concrete European building stock". Bull Earthquake Eng 19, 2839–2865. https://doi.org/10.1007/s10518-021-01083-3
- Crowley, H., Silva, V., Kalakonas, P., Martins, L., Weatherill, G., Pitilakis, K., Riga, E., Borzi, B., Faravelli, M. (2020), "Verification of the European Seismic Risk Model (ESRM20)", 17WCEE Conference paper.
- Dabbeek, J., Crowley, H., Silva, V. et al. (2021) "Impact of exposure spatial resolution on seismic loss estimates in regional portfolios". Bull Earthquake Eng. https://doi.org/10.1007/s10518-021-01194-x
- Dallo, I., Marti, M. (2021) "Why should I use a multi-hazard app? Assessing the public's information needs and app feature preferences in a participatory process". International Journal of Disaster Risk Reduction 2021, 57, 102197; https://doi.org/10.1016/j.ijdrr.2021.102197
- Dallo, I., Stauffacher, M. and Marti, M. (2020), "What defines the success of of maps and additional information on a multi-hazard platform?", International Journal of Disaster Risk Reduction, Volume 49, doi: 10.1016/j.ijdrr.2020.101761
- Falcone, G., Spassiani I., Ashkenazy Y., Shapira A., Hofstetter R., Havlin S., Marzocchi W. (2021) "An Operational Earthquake Forecasting Experiment for Israel: Preliminary Results". Frontiers in Earth Science, 9; doi: 10.3389/feart.2021.729282
- Finazzi, F. (2020), "The Earthquake Network Project: A Platform for Earthquake Early Warning, Rapid Impact Assessment, and Search and Rescue", Front. Earth Sci., 8, 243, doi: 10.3389/feart.2020.00243
- Fallou, L., Bossu, R., Landès, M., Roch, J., Roussel, F. and Steed, R. (2020), "Citizen Seismology Without Seismologists? Lessons Learned From Mayotte Leading to Improved Collaboration", Frontiers in Communication, Volume 5, doi: 10.3389/fcomm.2020.00049
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- Gulia, L., Gasperini, P. (2021) "Contamination of Frequency–Magnitude Slope (b-Value) by Quarry Blasts: An Example for Italy". Seismological Research Letters; doi: https://doi.org/10.1785/0220210080

- Gulia, L., Wiemer, S. and Vannucci, G. (2020), "Pseudoprospective Evaluation of the Foreshock Traffic-Light System in Ridgecrest and Implications for Aftershock Hazard Assessment", Seismological Research Letters, doi:10.1785/0220190307
- Herrmann, M. and W. Marzocchi (2020). "Inconsistencies and Lurking Pitfalls in the Magnitude–Frequency Distribution of High-Resolution Earthquake Catalogs". Seismological Research Letters 92(2A). doi: 10.1785/0220200337
- Iervolino, I., Chioccarelli, E., Suzuki, A. (2020), "Seismic damage accumulation in multiple mainshock–aftershock sequences", Earthquake Engng Struct Dyn. 2020; 49:1007–1027. doi: 10.1002/eqe.3275
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- Martakis, P., Reuland, Y., Ntertimanis, V. & Chatzi, Eleni. (2020, October 7). "Vibration monitoring of an existing Masonry Building under Demolition." International Association for Bridge and Structural Engineering Symposium: Synergy of Culture and Civil Engineering – History and Challenges (IABSE 2020), Wrocław, Poland. doi: https://doi.org/10.3929/ethz-b-000384072
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3.6 Overview of the main external communication activities

In Table 5, we provide an overview of the responsibility, task, function, target groups, success factors and tools for each external communication activity.

RISE website www.rise-eu.org	
Responsibility	ETH Zurich
Task	Setup and updates of website www.rise-eu.org. The website is the main external communication tool of RISE.
Function	Access to project information, current developments and achievements, contact and other useful information
Target groups	Everyone
Success factor	Website traffic, number of page views, document downloads, and feedback received
Tool	OpenCMS

External newsletter	
Responsibility	ETH Zurich
Task	Regularly distribution (month 3, 12, 24, 36) of an external newsletter: create template, plan content, edit newsletter
Function	Provide deeper insights to the project (compared to news on the website), spread knowledge, inform about achievements of RISE
Target groups	EC, data and service providers, governmental organizations, scientific and engineering community, industry, interested public.
Success factor	Growing of mailing list, opening and click rate, feedback
Tool	Mailchimp

Social media	
Responsibility	ETH Zurich
Task	Post project news and relevant information about related projects (e.g. conferences). Minimum: liking and retweeting updates once a week. Follow accounts from partners and related projects
Function	Visibility; inform when RISE participants give talks in conferences, publish a paper, or had a successful collaboration
Target groups	Data and service providers, governmental organizations, scientific and engineering community, industry
Success factor	Followers, frequency of posts
Tool	Twitter

Good practice reports	
Responsibility	ETH Zurich
Task	Editing and designing good practice guidelines, coordinating best practice reports At least five good practice reports will be compiled based on RISE deliverables and be made available to browse and download on the RISE and EFEHR websites. The best practice reports will be updated and continued even after the project as part of EPOS.
Function	Visibility, provide access to preliminary results
Target groups	Governmental organizations, scientific and engineering community
Success factor	Number of publications
Tool	Word template

Training workshops	
Responsibility	ETH Zurich
Task	Offering three training workshops to selected groups of stakeholders: • **Young scientists in interdisciplinary and dynamic risk assessment**: 3-day workshop presenting introductions to the methodologies and tools. Hosted in the form of a summer or winter school • **End-users**: two-day workshop focused on good practice for end-users from governmental and regulatory agencies, including civil defence offices and national services from around Europe. The focus will be to introduce capabilities and limitations of real-time earthquake risk assessment as a tool for more resilient societies • **Industry**: A one-day workshop focused on exploitation of business opportunities and applications with users from industry. This includes hardware/sensor manufacturers, software and app developers, and insurance companies.
Function	Visibility
Target groups	Scientific and engineering community
Success factor	Number of workshops, number of participants

Presentations at conferences	
Responsibility	ETH Zurich, all
Task	Connect with scientists from other fields; dissemination of scientific results
Function	Visibility
Target groups	Scientific and engineering community
Success factor	Increased collaboration, growing newsletter mailing list

Special issue	
Responsibility	ETH Zurich
Task	Towards the end of the project, a special issue will be created in a journal (to be determined) to demonstrate and summarize all of the project's results and progress. The special issue could either be a full RISE-only issue or an issue dedicated to a RISE-related topic where we provide inputs from each work package.
Function	Provide information to all relevant stakeholder, visibility
Success factor	Number of contributions, depending on journal: number of reads
Target groups	Scientific and engineering community

Final conference	
Responsibility	ETH Zurich
Task	Organise the final conference, designed as a public 2.5-day workshop in the tradition of other acclaimed workshops previously organised by the coordinator of RISE. We will bring together about 170 of the leaders from around the world in the domain of real-time risk assessment for an exchange of the state-of-the-art and future directions.
Function	Visibility, provide access to results
Target groups	EC, governmental organizations, scientific and engineering community, industry
Success factor	Number of participants, number of presentations

Table 5. Overview external communication activities

4. RISE products and services

RISE develops, establishes, and provides numerous products and services. To unfold their potential, these products and services need to be relevant for interested stakeholders and advertised within those communities. The latter is ensured in the form of different external communication measures and activities described previously.

The following products and services will be made available until the end of the project (Table 6). Each of these achievements will be documented in a dedicated milestone or deliverable.

	Short description of products and services provided by RISE	**Relevant milestones and deliverables**
OEF output format testing capabilities	OEF testing capabilities already exist (CSEP 1); operation capabilities are under development (RT-RAMSIS). Input and output parameters and formats will be homogenized, extended, implemented in the respective platforms, and documented for model contributors.	MS 22: OEF output format for testing 8.7: EU forecast testing centre operational
Description of standards for dynamic risk services	A whitepaper will be collaboratively designed describing preferred technical and outreach solutions.	MS 56: Community agreement on requirements and technical baseline for dynamic risk service standardisation D. 8.4: Description of standards for dynamic risk services MS 57: First version of standardised exchange protocol released
Harmonized platform for OEF forecasts and ensemble models	This task brings together the achievements made in other RISE work packages namely WP3 and WP6. It builds on the different preceding milestones. Suggested to extend the currently developed RT-RAMSIS platform for time-dependent induced seismicity to time-dependent natural seismicity	D 8.6: Harmonised platform for OEF forecasts and ensemble models
RLA software; including operational setup for Europe	Integration of Shakemap (extended for probabilistic path effects) with OpenQuake Risk stage.	D 8.8: EU RLA service operational
Establishing operational capability of services	Ensuring operational service for the EU forecasting centre, RLA, and OEF. This sets the basis for being able to establish dynamic risk services within EPOS and in Italy and Switzerland.	MS 18: Finalisation of the whitepaper and selection of the preferred technical solutions D 8.5: Report on the sustainable operation of dynamic risk services within EPOS
OEF infrastructure and services set up for Switzerland and Italy	Operative set-up of the " Harmonized platform for OEF forecasts and ensemble models", amended with public displays for the results, and (to be decided) threshold based alerting	D. 8.9: OEF services in Italy, Switzerland and Europe wide operational
Operational dynamic risk services in Italy and Switzerland	In each of these countries, a dynamic risk service has to be made available until the end of the project.	MS 43: Dynamic risk services for Switzerland operational

Table 6. RISE products and services

5. Stakeholder panels

The knowledge generated as well as the products and services developed within RISE are only useful and successful when they meet future end-users needs. We aim at translating RISE outputs and deliverables into tangible products and services, useful for and used by a wide range of stakeholders. While the external communication activities mainly focus on informing the RISE community, our stakeholders and end-users; the stakeholder panel aims at establishing a dialogue with exponents of these communities.

The following steps have been taken so far:

- Italian Civil Protection Agency is contacted by WP3 leader, Warner Marzocchi.
  The Italian Civil Protection Agency responded positively to the invitation and they are keen to take part in RISE Stakeholder Panel.
- ARISTOTLE-ENHSP is contacted by the WP6 leader Helen Crowley.
  Alberto Michelini from ARISTOTLE-ENHSP will represent the interests of ERCC (Emergency Response Coordination Centre) They agreed on their participation in RISE SP.
- Guy Carpenter (reinsurance brokerage company) has been contacted by Helen Crowley. They agreed on their participation.
- Disaster Risk Management Knowledge Centre (DRMKC) is contacted and JRC (Joint Research Centre) is invited. They agreed on their participation.
- Cantonal Civil Defence, Basel had been contacted by Stefan Wiemer for participating in the SP and he confirmed their participation.

Although we have some delays due to Covid-19, we are working on expanding the SP by contacting more institutions. A subgroup of the Stakeholder Panel will form the National Swiss Stakeholder Board.

The format of all stakeholder panels will be a workshop, where the different products and services developed within RISE will be presented and discussed. Besides technical aspects, social acceptance and communications will be in the focus of the dialogue. Therefore, RISE will make use of its interdisciplinary capabilities to organize and conduct these workshops.

6. Quantitative key performances indicators

In order to define the impact of RISE in a quantitative way, different key performance indicators are assessed (Table 7). A suitable metric highlights a specific project contribution. In combination, the metrics chosen shall reflect the project's impact on its entity. In the following, these metrics as well as targeted impact goals to be reached until M12, M24, and M36 are listed as well as the current numbers of M30.

Key performance indicator(s)	**Quantitative goal**	**M6**	**M12**	**M30**
Number of unique website visitors	Monthly average: 500 M12: 6'000 total unique visitors M24: 12'000 total unique visitors M36: 18'000 total unique visitors	Average: 211 Total: 892	Average: 320 Total: 3'835	Average: 489 Total: 14'370
Number of Twitter followers	M12: 100 followers M24: 250 followers M36: 300 followers	74 followers (12.02.2020)	161 followers (28.08.2020	274 followers (10.02.2022)
Number of external newsletter subscribers	M12: 100 subscribers M24: 200 subscribers M36: 250 subscribers	92	149	230
Number of publications in scientific journals	M12: 20 publications M24: 30 publications M36: 100 publications	0	13	43
Participants of stakeholder exchange	Until M36: Workshops: 3 Presentations: 50 Other exchange opportunities: 5	0	0	Presentations: 33

Table 7. Overview key performance indicators

6.1 Conclusion

As can be seen in Table 7, all KPI's have been increased by M30 of the project. In particular, the number of website visitors is on a higher level than at the beginning of the project. However, regular updates, additional news items and the publication of further good practice reports should continue and will help to further increase these numbers and thus reach more stakeholders.

Special attention must be paid to increase the number of newsletter subscribers in the next months, as this is usually a challenging undertaking.

7. Qualitative key performance indicators

To maximise the impact of RISE, WP8 focuses on securing a broad impact on various levels. Beside the quantitative indicators to assess the outreach on the RISE communication activities and channels (chapter 6), we developed a framework with four pillars to measure the technological, scientific, social and economic impact of RISE. For each pillar *Science*, *Society*, *Technology* and *Economy,* we defined several indicators that measure the specific impacts. These indicators cover the four priorities defined by the Sendai Framework for disaster risk reduction (UNISDR, 2015; Wahlström, 2015):

1) Understanding disaster risk
2) Strengthening disaster risk governance to manage disaster risk
3) Investing in disaster risk reduction for resilience
4) Enhancing disaster preparedness for effective response

For example, we assessed the improvement of existing models or development of new assets/technologies for a better understanding of seismic hazard and risk (priority 1), the contribution to standards, regulations, and policies (priority 2), the efforts to minimise economic losses and fatalities (priority 3), and the extent of interactions between the scientific community and the society (priority 4). Further, we evaluated whether ethical issues are considered by the RISE communities (Di Capua & Peppoloni, 2021) and whether transdisciplinary efforts are applied to ensure the development of user-centred products and services (Dallo, 2022; Pohl et al., 2021). Additionally, since RISE aims at adopting an interdisciplinary and multi-hazard users' perspective, we evaluated the cross-disciplinary collaboration within the RISE community and the outside community. This assessment allowed us to identify if supporting activities are needed to improve RISE's impacts and to evaluate how to address existing barriers for communication and exploitation (see chapter 8).

Data was collected through an online questionnaire filled in by RISE WP leaders and task leaders (see chapter 7.2).

7.1 Methodological procedure

In Figure 4, we provide an overview of the indicators we assessed within each of the four pillars. In the pillar *Science*, we evaluated the efficiency and extent of (cross-disciplinary) collaboration within and outside RISE. Further, we assessed the spatial impact, the level of innovation and relevance of the RISE research activities, the already applied outreach activities and the importance of ethical issues. In the pillar *Society*, we captured which societal relevant assets (=products, services, tools etc.) are developed within RISE and which stakeholders of society benefit from them and to which extent. Further, we assessed which channels and activities are used to collaborate with these stakeholders (e.g. transdisciplinary efforts) and whether the RISE research activities also contribute to the development or definition of policies. In the pillar *Technology*, we collected which types of technologies (=software, applications, models, sensors, other technological devices etc.) have been developed within RISE. Further, we assessed who the main end-users are and how they benefit from these technologies. Additionally, we evaluated whether the technologies comply with specific standards and are (commercially) accessible. In the pillar *Economy*, we capture the activities which are calculating cost-benefit analyses, whether the long-term financial sustainability is guaranteed, and to which extent RISE contributes to the prevention of economic losses.

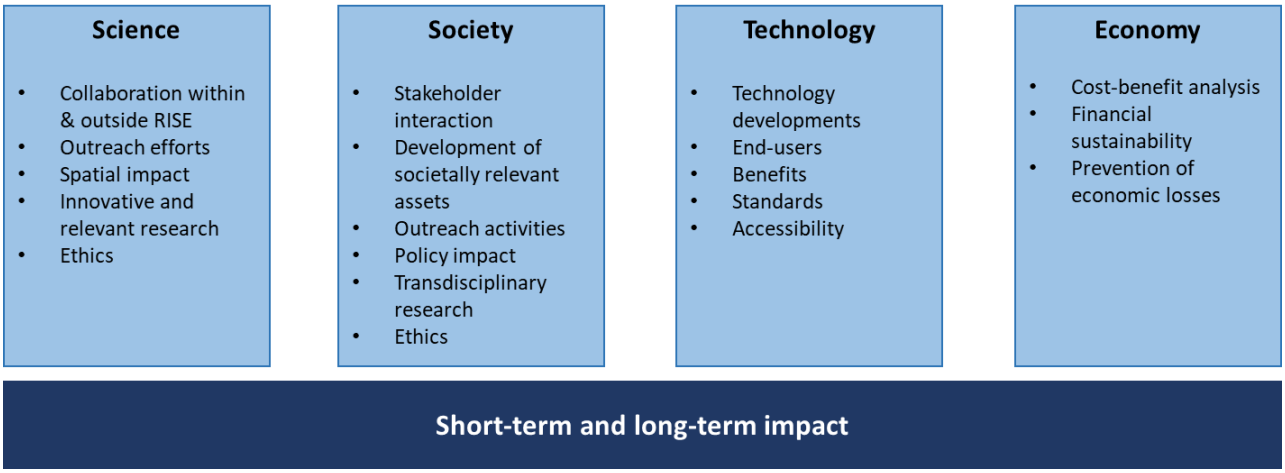


Figure 4. Overview of the indicators within each pillar to increase short- and long-term impact

7.2 The survey

The survey consisted of five question blocks (QB), whereas QB1 assessed which work packages and tasks the responders represented. In QB2 to QB4, we then assessed the indicators of the four pillars introduced in the section before. Thereby, we adapted the ethics questions from the survey conducted by Di Capua and Peppoloni in the context of the project EPOS (Di Capua & Peppoloni, 2021). The entire survey with all questions is listed in Appendix A1.

We conducted the online survey from January 19 to February 8, 2022. The survey was programmed in Unipark and pre-tested to improve the questions' clarity and technical functionalities. The data was then descriptively analysed with SPPS. In total, 19 representatives of the RISE project filled in the survey. **Table 8** provides an overview of the responses per work package (WP). All WP leaders have filled in the survey. In addition, several task leaders answered the questionnaire to provide more details about the impact of certain assets and technologies developed in the context of RISE.

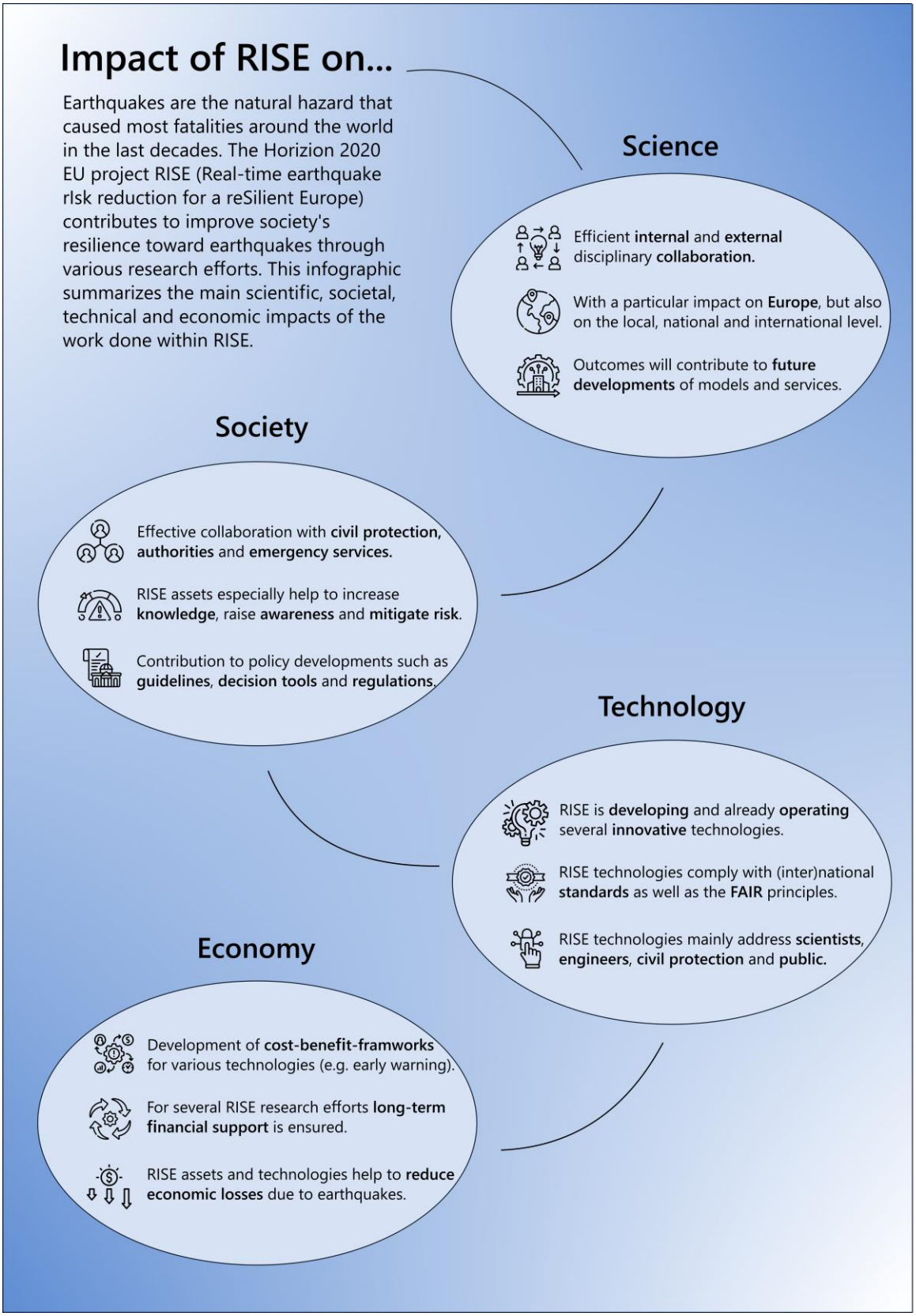
	WP1	WP2	WP3	WP4	WP5	WP6	WP7	WP8
# of responders	1	4	3	7	3	5	3	2
Tasks		2.2 2.4 2.6 2.7	3.1	4.1 4.3 4.4 4.6	5.1 5.2 5.3	6.1 6.5	7.1 7.2 7.3 7.4	8.1 8.4

Table 8: Overview of the number of responses per work package (WP)

7.3 Results and discussion

The infographic in chapter 7.4.1 shows the main impacts of the RISE efforts. Chapter 7.4.2 summarised the results per pillar and provided recommendations for the second phase of the RISE project to improve its impacts. And in sections 7.4.3 to 7.4.6, we provide the detailed results.

7.3.1 Main insights in a nutshell



7.3.2 Summary of the main results and recommendations

In the following boxes, we summarised the main insights for each of the four pillars – *Science, Society, Technology* and *Economy* –, and further provide recommendations for the last phase of the RISE project.

Science
Collaboration within the RISE community • Within the different work packages, the collaboration between the scientists is efficient. • Cross-disciplinary research efforts help the RISE community to grasp the complexity of their research issues. **Collaboration with the scientific community outside RISE** • The RISE community mainly collaborates with other scientists from their institutions/universities coming from the same discipline. • Some also collaborate with scientists from other institutions/universities in Europe as well as outside of Europe and scientists from other disciplines. • About half of the scientists who are reached outside the RISE community are students and early career scientists. **Outreach activities** • The main scientific outreach activities of the RISE community are peer-reviewed publications and presentations at conferences, followed by webinars/seminars for early career scientists and institution-internal presentations. In comparison, scientific blog posts or discourses on social media are less often used for outreach. **Spatial impact** • RISE research efforts have an impact mainly on the European level, but also on an international, national and regional level. **Innovative and relevant research** • The findings gained within RISE will/ can be used for future research in other (EU) projects and a basis for future activities in the specific disciplines. • The RISE findings help improve existing models and assets and, thus, leverage the disciplines' knowledge and expertise. • The institutions and universities involved in the RISE project benefit from the findings of the RISE project and will continue working on these efforts after the end of the project. **Ethics** • The majority of the RISE community thinks that ethics is important in research in general as well as for the RISE management and activities. However, within each work package and task the perceived importance differs. • In the context of the work done in RISE, ethical issues (e.g., conflicts of interest, data abuse, GDPR) especially emerge with respect to commercialization and communicating of scientific results to society. In comparison, the responders think that data gathering, analysis, sharing and use are less critical with regard to ethical implications. All results and corresponding data is provided in sections 7.4.3.
Recommendations actions for the last phase of the project • Increase the (cross-disciplinary) collaboration between the different work packages and tasks. • Increase the scientific outreach through sharing the results also via newsletter articles, blog posts and social media presence.

- Offer an ethical workshop to increase researchers' awareness regarding possible implications during the following phases: data gathering, analysis, sharing and use.

Society

Stakeholder interaction

- The national/local civil protection agencies, authorities and emergency services benefit most from the RISE research efforts, followed by the public and insurances. The media is only involved for specific efforts such as the public release of the first open-access European Seismic Risk Model.
- The extent of collaboration with the professional stakeholders of society and the public differs highly between the different work packages. WP5, for example, has a strong emphasis on involving stakeholders of the society to make sure that the developed products fulfil the end-users' needs.
- The RISE community collaborates most with the national/local civil protection agencies, followed by authorities and emergency services, the public, industry and insurances.

Development of societal relevant assets

- Nine WP and task leader representatives indicated to provide assets (e.g., real time earthquake information services) that are or will be of direct use for the professional stakeholders of society and the public.
- These assets are mainly in the development stage "data collection/designing/developing" followed by "testing", "implementation" and "operationalisation/demonstration".
- The assets contribute most to the dimension of the disaster cycle "preparedness", followed by "mitigation", "emergency intervention", and "recovery and reconstruction".

Benefits for stakeholders of society

- Regarding the direct benefits, the work done within RISE contributes most to increase knowledge, raise awareness, mitigate risk and to a slightly lower extent to help reduce personal risks.
- Regarding the indirect benefits, three examples are: enhancing confidence of the stakeholders on the tools, establishing trustworthy communication between the seismological community and the professional stakeholders of society and the public, and training the next generation.

Outreach activities to communicate scientific knowledge

- All work packages do invest in passing on scientific knowledge to society. Especially, work packages 5 and 8 since they are responsible for the design of communication products for the society and the internal and external communication of RISE.
- The highest effort is put into assuring the timely production of reliable scientific information, followed by promoting/sustaining credibility and trust, investing in understandable and accessible information and fostering completeness, clarity and accessibility of information.
- Mainly websites are used to share and communicate RISE outcomes with the stakeholders of society, followed by public presentations, seminars and town halls. Further, training courses, social media and community events are used by some of the RISE community members to pass on their assets to the society.

Policy impact

- RISE contributes to several policy products. The highest contributions are with regard to decision support tools, guidelines, disaster management plans and mitigation strategies. RISE activities further contribute/provide input to regulations and standards (e.g., Eurocode).

Transdisciplinary research

- The RISE community puts much effort into tailoring their assets to the needs of different stakeholders. To this end, the researchers mainly draw on their own professional expertise and experiences. Further, they collaborate with social scientists and take into account relevant publications. Additionally, some also involve the stakeholders in the development process and have regularly exchanged with them.

Ethics

- The RISE community agrees that we, as scientists, should do more to share our hazard and risk knowledge with the society. This should be primary done via national authorities.
- Some would like to improve their skills to share their research more effectively with the society.
- Some of the RISE community's efforts also address the needs of vulnerable societal groups.

All results and corresponding data is provided in section 7.4.4.

Recommendations actions for the last phase of the project

- Continue the efforts that are already on-going.
- Evaluate whether public and medial outreach should and could be increased.
- Investigate in more transdisciplinary research (e.g., stakeholder workshops).
- Offer a training workshop to improve researchers' expertise and skills to share scientific findings with stakeholder of society.

Technology

Development of (innovative) technologies

- Nine responders indicated that they are developing technologies (e.g., public early warning system, monitoring applied on buildings, dynamic risk services, open access data and models). The majority of these technologies is in the conceptualisation phase, followed by the development phase, testing phase, implementation phase and operation phase.
- Those that are already in the implementation and operation phase are recording their effectiveness (e.g. number of access, number of sensors installed in buildings).

End-users

- The main end-users of these technologies are scientists, engineers and specific stakeholders (e.g. civil protection). Further, some technologies are also used by data analysts in the financial sectors, industry, and the public.

Benefits for the end-users

- The main benefits of these technologies are an increased performance of existing models, more accurate analyses, and a better earthquake risk assessment. Further, they increase the efficiency of certain workflows, ensure access to additional data sets, and provide data to run own calculations.

Standards

- Several of these technologies fulfil EU standards, ISO standards and (inter-)national (seismological) standards.
- All technologies follow the FAIR (findable, accessible, interoperable, reusable) principles either entirely or partially.
- Two technologies have a patent, two hold a license and one technology (will) generate a revenue.

Accessibility

- Four technologies can be commercially used, three of them to a certain extent and two not.

All results and corresponding data is provided in section 7.4.5.

Recommendations actions for the last phase of the project

- Increase the visibility of these technologies by promoting them through the RISE outreach efforts.
- Further develop the technologies and put them into operation.

Economy

Cost-benefit analysis

- Four responders indicated that they are doing a cost-benefit analysis (CBA). The first group is developing a framework for CBA. The second group assesses the costs and benefits for risk-management actions. The third group makes a comparison between the additional cost of rapid post-earthquake inspection and benefits of improved damage and recovery estimates. And the fourth group calculates CBAs for the seismic sensors for strong-motion and regional earthquake monitoring, open-source firmware for the sensor device for producing high-level data products, and the management backend for sensor fleet management and data dissemination

Long-term financial sustainability

- For 26.3 % of the research activities the long-term financial sustainability is already guaranteed. 42.1 % are working on it and 21.1 % indicated that they would like to have financial resources for the future but have no support/funding. Further, 10.5 % indicated that the long-term financial sustainability is not important for their efforts.

Prevention of economic losses

- RISE research activities contribute to preventing economic losses due to earthquakes in several ways. First, they facilitate rapid decision making after an event to distribute resources efficiently. Second, they increase the efficiency of emergency interventions. Third, they contribute to providing rapid information on building damages, leading to a faster recovery after an earthquake. Fourth, they also contribute to the prevention of massive service interruptions, insurance models, reduction of fatalities, and the establishment of seismic building codes.

All results and corresponding data is provided in section 7.4.6.

Recommendations actions for the last phase of the project

- Establish a framework for cost-benefit-analysis that can be adopted by other projects in future.
- Identify which RISE research activities are struggling with ensuring long-term financial sustainability and try to find solutions.

7.3.3 Science

The impact in the pillar *Science* is divided into the indicators: collaboration within the RISE community, collaboration with the scientific community outside RISE, outreach activities, spatial dimension, innovative and relevant research, and ethics.

Collaboration within the RISE community

The collaboration within the RISE community was divided into two parts, namely efficacy of collaboration and the extent of cross-disciplinary collaboration.

The main insights are (Table 9 & Figure 5) that within the different work packages, the collaboration between the involved scientists is efficient (M=4.00, SD=0.75) and cross-disciplinary efforts efficiently help them to grasp the complexity of their research issues (M=3.89, SD=0.94; M=3.95, SD=0.97). Further, what could be improved in the second phase is the collaboration between the different work packages (M=3.32, SD=0.95) as well as between the different disciplines (M=2.95, SD=1.22).

Table 9: Efficacy and cross-disciplinary collaboration within the RISE community

Collaboration within the RISE community				
		N	Mean*	SD
Efficacy of collaboration	*Within RISE, the collaboration between the involved scientists is efficient (e.g. regular meetings, data exchange).*	19	3.79	0.86
	Within my work package, the collaboration between the involved scientists is efficient.	19	4.00	0.75
	The exchange between the work packages is efficient.	19	3.32	0.95
Cross-disciplinarity	*The scientists from the different disciplines collaborate regularly.*	19	2.95	1.22
	The scientists from different disciplines collaborate constructively.	19	3.63	1.07
	Within my task/work package there are cross-disciplinary research efforts.	19	3.89	0.94
	The cross-disciplinary research allows to holistically grasping the issues and challenges which my task/work package is addressing.	19	3.95	0.97

**Ranging from 1=strongly disagree to 5=strongly agree*

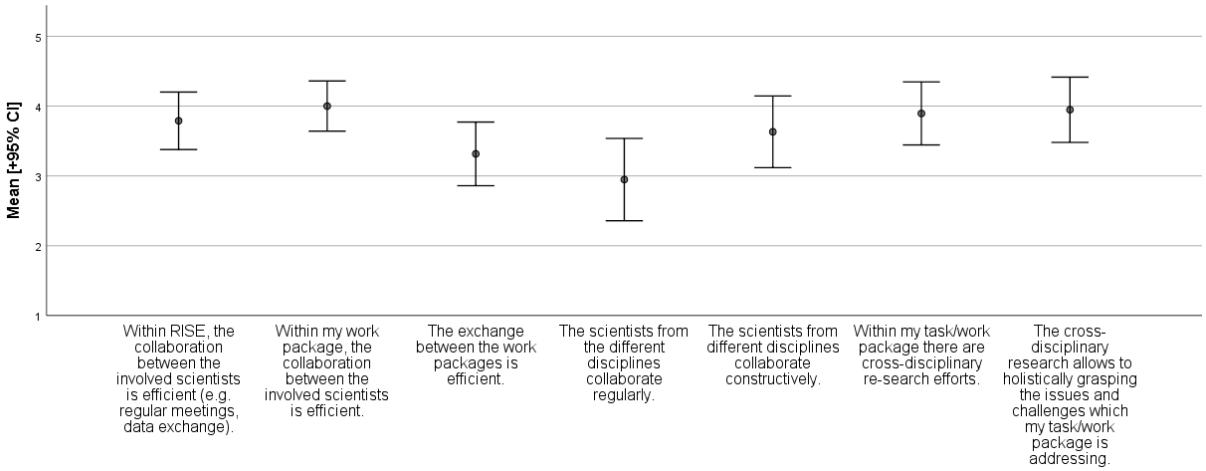


Figure 5: Collaborations within the RISE community, ranging from 1=strongly disagree to 5=strongly agree

Collaboration with the scientific community outside RISE

The RISE community collaborates with other scientists from their institutions/universities (89.5%), scientists from the same discipline (78.9%), scientists from other institutions/universities in Europe (68.4%) and outside of Europe (57.9%), and scientists from other disciplines (42.1%). Additionally, about half of the scientists who are reached are students and early-career scientists. See an overview in Table 10.

Table 10: Overview of the scientific communities with whom the RISE community collaborates

Collaboration with the scientific community outside RISE	Yes [%]	No [%]
Other scientists from my institution/university	89.5	10.5
Other scientists from institutions/universities in Europe that are not part of the RISE project	68.4	31.6
Other scientist from institutions/universities outside of Europe that are not part of the RISE project	57.9	42.1
Scientists from the same discipline	78.9	21.1
Scientists from other disciplines	42.1	57.9
Students, early career scientists etc.	52.6	47.4

In addition, thirteen responders indicated that they are involved in or collaborate with other projects/initiatives apart from RISE. These are:

- H2020 TURNKey
- H2020 LEXIS
- German BMBF-funded LOKI project
- The Transdisciplinarity Lab at ETH Zurich
- CSEP (Collaboratory for the Study of Earthquake Predictability)
- DynaRisk (Enabling Dynamic Earthquake Risk Assessment)
- Fusion of Models and Data for Enriched Evaluation of Structural Health
- Project #200021L_192139
- Polish Academy of Sciences (IMP PAN)
- ITN Training Network
- H2020-MSCA-ITN-2018
- INSPIRE (Innovative Ground Interface Concepts for Structure Protection)
- USGS
- GNS Science New Zealand
- The UK's COMET center

Half of those who answered that they are not collaborating with groups of other projects mentioned that they will do so in the future. These are the projects: H2020 CORE, the UK Reproducibility Network, NHERI SimCenter and the ETH Future Resilient Systems.

Outreach activities

The RISE community applies different outreach activities to share their findings and developed assets with the scientific community outside of RISE (see Figure 6). The main efforts are peer-reviewed publications (M=3.89, SD=1.24) and presentations at conferences (M=3.74, SD=1.10), followed by webinars/seminars for early-career scientists (M=3.16, SD=1.21) and institution-internal presentations (M=3.00, SD=1.45). In comparison, scientific blog posts (M=1.58, SD=0.96) or discourses on social media (M=1.63, SD=1.21) are less often used.

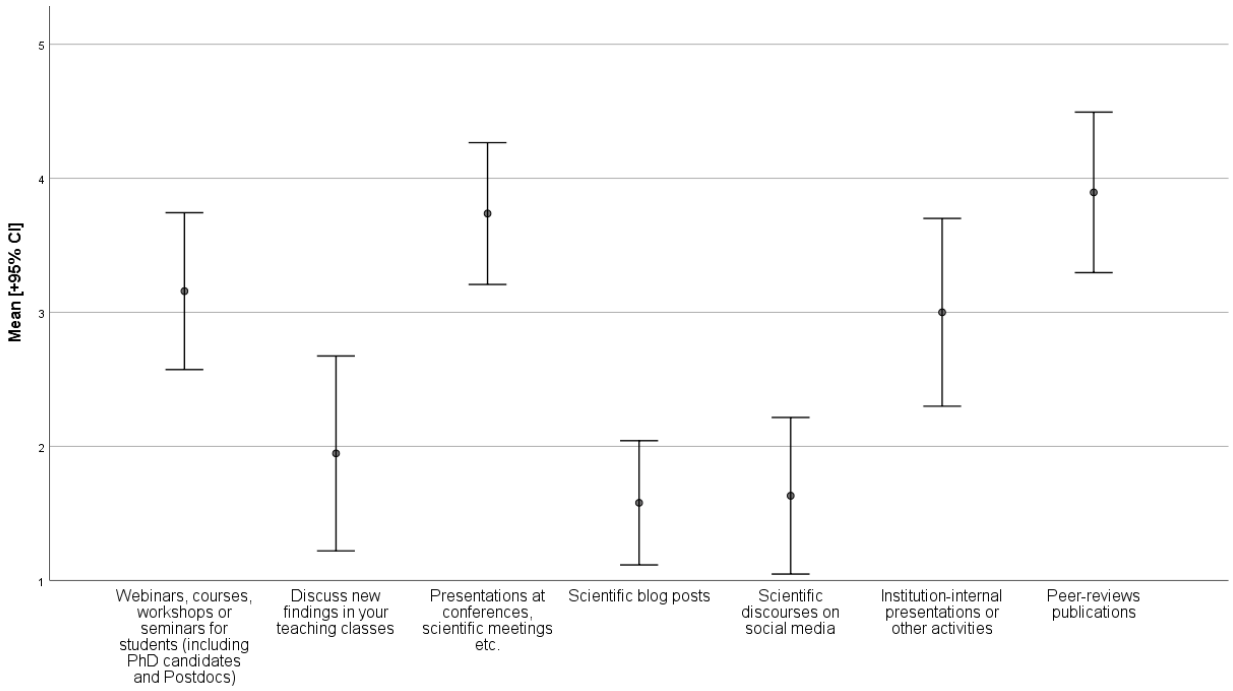


Figure 6: Scientific outreach efforts of the RISE community, ranging from 1=never to 5=very much

Spatial impact

The RISE research efforts have an impact mainly on the European level (78.9 %), but also on an international (47.4 %), national (52.6 %) and regional level (26.3 %).

Innovative and relevant research

As visible in Figure 7, the findings gained within RISE will/can be used for future research in other (EU) projects (M=4.79, SD=0.42) and are a basis for future activities in the specific disciplines (M=4.16, SD=0.77). Moreover, the RISE findings help improve existing models and assets and, thus, leverage the disciplines' knowledge and expertise (M=4.16, SD=0.83). In addition, the institutions and universities involved in the RISE project benefit from the findings of the RISE project and can continue working on these efforts (M=4.47, SD=0.77).

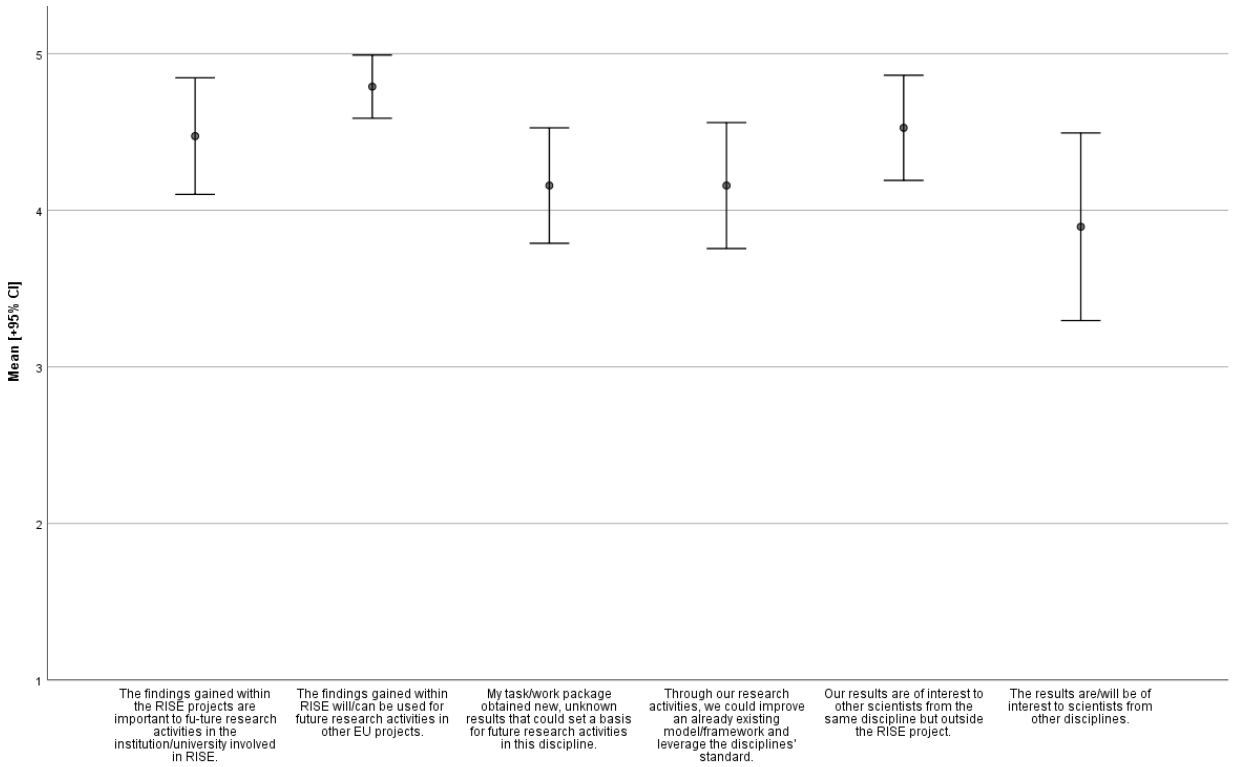


Figure 7: Impact of the RISE projects outcomes on the scientific community, ranging from 1=strongly disagree to 5=strongly agree

Ethics

In Figure 8, one can see that the majority of the RISE community thinks that ethics is important in research in general (M=4.68, SD=0.67) and for the RISE management and activities (M=4.42, SD=0.77). However, the importance differs within each work package and task (M=3.95, SD=1.47).

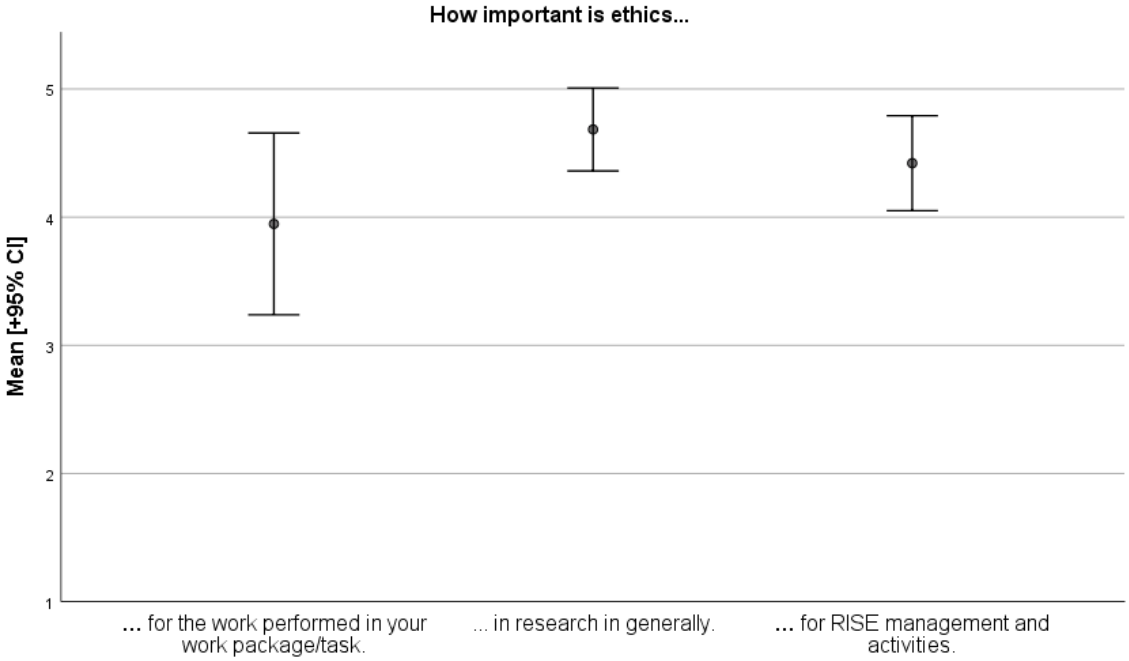


Figure 8: Relevance of ethical issues

In the context of the work done in RISE, ethical issues (e.g., conflict of interest, data abuse, GDPR) especially emerge with respect to commercialisation (M=3.47, SD=1.43) and communicating scientific results to society (M=3.42, SD=1.35). In comparison, the responders think that data gathering, analysis, sharing and use are less critical with regard to ethical implications (see Table 11).

Moreover, 57.9 % of the responders think a personal data protection policy is necessary for RISE data and service provision. Already 42.1 % of the institutions/universities RISE members are part of or have a policy for the data life cycle. In comparison, 10.5 % have no policy in place, 5.3 % are working on one, and 42.1 % do not know whether they have one or not.

Table 11: Overview of the scientific communities with whom the RISE community collaborates

Ethical implications on			
	N	Mean*	SD
Data gathering	19	2.47	1.43
Data analysis	19	2.79	1.36
Communicating scientific results to society	19	3.42	1.35
Data sharing	19	2.84	1.39
Data use	19	2.89	1.29
Commercialisation	19	3.47	1.43

**Ranging from 1=no ethical implications to 5=clear ethical implications*

7.3.4 Society

The impact in the pillar *Society* is divided into the indicators: stakeholder interaction, development of societally relevant assets, outreach activities, policy impacts, transdisciplinary research and ethics.

Stakeholder interaction: who benefits

Figure 9 depicts which stakeholders of the society benefit from the research efforts within RISE. National/local civil protection agencies (M=4.32, SD=0.82), authorities (M=4.26, SD=0.81) and emergency services (M=4.11, SD=0.94) benefit most from the research efforts. Additionally, the public (M=3.59, SD=0.96) as well as insurances (M=3.68, SD=1.06) and industries (M=3.11, SD=1.10) also benefit to a certain extent. Media (M=2.84, SD=1.12) and the private sector (M=2.68, SD=0.75), on the other hand, are not among the main target groups. However, for the release of the first openly available European Seismic Risk Model and the updated European Seismic Hazard Model, a press release distributed in various European countries is planned for spring 2022, thus ensuring also medial outreach.

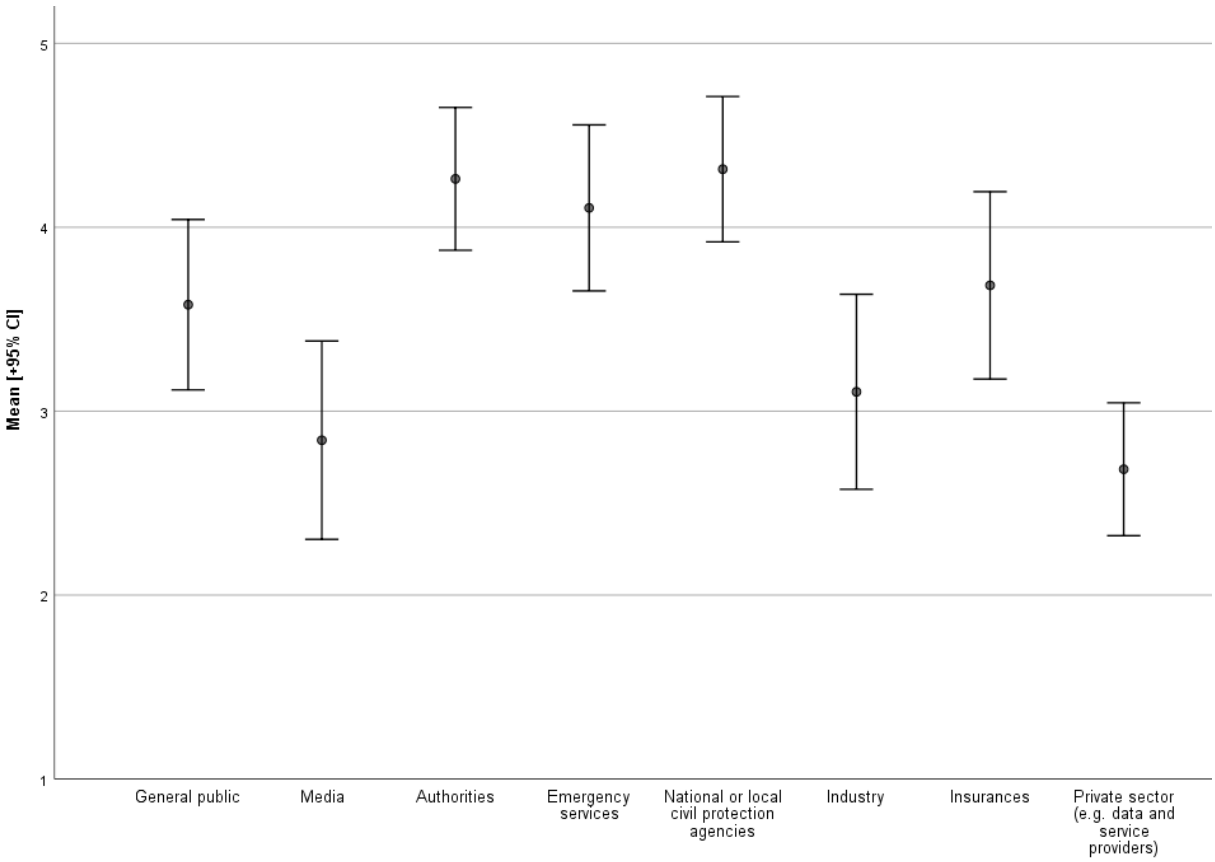


Figure 9: Extent to which various stakeholders from society benefit from the RISE research efforts, from 1=not at all to 5=very much

Stakeholder interaction: with whom RISE collaborates

Figure 10 shows to which extent the RISE community collaborates with the various stakeholders of society. As visible at first glance (Figure 10), the RISE community collaborates most with the national/local civil protection (M=3.84, SD=1.34), followed by the authorities (M=3.26, SD=1.20) and emergency services (M=3.26, SD=1.28). Also the public (M=2.95, SD=1.39), industries (M=2.84, SD=1.54) and insurances (M=2.74, SD= 1.41) are involved in the activities of RISE. And equal to the scientific outreach, media (M=2.32, SD=1.49) and the private sector (M=2.11, SD=1.29) is less directly involved.

Thereby, it is crucial to consider that the range of collaboration differs highly between the different work packages. WP5, for example, has a strong emphasis on involving stakeholders of the society, mainly the public, to make sure that the developed products fulfil the end-users' needs. In comparison, other work packages focus on the development of models that are not yet mature enough to provide reliable information to the public. The extent of the collaboration with the different stakeholder groups is in line with the extent of benefits for these groups.

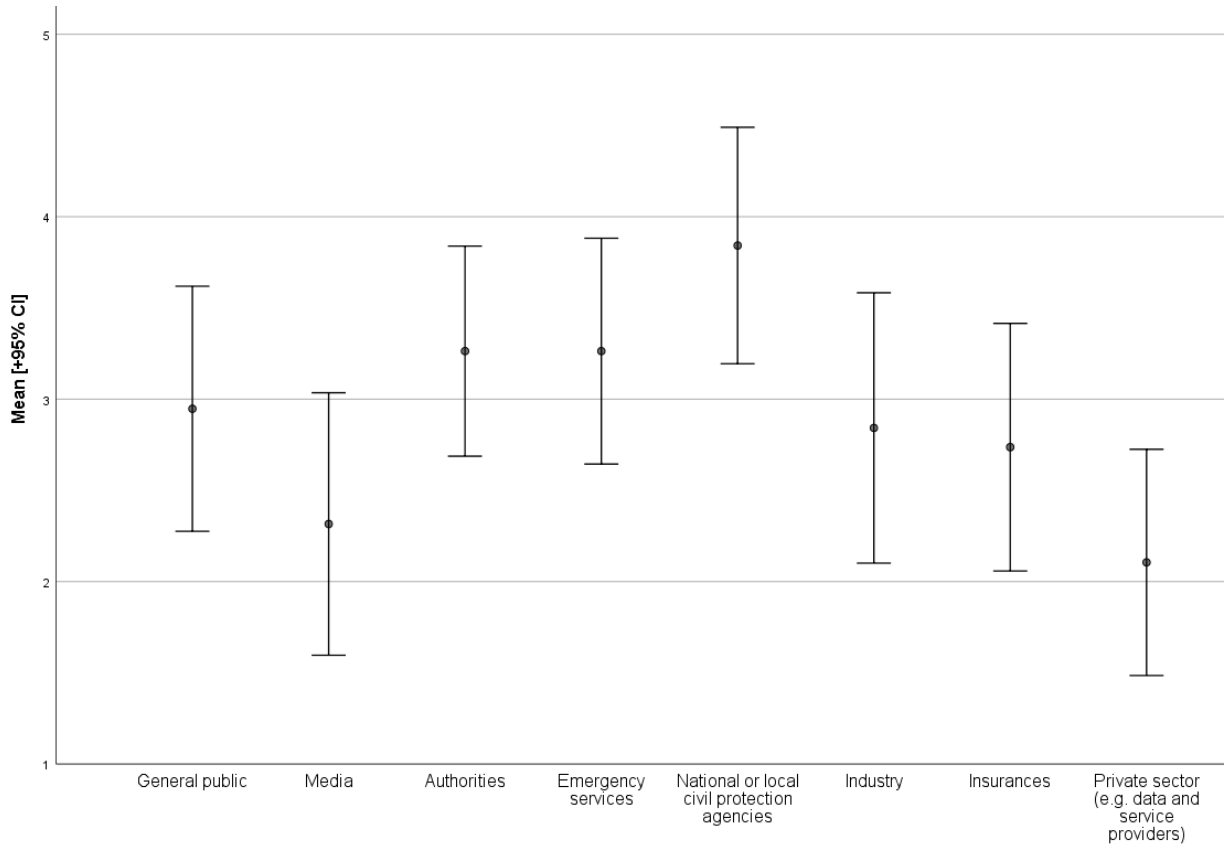


Figure 10: Extent to which the RISE community collaborates with the various stakeholders of society, ranging from 1=not at all to 5=very much

Development of societal relevant assets

Nine work package and task leader representatives indicated to provide assets (= products, services, tools etc.) that are or will be of direct use for stakeholders of society. These assets include earthquake catalogues, patent commercialised by the company GEOLINKS Services, access to exposure and vulnerability models, real-time earthquake information services, multi-hazard warning prototypes, a web tool for public OEF communication, earthquake forecast evaluations that build confidence in OEF models, dynamic risk services, seismic sensors and software, shake maps, rapid loss assessment services, post-earthquake building damage estimates, and post-earthquake recovery estimates.

These assets are mainly in the development stage "data collection, designing, developing" (n=9) followed by "testing" (n=8), "implementation" (n=7) and "operationalisation/demonstration" (n=7). The target audiences are not yet regularly using them (M=1.53, SD=1.61) since most of them are still in the developing and testing phase. Moreover, these assets contribute most to the dimension of the disaster cycle "preparedness" (n=13) followed by "mitigation" (n=9), "emergency intervention" (n=10), and "recovery and reconstruction" (n=5).

Benefits for stakeholders of society

Regarding the direct benefits (see Figure 11), the work done within RISE contributes most to increase knowledge (M=4.16, SD=0.83), raise awareness (M=3.79, SD=0-86), mitigate risk (M=3.63, SD=0.83) and to a slightly lower extent to help reduce personal risks (M=3.16, SD=1.12). Further, one responder also listed the benefit of building trust under the option "others".

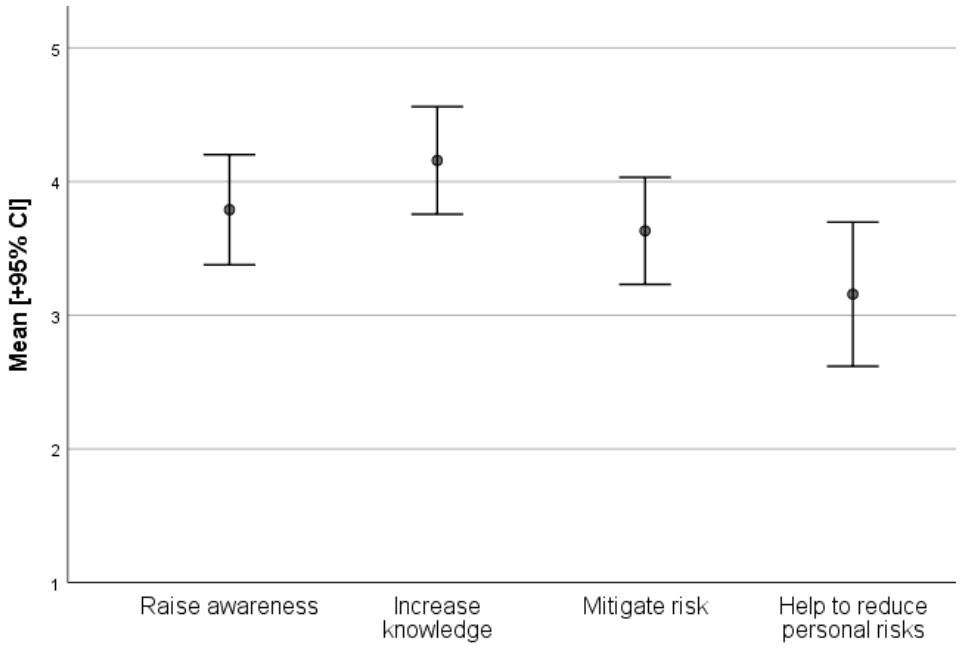


Figure 11: Benefits for the stakeholders of society, ranging from 1=not at all to 5=very much

Regarding the indirect benefits, the WP and task leaders mentioned the following:

- One of the responders mentioned the Patent of the CNRS (he is the inventor, and "this technique allows the tracking of fluids in the subsurface. The company Geolinks services develops the implementation of the technique for the monitoring of underground gas storage (CO2, CH4, H2)."
- "Enhancing confidence of the stakeholders on the tools that we use."
- "It will produce trustworthy communication between the seismological community and others in society."
- "Training the next generation of academics, government agency workers and industry/re/insurance disaster/hazard/risk specialists."
- "We invest in designing accessible and understandable dynamic risk services. If successful, this would be of direct relevance for society."
- "Improve planning for recovery after future disasters."

Outreach activities to communicate scientific knowledge

Level of effort

In Figure 12, it is visible that all work packages do invest in passing on scientific knowledge to society. Thereby, work packages 5 and 8 put a lot of effort into it since they are responsible for the design of communication products for society and the internal and external communication efforts. Also within the other work packages, several tasks put much effort into sharing their gained insights with stakeholders of society.

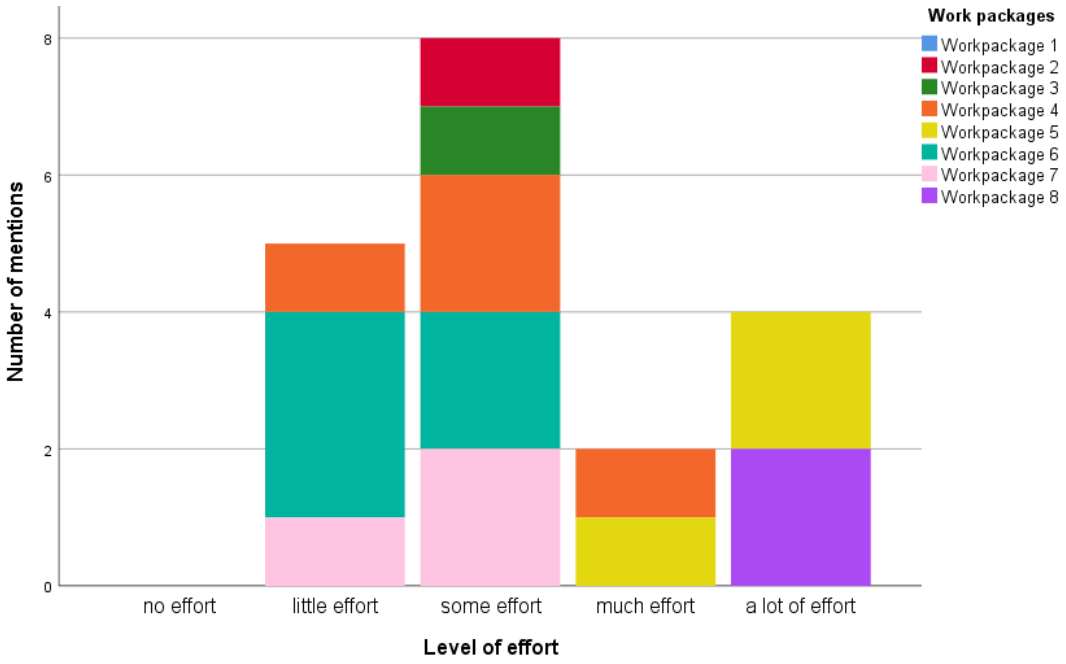


Figure 12: How much effort do the different work packages and tasks put into passing on scientific knowledge to society

Outreach mechanisms

In Figure 13, it is listed in descending order to what extent specific outreach activities are applied (the exact values are in Table 12). The highest effort is put into assuring the timely production of reliable scientific information, followed by promoting/sustaining credibility and trust, investing in understandable and accessible information and fostering completeness, clarity and accessibility of information. Less used is social media and the provision of information to media, which is in line with the scientific outreach efforts.

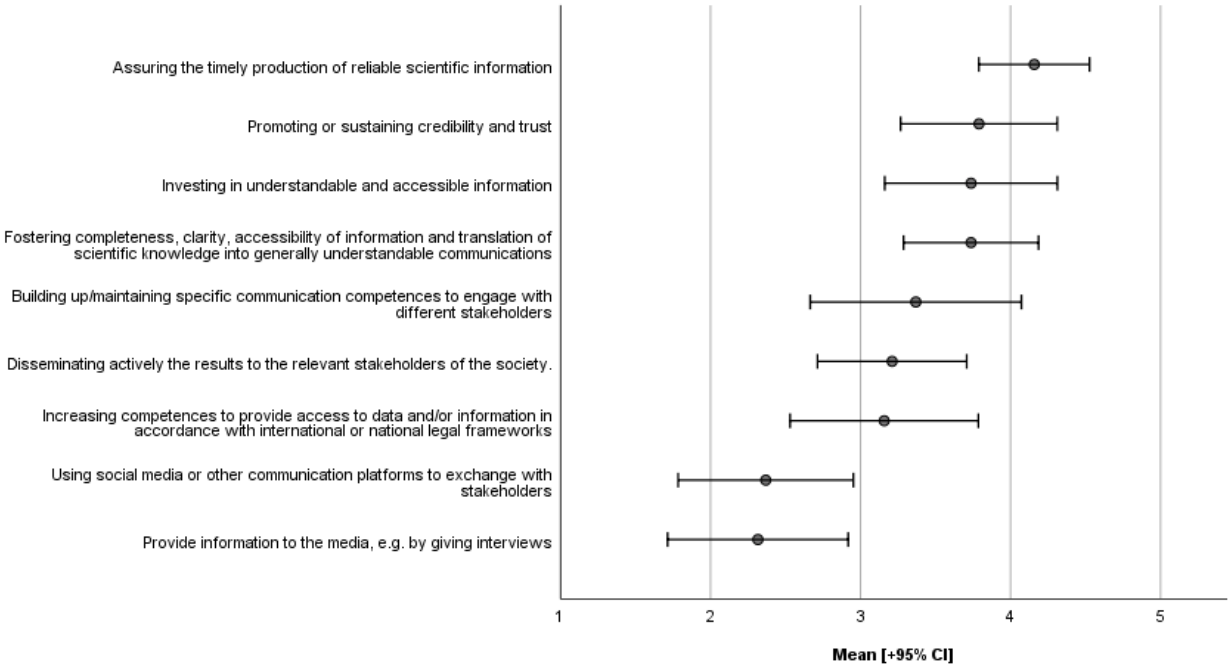


Figure 13: Extent to which specific outreach activities are applied, ranging from 1=not at all to 5=very much

Table 12: Extent to which specific outreach activities are applied

Outreach activities			
	N	Mean*	SD
Building up/maintaining specific communication competences to engage with different stakeholders	19	3.37	1.46
Assuring the timely production of reliable scientific information	19	4.16	0.77
Fostering completeness, clarity, accessibility of information and translation of scientific knowledge into generally understandable communications	19	3.74	0.93
Investing in understandable and accessible information	19	3.74	1.20
Using social media or other communication platforms to exchange with stakeholders	19	2.37	1.21
Provide information to the media, e.g. by giving interviews	19	2.32	1.25
Promoting or sustaining credibility and trust	19	3.79	1.08
Increasing competences to provide access to data and/or information in accordance with international or national legal frameworks	19	3.16	1.30
Disseminating actively the results to the relevant stakeholders of the society.	19	3.21	1.03

**Ranging from 1=no extent to 5=big extent*

Outreach channels

As visible in Table 13, mainly websites are used to share and communicate RISE outcomes with the stakeholders of society, followed by public presentations, seminars and town halls. But also training courses, social media and community events are used by some of the RISE community members to bring their assets to the society.

Table 13: Extent to which specific channels are used to disseminate the RISE research results/activities to society

Outreach channels			
	N	Mean*	SD
Websites	19	3.68	1.11
Public presentation/seminars/town halls	19	3.00	1.41
Training courses	19	2.42	1.26
Social media	19	2.37	1.30
Community events	19	2.26	1.33
Videos	19	2.05	1.13
Newspapers, radio, TV	19	2.05	1.18
E-learning platform	19	1.63	1.01
Others: direct conversations with stakeholders and with journalists to help design communication channels for their needs	19	0.47	1.31

**Ranging from 1=no use to 5=very often*

Policy impacts

As visible in Table 14, RISE contributes to several policy products. The highest contributions are with regard to decision support tools, guidelines, disaster management plans and mitigation strategies. Additionally, RISE activities further contribute/provide input to regulations and standards (e.g., Eurocode).

Table 14: RISE's contribution to policy products

Contribution to policy products	Yes [%]	No [%]
Regulations (e.g. new building constructions against earthquakes)	36.8	63.2
Guidelines (e.g. earthquake preparedness guide for the public)	57.9	42.1
Decision support tools	84.2	15.8
Standards (e.g. ISO standards, Eurocode)	15.8	84.2
Disaster management plans	57.9	42.1
Mitigation strategies	57.9	42.1
Others (e.g. Rapid impact assessment & rapid public earthquake information)	5.3	94.7
None	5.3	94.7

Transdisciplinary research

As visible in Table 15, the RISE community puts much effort into tailoring its assets to the specific needs of the relevant stakeholders. They mainly draw on their own professional expertise and experiences. Further, they collaborate with social scientists and take into account relevant publications. Additionally, some also directly involve the relevant stakeholders in the development process and have regular exchanges with them.

Table 15: Efforts of the RISE community to tailor their assets to the needs of the stakeholders of society

Efforts to tailor the assets to the needs of the society	Yes [%]	No [%]
Collaborating with social scientists to assess the needs of the relevant stakeholder groups	57.9	42.1
Including the relevant stakeholders already in the development process (participatory procedure)	52.6	47.4
Based on the own professional experience and knowledge of the RISE task members	78.9	21.1
Taking into account relevant publications (desk research)	57.9	42.1
Regularly exchanging with the relevant stakeholders (e.g. email, workshops, meetings)	52.6	47.4

Ethics

The RISE community agrees that we, as scientists, should do more to share our hazard and risk knowledge with society (see Table 16). This should be primarily done via national authorities. Further, some also indicated that they would like to improve their skills to share their research more effectively with society.

Prior studies have shown that minority and vulnerable groups are most affected by disasters (Lukasiewicz & Baldwin, 2020; Shrestha et al., 2019). Thus, more efforts are needed to address the needs of these societal groups. The RISE community, about 16%, contributes to these investigations. A follow-up H2020 project, CORE, will set a more special focus on these groups.

Table 16: Researchers' responsibilities to share their knowledge with the society

Researchers' responsibility			
	N	Mean*	SD
I think, we as scientist should do more to share our hazard and risk knowledge with society.	19	3.89	1.15
In my opinion, hazard and risk information should be primary shared via national authorities with society.	19	3.79	1.27
My primary duty is to share my research with the scientific community.	19	3.37	1.12
Personally, I would like to improve my skills to share my research more with society.	19	3.68	1.34

**Range 1=strongly disagree to 5=strongly agree*

7.3.5 Technology

The impact in the pillar *Technology* is divided into the indicators: technology development, end-users, standards and accessibility.

Development of (innovative) technologies

Nine responders indicated that they are developing technologies (e.g. software, applications, models, sensors). With regard to the development stage, the majority of the technology is in the conceptualisation phase (n=6), followed by the development phase (n=4), testing phase (n=4), implementation phase (n=3) and operation phase (n=2). Moreover, the groups that already have technology in the implementation and operation phase are recording their effectiveness (e.g. number of access, number of sensors installed in buildings).

What is innovative about these technologies: [open comments]

- "Open source software, open access data and models"
- "In WP5 there is the 1st operational smartphone based public early warning system (Univ. Bergamo) and we implement fast (60s) and reliable seismic location at global scale by the combined analysis of crowdsourced & seismic data (EMSC)"
- "Monitoring applied on buildings (beyond ground/seismic monitoring)"
- "Time-dependent seismic risk assessment"
- "We are still at the conceptualisation phase, but our efforts should result in dynamic risk services."
- "Modern software development, low-cost sensors, Large-scale computations (Big data)"
- "Integration and dissemination of data products, cost effectiveness, easy installation and maintenance, integration into existing monitoring systems"
- "Data management strategies"
- "Bayesian update of damage and recovery estimates based on rapidly collected post-earthquake inspection data."

End-users

The main end-users of the technologies developed in RISE are scientists, engineers and specific stakeholders from society (e.g., civil protection). Further, some technologies are also for data analysts in the financial sectors, industry and the public. All end-users are listed in Table 17.

Table 17: Overview of the end-users of the technologies developed in the context of RISE

End-users of the technologies	Yes [%]	No [%]
Engineers	77.8	22.2
Scientists	88.9	11.1
Data analysts or CAT modeller working in the financial sectors	33.3	66.7
Data analysts or CAT modeller working for insurances	55.6	44.4
Specific stakeholders from the society (e.g. governmental agencies, civil protection emergency services)	77.8	22.2
Industry	55.6	44.4
General public	33.3	66.7

Benefits for the end-users

The main benefits of the technologies are increased performance of existing models, more accurate analyses and a better risk assessment (see Table 18). Further, they increase the efficiency of certain workflows, ensure access to additional data sets and provide data to run their own calculations.

Table 18: Overview of the benefits of the technologies for the end-users

Benefits of the technologies	Yes [%]	No [%]
Access to additional/comprehensive data sets	44.4	55.6
Data to run own calculations (e.g. insurances)	44.4	55.6
Increase in efficiency of workflow	44.4	55.6
Improvement of productivity	11.1	88.9
Cost efficiency	33.3	66.7
Increase of innovation	33.3	66.7
More accurate analysis possible	66.7	33.3
Increase the performance of existing models	77.8	22.2
Better risk assessment	55.6	44.4
Others (i.e., advanced information for disaster management)	11.1	88.9

Standards and Accessibility

Five out of nine responders who indicated that their work package/task is developing a technology pointed out that their technologies do not comply with specific standards. Those that fulfil EU standards, ISO norms and national standards (see Table 19). Further, one responder indicated that they comply with the international seismological standards (e.g., FDSN). Moreover, all technologies follow the FAIR (findable, accessible, interoperable, reusable) principles either entirely (55.6 %) or partially (44.4 %). In addition, two technologies have a patent, two hold a license and one technology (will) generate revenue. Further, four of the technologies can be commercially used, three to a certain extent and two not.

Table 19: Overview of the standards the technologies comply with

Completion with specific standards	Yes [%]	No [%]
National standards	11.1	88.9
ISO standards	11.1	88.0
EU standards (e.g., Technology readiness levels)	22.2	77.8
Others (e.g., International seismological standards such as FDSN)	33.3	66.7

7.3.6 Economy

The impact in the pillar *Economy* is divided into the indicators: cost-benefit analyses, long-term financial sustainability and prevention of economic losses.

Cost-benefit analysis

Four responders indicated that they do a cost-benefit analysis (CBA). The first group is developing a framework for CBA. The second group assesses the costs and benefits of risk-management actions. The third group compares the additional cost of rapid post-earthquake inspection and the benefits of improved damage and recovery estimates. And the fourth group calculates CBAs for the seismic sensors for strong-motion and regional earthquake monitoring, open-source firmware for the sensor device for producing high-level data products, and the management backend for sensor fleet management and data dissemination. In Table 20, the benefits and costs included by these groups are listed.

Table 20: Overview of the standards the technologies comply with

CBA efforts	Which assets	Benefits and costs
Group 1	OEF, EEW, RLA	Task itself is to develop a framework for CBA
Group 2	Costs and benefits of risk-management actions	Seismic risk and loss reduction benefit
Group 3	• Seismic sensor for strong-motion and regional earthquake monitoring • Open-source firmware for the sensor device for producing high-level data products • Management backend for sensor fleet management and data dissemination	• Procurement of sensor hardware • Risk of open-sourcing the software • Market and science acceptance of novel instruments and standards
Group 4	Comparison of the additional cost of rapid post-earthquake inspection vs. benefit of improved damage and recovery estimates	• Risk of false inspection reports • Risk of inconsistency between observed damage and that predicted using ground motion estimates

Long-term financial sustainability

For 26.3 % of the research activities, long-term financial sustainability is already guaranteed (see Figure 14). 42.1 % are working on it and 21.1 % indicated that they would like to have financial resources for the future but have no support/funding. Further, 10.5 % indicated that long-term financial sustainability is not essential for their efforts.

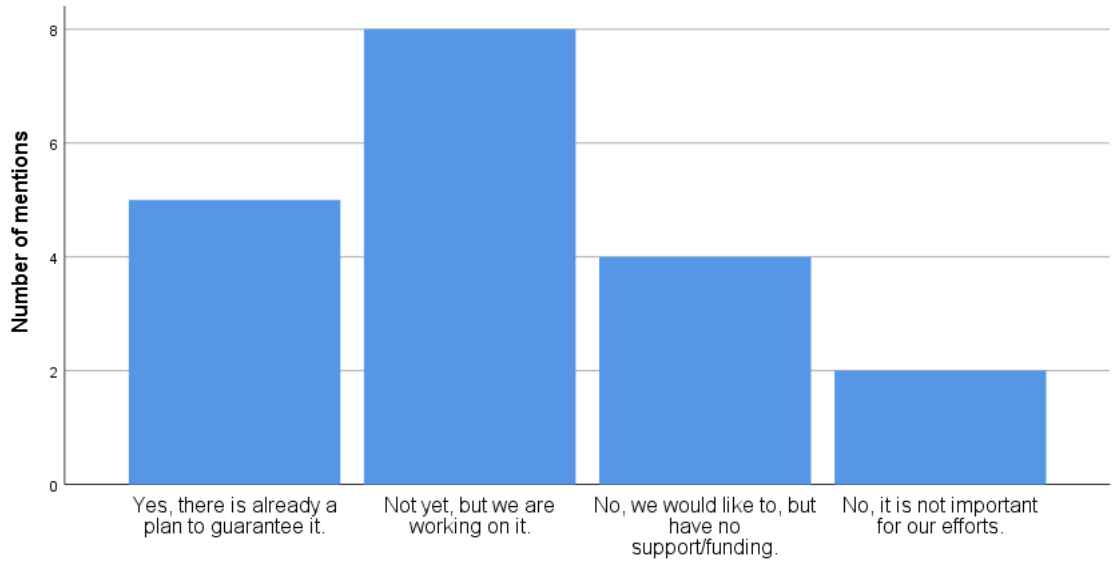


Figure 14: Will the long-term financial sustainability of the research activities and resulting outcomes be ensured after the end of RISE?

Prevention of economic losses

RISE research activities contribute to preventing economic losses due to earthquakes in several ways (see Figure 15). First, they facilitate rapid decision making after an event to distribute resources efficiently (M=3.68, SD=1.25). Second, they increase the efficiency of emergency interventions (M=3.68, SD=1.49). Third, they contribute to providing rapid information on building damages, leading to a faster recovery after an earthquake (M=3.21, SD=1.62). Fourth, they also contribute to the prevention of massive service interruptions (M=3.00, SD=1.56), insurance models (M=2.79, SD=1.51), reduction of fatalities (M=2.79, SD=1.44), and the establishment of seismic building codes (M=2.32, SD=1.49).

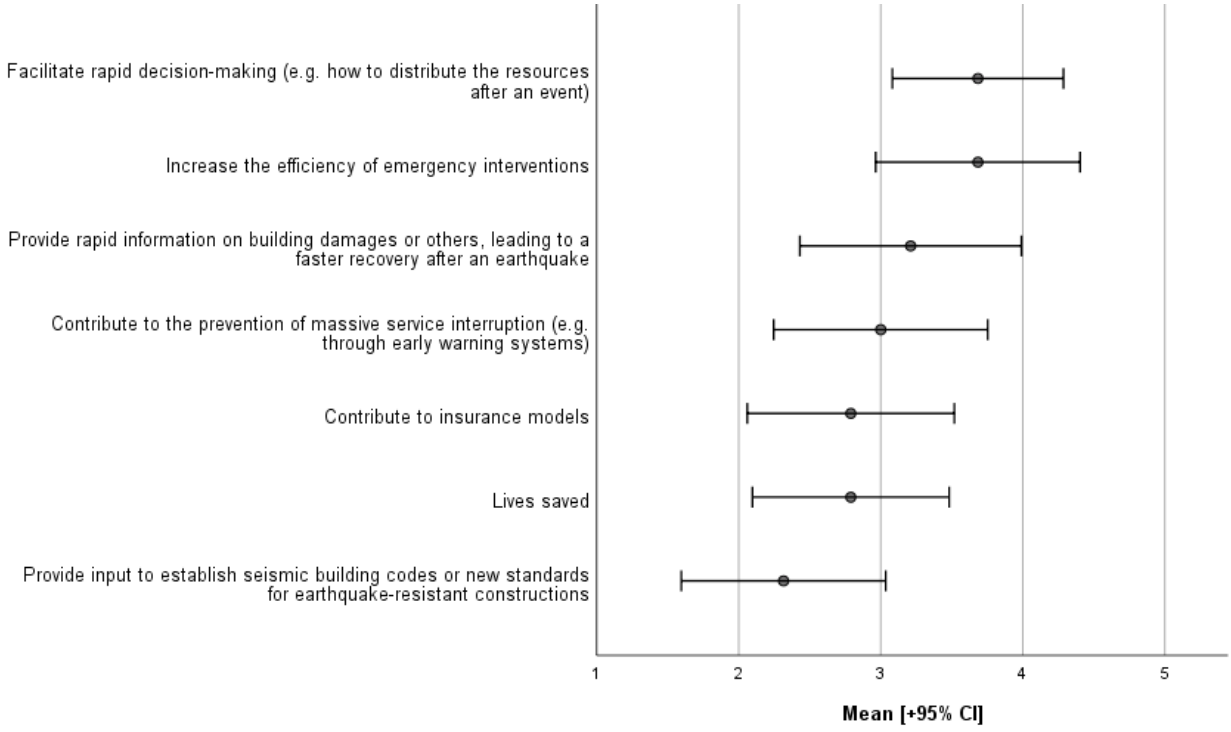


Figure 15: Extent to which RISE research activities contribute to preventing economic losses due to earthquakes

8. Conclusion

Our impact assessment shows that RISE has a relevant impact on the scientific, social, technological as well as on the economic level.

The scientific findings gained throughout the project as well as the assets and technologies developed within RISE significantly and sustainably contribute to the disaster risk reduction on the European, international and national level. The collaboration with other international and national projects and initiatives further supports the knowledge transfer and joint efforts to increase societies' resilience to earthquakes. What could be improved is the interaction between the WPs, which may facilitate joint research investigations in the last phase of RISE.

Moreover, the main target audiences – i.e. the scientific community, engineers, governmental institutions, civil protection and emergency services – are efficiently involved by the majority of the WPs, whereas industry, insurances, and the public are addressed by specific WPs. These target audiences are also those who we defined as the relevant stakeholders at the beginning of the project. As outreach activities, mainly peer-reviewed publications, presentations at conferences and meetings are used. Thus, in the last phase of the project, we will try to additionally focus on other outreach activities such as social media, good practice reports, newsletters, and training courses for specific stakeholders. The planned event – e.g., the public and media release of the 2020 European Seismic Risk and Hazard Model and the OEF workshop in Italy – are good opportunities for that.

Further, various technologies are still under development and the last phase of RISE will allow to further test them and even implement some of them. Already conducted cost-benefit analyses show that these technologies have the potential to reduce damages, economic losses, and fatalities. Thus, it is important that the RISE efforts that have not yet a long-term financial plan ready, should be supported in establishing one (e.g., future collaboration in other projects).

WP8 will continue with its internal and external communication activities to support the RISE community's outreach efforts. A stronger empathise will be put into compiling additional good practice reports, outreach on the Twitter account, and supporting internal collaboration and exchange through newsletters, workshops, and internal RISE events.

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Appendix

1.1 Appendix A1 – Survey

Introduction

Dear RISE work package and task leaders

PEDR is our master plan to maximise the long-term socio-economic impact and to achieve a measurable impact on societies to increase their resilience against the threat of future earthquakes. In the framework of deliverable 8.3, we defined metrics to measure RISE's impact in terms of science, society, technology and economy. The aim of this survey is to assess for each work package (WP) and task within RISE their contribution to these four fields. **Attention**: you should answer the questions for your WP or task as a whole and not only for your own research.

The survey includes around 45 questions and therefore requires about 60 minutes to complete. We kindly ask all RISE WP and task leaders to fill in the survey until 31 January 2022.

Questions? Do not hesitate to contact Michèle Marti (michele.marti@sed.ethz.ch) or Nadja Valenzuela (nadja.valenzuela@sed.ethz.ch).

General information

1. Name [open answer]

2. E-Mail Address (we will only use your email address if we have clarification questions) [open answer]

3. Which work package do you lead or do(es) your task(s) belong to?
   - WP1
   - WP2
   - WP3
   - WP4
   - WP5
   - WP6
   - WP7
   - WP8

4. Please indicate the number(s) of your task(s) or work packages that you are leading. [open answer]

5. Affiliation of your institution/university: [Open answer]

Science

The first block of this survey focuses on the scientific impact of your work within RISE. There are some additional questions with a special focus on ethics at the end of this block.

Indicators	**Questions**
Collaboration within the RISE community	6. To what extent do you agree with the following statements? 1=strongly disagree; 5=strongly agree

	• Within RISE, the collaboration between the involved scientists is efficient (e.g. regular meetings, data exchange). • Within my work package, the collaboration between the involved scientists is efficient. • The exchange between the work packages is efficient. 7. Please indicate to what extent you agree with the following statements. 1=strongly disagree; 5=strongly agree • The scientists from the different disciplines collaborate regularly. • The scientists from different disciplines collaborate constructively. • Within my task/work package there are cross-disciplinary research efforts. • The cross-disciplinary research allows to holistically grasping the issues and challenges which my task/work package is addressing.
Collaboration with the scientific community outside RISE	8. Which of the following groups from the scientific community outside the RISE project have you already reached with your findings / are you collaborating with? [multiple choices possible] • Other scientists from my institution/university • Other scientists from institutions/universities in Europe that are not part of the RISE project • Other scientist from institutions/universities outside of Europe that are not part of the RISE project • Scientists from the same discipline • Scientists from other disciplines • Students, early career scientists etc. • Others, please specify: _____ 9. Is your task/ work package collaborating with other projects/initiatives apart from RISE? • Yes • No 9.1 If yes, please specify with which ones: [Open answer] 9.2 If not, are you planning a collaboration with other projects/initiatives? • Yes, with: _____ • No
Outreach activities	10. To what extent do you apply the following activities to share your scientific work conducted in the RISE project? 1=never; 5=very often • Webinars, courses, workshops or seminars for students (including PhD candidates and Postdocs) • Discuss new findings in your teaching classes • Presentations at conferences, scientific meetings etc. • Scientific blog posts • Scientific discourses on social media • Institution-internal presentations or other activities • Peer-reviews publications • Others, please specify: _____
Spatial impact	11. On which spatial levels do the research efforts of your task/work package mainly focus on?

	• Regional level • National level • European level • International level
Innovative and relevant research	12. To what extent do the following statements apply to your task/work package? 1=strongly disagree; 5=strongly agree • The findings gained within the RISE projects are important to future research activities in the institution/university involved in RISE. • The findings gained within RISE will/can be used for future research activities in other EU projects. • My task/work package obtained new, unknown results that could set a basis for future research activities in this discipline. • Through our research activities, we could improve an already existing model/framework and leverage the disciplines' standard. • Our results are of interest to other scientists from the same discipline but outside the RISE project. • The results are/will be of interest to scientists from other disciplines.
Ethics [Adapted from D6.1 EPOS-SP]	13. How important is ethics… 1=irrelevant; 5=essential • … for the work performed in your work package/task. • … in research generally. • … for RISE management and activities. 14. To what extent does your research in the context of RISE cause any possible ethical issues, or could your research evolve into problematically ethical consequences* in future with respect to the following aspects? *Examples of ethical issues: conflict of interest, data abuse, biased information, GDPR. [1= no ethical implications; 5= clear ethical implications] • Data gathering • Data analysis • Communicating scientific results to society • Data sharing • Data use • Commercialisation 15. Based on your opinion, is a personal data protection policy necessary for RISE data and service provision? • Yes • No 16. Does your group/institution/university have a policy for the data life cycle? • Yes • No, but is working on one • No • I don’t know

Society

In the following part, we would like to know more about the impact of your efforts on society. In other words, it includes all activities of your task/work package that contribute to increasing the societies’ resilience to future earthquakes.

Indicators	**Questions**
Stakeholder interaction	17. To what extent will the following stakeholders benefit from your research activities? 1=not at all to 5=very much • General public • Media • Authorities • Emergency services • National or local civil protection agencies • Industry • Insurances • Private sector (e.g. data and service providers) • Others: _____ 18. To what extent do you already collaborate/plan to collaborate with stakeholder(s) from the society? 1=not at all to 5=very much • General public • Media • Authorities • Emergency services • National or local civil protection agencies • Industry • Insurances • Private sector (e.g. data and service providers) • Others: _____
Development of societal relevant assets (e.g. products, services, tools)	19. Do you provide assets (=products, services, tools etc.) that are or will be of direct use for stakeholders from the society? • Yes, please specify what kind of assets: _____ • No 20. In which development stage are these assets? • Data collection, designing, developing • Testing • Implementation • Operationalisation / Demonstration 21. If the stakeholders are already using these assets, to what extent do they use them? [from 1= not used so far to 5= widely used] 22. To what dimension(s) of the disaster cycle do these assets contribute? [Multiple choices possible] • Mitigation • Preparedness • Emergency intervention • Recovery & reconstruction
Benefits for stakeholders of society	23. To what extent do the stakeholders of the society benefit from your research activities conducted within the framework of RISE? 1= no benefit; 5=strongly benefit • Raise awareness • Increase knowledge

	• Mitigate risk • Help to reduce personal risks • Others, please specify: _____ 24. Can you think of any **indirect** benefits from the research conducted as part of your task/work package for society? [open answer]
Outreach activities to communicate scientific knowledge	25. How much effort do you put into passing on scientific knowledge to society? 1= no effort; 5= a lot of effort 26. To what extent do you apply the following procedures/mechanisms to transfer your research activities and results gained within RISE to relevant stakeholders of the society? 1= no extent; 5= big extent • Building up/maintaining specific communication competences to engage with different stakeholders • Assuring the timely production of reliable scientific information • Fostering completeness, clarity, accessibility of information and translation of scientific knowledge into generally understandable communications • Investing in understandable and accessible information • Using social media or other communication platforms to exchange with stakeholders • Provide information to the media, e.g. by giving interviews • Promoting or sustaining credibility and trust • Increasing competences to provide access to data and/or information in accordance with international or national legal frameworks • Disseminating actively the results to the relevant stakeholders of the society. 27. To what extent do you use the following channels to disseminate the research results/activities of your task/work package to society? 1= no use; 5= very often • Public presentations/seminars/town halls • Newspapers, radio, TV • Websites • Social media • Videos • Training courses • E-learning platform • Community events • I do not actively disseminate the results to stakeholders of the society • Others, please specify: _____
Policy impact	28. To what of the following policy products did the research activities lead or contribute? [multiple choices possible] • Regulations (e.g. new building constructions against earthquakes) • Guidelines (e.g. earthquake preparedness guide for the public) • Decision support tools • Standards (e.g. ISO standards, Eurocode) • Disaster management plans • Mitigation strategies • Others: _____ • None

Transdisciplinary research	29. How do you make sure that the scientific work in your task/ work package will be translated into tangible assets tailored to the needs of the specific stakeholder of the society? [multiple choices possible] • Collaborating with social scientists to assess the needs of the relevant stakeholder groups • Including the relevant stakeholders already in the development process (participatory procedure) • Based on the own professional experience and knowledge of the RISE task members • Taking into account relevant publications (desk research) • Regularly exchanging with the relevant stakeholders (e.g. email, workshops, meetings) • Other ways, please specify: _____
Ethics	30. To what extent do you agree with the following statements in terms of ethics towards society? 1= strongly disagree; 5= strongly agree • I think, we as scientist should do more to share our hazard and risk knowledge with society. • In my opinion, hazard and risk information should be preliminary shared via national authorities with society. • My primary duty is to share my research with the scientific community. • Personally, I would like to improve my skills to share my research more with society. 31. Do you consider people with special needs (physical or cognitive disabilities, elderly people, children etc.) within the research activities of your task/work package? • Yes • No

Technology

The following questions now refer to technological achievements. As technology, we understand software, applications, models, sensors, other technological devices or means that apply scientific knowledge to the practical aims of human life, society, and the environment.

Indicators	**Questions**
Development of (innovative) technologies	32. Does your task include the development of technologies? • Yes • No *[→ then jump to next part of the survey 'economy']* 33. In which development stage is/are your technology/technologies currently? • Conceptualisation • Development • Testing • Implementation • In operation 34. If the technology/technologies is/are already in usage, do you record their success (e.g. number of downloads, number of accesses, number of sensors installed in

	buildings)? If yes, would you be able to share these numbers with WP8: nadja.valenzuela@sed.ethz.ch • Yes • No 35. What is innovative about your technology/technologies (in keywords)? [Open comments]
End-users	36. Who are the end-users of the technology/technologies? [multiple choices possible] • Engineers • Scientists • Data analysts or CAT modeller working in the financial sectors • Data analysts or CAT modeller working for insurances • Specific stakeholders from the society (e.g. governmental agencies, civil protection emergency services) • Industry • General public • Others: _____
Benefits	37. What are the specific benefits/advantages of the technology/technologies for these end-users? [multiple choices possible] • Access to additional/comprehensive data sets • Data to run own calculations (e.g. insurances) • Increase in efficiency of workflow • Improvement of productivity • Cost efficiency • Increase of innovation • More accurate analysis possible • Increase the performance of existing models • Better risk assessment • Others: _____
Standards	38. Do(es) the technology/technologies comply with proven standards, or will they do so? National standards ISO standards EU standards (e.g. Technology readiness levels ((TRL)) Others: _____ Technology/technologies do(es) not comply with proven standards 39. Please indicate if the technology/technologies correspond(s) to the following characteristics: [multiple answers possible] The technology/technologies has/have a patent. The technology/technologies hold/holds a license. The technology/technologies generate(s) revenue or will generate revenue in the future. None Others, please specify: _____ 40. Do(es) the technology/technologies follow the FAIR (findable, accessible, interoperable, reusable) principles? • Yes, entirely. • Yes, parts of it/them.

	• No.
Accessibility	41. Do you allow commercial use of your technology/technologies? • Yes • No

Economy

You have now reached the last question block, which relates to economic impacts.

Indicators	**Questions**
Cost-benefit analysis [yes/no and how broad]	42. Does/will your task conduct a cost-benefit analysis? • Yes • No [→survey to be continued with question 44] 43. Which assets (e.g. a specific product, service, tool) does the cost-benefit analysis cover? [Open answer] 44. Which risks and benefits have been included to the cost-benefit analysis? [Open answer]
Long-term Financial Sustainability	45. Will the long-term financial sustainability of the research activities and resulting outcomes be ensured after the end of RISE? • Yes, there is already a plan to guarantee it (e.g. follow-up European project, institutional-internal funding). • Not yet, but we are working on it. • No, we would like to, but have no support/funding • No, it is not important for our efforts.
Prevention of economic losses	46. To what extent do your research activities contribute to preventing economic losses due to earthquakes? [1= little contribution; 5= great contribution] • Provide input to establish seismic building codes or new standards for earthquake-resistant constructions (e.g. reducing the chance of damaged and collapsed building) • Contribute to insurance models • Increase the efficiency of emergency interventions • Facilitate rapid decision-making (e.g. how to distribute the resources after an event) • Contribute to the prevention of massive service interruption (e.g. through early warning systems) • Provide rapid information on building damages or others, leading to a faster recovery after an earthquake. • Lives saved • Other: _____

End of survey

Thank you very much for your responses to the survey. As this survey will be repeated at the end of the project, please write your suggestions for improvement or other comments in the box below.

[comment box]

In case of further questions, please contact Michèle Marti (michele.marti@sed.ethz.ch) or Nadja Valenzuela (nadja.valenzuela@sed.ethz.ch)