Increasing stakeholder engagement in research projects through standardization activities

Abstract

Purpose – This research assesses the implications of integrating standardization activities into European research projects to foster the engagement of project internal and external stakeholders and into different project stakeholder management theories.

Design/methodology/approach – This paper analyzes the integration of standardization and the engagement of project internal and external stakeholders in standardization activities in a multi-case study of four European Framework Program projects and with the projects ARCH and SMR in two separate case studies more deeply. The multi-case study mainly evaluates the stakeholder participation in 10 CEN Workshop Agreements. While in the two case studies, among other things, two project surveys are used to investigate how stakeholder engagement was supported by standardization activities.

Findings – The results show that standardization significantly supports stakeholder engagement and lead to a proposal on how standardization can support achieving stakeholder engagement goals in the different research project phases.

Originality/value – This research provides practical information for policy makers who support standardization as a tool for research, as well as for researchers and project managers who want to use standardization activities efficiently in research projects.

Keywords Standardization, research projects, internal and external stakeholders, stakeholder engagement, project stakeholder management

Paper type Research paper

1. Introduction

The European Commission (EC) has started its 9th Framework Programme (FP) Horizon Europe in 2021 with a budget of more than 95 billion Euros. In comparison to the 6th FP, which was conducted from 2002 to 2006, this is an increase of more than 75 billion Euros or about five times (EC, 2021). At the same time, there has been a greater focus on bringing research to market to achieve the EU's goals of international competitiveness and to foster innovations to improve our lives and create new jobs. In order to achieve this, the EC aims to further promote interaction with end-users and international organizations through its FPs, thereby improving the dissemination and exploitation activities of the FP projects among their target groups, which has been raised as a major issue for several years (EC, 2015).

As these collaborative research projects face several challenges and their success depends on implicit knowledge transfer between industry and academia (vom Brocke and Lippe, 2015), appropriate support activities are needed to interact with the projects' stakeholders. An appropriate and effective stakeholder management is therefore key for these projects. In this regard, especially the stakeholder engagement is a challenge, but it is crucial for bringing significant value to all relevant stakeholders and thus ensuring the projects' success (Lehtinen and Aaltonen, 2020). For research projects on topics such as city resilience that involve a relatively large number and variety of stakeholders, there is an urgent need to actively engage the respective stakeholders in the projects in order to develop tools that can subsequently be implemented by the affected stakeholders.

Several challenges have been identified in the literature on project stakeholder management such as the sustainability of engaging project externals like local communities (e.g. di Maddaloni and Sabini, 2022) or situations like Covid-19 pandemic that lead to difficulties in approaching project stakeholders (e.g. Köpsel *et al.*, 2021). Even as project stakeholders get used to consider more online tools for interaction, it is hard to approach them due to their limited time and priorities (Köpsel *et al.*, 2021). In addition, Gramberger *et al.* (2015) collected four other challenges: focus of stakeholder contributions to the main project researches; identify and select stakeholders that are representative for their domain; doubts on the stakeholders' qualifications to contribute to the research; and avoid stakeholders' tiredness of participation.

In order to support the interaction with relevant stakeholders and, at the same time, dissemination and exploitation activities of research projects, the EC has been promoting the integration of standardization into research projects in its FPs for several years and in the new, recently published EU standardization strategy (EC, 2018; EC, 2022). Standardization can help in research activities, among others, to keep up with leading technologies, as standards are part of the state-of-the-art in a specific subject; to support the transfer of project results into practice by developing new standards or provide input to existing ones, thus ensuring the sustainability of project outcomes; and to interact with a variety of stakeholders of the research subject, e.g. in Europe more than 200,000 experts are actively involved in standardization (see e.g. CEN-CENELEC, 2023).

The latter, in particular, is of great importance for addressing the challenges in stakeholder engagement outlined above. Standardization activities support verification of key project outcomes with project stakeholders, encourage interaction with a variety of stakeholders, involve experts of different nationalities through European and international standardization and motivates stakeholder participation through its simple and transparent process (Poustourli, 2016).

However, standardization is currently not a priority for researchers and new emerging companies, due to a lack of awareness on its benefits, insufficient resources or missing recognition of participation (EC, 2022). Awareness-raising activities such as the Standards+Innovation initiative of the European

standardization organizations CEN and CENELEC try to fill these gaps by, among other things, providing best practices and proposals for the use of standardization in research projects, and recognizing researchers' work with annual awards (CEN-CENELEC, 2023). Considering that standardization will play a greater role in the FPs in order to also achieve the above-mentioned EU goals, it is surprising that the current research literature pays little attention to this aspect and lacks studies on the impact of standardization on research projects, focusing for example on stakeholder engagement. As one of the few literatures, Radauer (2020) emphasized the lack of awareness on standards and the standardization process, the need to encourage interaction with a variety of stakeholders such as researchers during the standardization process, and the gap in research on how standardization addresses topics such as open innovation or technology transfer where stakeholder engagement plays a major role (e.g. Wayne Gould, 2012).

In summary, there are numerous challenges to engaging stakeholders in research projects in particular, and little research has been carried out on how standardization can help to address them. This research is addressing this gap by attempting to resolve the following research questions: Does the integration of standardization into research projects encourage stakeholder engagement? How can standardization support the interaction between project internal stakeholders and with project external stakeholders? To answer these questions, this research examines the integration of standardization and the number and motivations of project stakeholders involved in standardization activities in several FP projects on smart cities and resilience, as well as the engagement of stakeholders in standardization activities in two FP projects in more detail. Based on this analysis, implications of standardization on theories of project stakeholder management are presented.

This paper is structured as follows: Section 2 outlines relevant project stakeholder management and standardization research, followed by the research materials and methods for a multi-case study and two separate case studies in Section 3. The findings of the research are presented in Section 4, which leads to the proposal to enhance stakeholder engagement in FP projects through standardization activities. Section 5 highlights the main conclusions drawn from this research and provides an outlook on the relevance of standardization for future project stakeholder management.

2. Project stakeholder management and standardization

The management of project stakeholders has become into the spotlight due to the need of encouraging stakeholders to foster the uptake of project outcomes to the market, and thus to stakeholders being directly affected from the research. A project stakeholder can be defined as 'individuals, groups or organizations affected by the project or being in a position to influence the project' (Eskerod and Jespen, 2013). For the Project Management Institute (PMI, 2017), project stakeholder management includes processes for the stakeholder identification, the analysis of stakeholder expectations and their impact on the project, and the development of stakeholder engagement strategies. This confirms that stakeholder engagement is part of the overall stakeholder management process (Nair, 2020), so the literature on both aspects will consequently be considered. Stakeholder engagement itself can be defined as "aims, activities and impacts of stakeholder relations in a moral, strategic and/or pragmatic manner" (Kujala *et al*., 2022). Stakeholders of successful research projects typically include researchers, industry actors and funders, but also local authorities and end-users (Jiya, 2021). The nature of stakeholder engagement in FP projects has already been described in several studies related to smart and resilient cities, e.g. in projects on mobility, illustrating the positive impact of systematic, transparent and interactive involvement of academic institutions

(Bruzzone and Nocera, 2020); and on urban resilience, describing the successful linkage with co-creation and the need for further research in this regard (Baravikova *et al*., 2020).

The current literature on project stakeholder management is diverse, and covers topics such as stakeholder identification and analysis (Tampio *et al*., 2022), communication with key stakeholders (Brown *et al*., 2021), the importance of internal stakeholders for project success (Mugenyi *et al*., 2022), and the influence of external stakeholders on projects (Nguyen *et al*., 2023). The last two points show that for a successful research project, both internal and external stakeholders need to be considered in terms of stakeholder management (Derakhshan *et al.*, 2019). Especially in complex research topics such as smart cities or resilience, which are addressed in this research, the public and local communities play an important role as external stakeholders. While there are inclusive approaches to interact with them, there is a lack of methodology for comprehensive stakeholder engagement that includes both project internal and external stakeholders (di Maddaloni and Davis, 2017).

Another research line for project stakeholder management considers two perspectives: within the management "of" stakeholders approach, stakeholders are needed to fulfill the purposes of the project, whereas in the management "for" stakeholders approach, stakeholders are a source of ideas and are valued more (Huemann *et al.*, 2016). However, Huemann and Zuchi (2014) also identified the need to foster engagement with the stakeholders in a professional way and beyond the project. Therefore, more solutions for organizing a transparent project external stakeholder engagement are needed (Lehtinen and Aaltonen, 2020). Regarding knowledge creation in FP projects, lately, co-creation activities are more often integrated to collaborate with multiple stakeholders in a complex environment, however, intensive collaboration among stakeholders and timely dissemination are often lacking (Ruoslahti, 2020).

Although standardization activities can be a means to address the above issues regarding effective, sustainable, transparent and timely engagement and collaboration of project internal and external stakeholders, none of the identified articles consider standards or standardization in this context. There are different definitions for standardization such as 'activity of establishing, with regard to actual or potential problems, provisions for common and repeated use, aimed at the achievement of the optimum degree of order in a given context' (ISO and IEC, 2004) or which refer broadly to the process of developing standards by including all interested stakeholders (Goluchowicz and Blind, 2011). When referring to standardization in research projects, standardization refers to 'a process of using research project results for developing new standards or as inputs to existing standards' (Lindner *et al.*, 2021a).

Literature on standardization, research projects and stakeholder engagement or management is rare. For example, a search in the Web of Science, one of the two most important bibliographic databases in research (Pranckuté, 2021), in March 2023 using the search terms "stakeholder", "engagement" or "management", "research project", and "standardization" resulted in the identification of only 12 documents. Of these, only one article is about a research project on city resilience that had transferred research results into standards by describing the standardization process and stakeholders involved (Lindner *et al*., 2021a). Other articles such as Föhn *et al*. (2023) or Vaughan *et al*. (2012) focus on healthcare or medicine and use the term standardization for harmonizing approaches, but they do not refer to a formal standardization process. Furthermore, other authors such as Beccia *et al*. (2022) see the need for future standardization activities in the medical field, and Welege *et al*. (2023) target standardization bodies as participants in a city-related research activity.

Due to these limited results, literature was also considered which, apart from standardization, only deals with managing research projects or stakeholder engagement. For example, studies that focus

only on standardization and stakeholder engagement highlight the motivation of researchers and industry actors to participate in standardization (Blind *et al.*, 2018; Neshati and Daim, 2017) or describe the process of stakeholder engagement during the development of a standard on smart cities (Muse *et al.*, 2020). In comparison, the literature on standardization and managing research projects mostly focuses on the use of project management standards (e.g., Takagi and Varajao, 2022), even though these standards themselves give limited consideration to the issue of project stakeholder management (Eskerod and Huemann, 2013). Further literature, for example, describes the relevance of standards as a knowledge and technology transfer instrument in biotechnology research (Lorenz *et al*., 2019) or how standardization in general is integrated in European funded research projects such as on city resilience (Lindner *et al.*, 2021b). As outlined above, especially for complex topics such as smart cities and resilience, the success of projects depends to a large extent on interaction with the stakeholders concerned. Other articles on these topics and related to standardization activities mostly focus on the development of CWAs (e.g., Neubauer *et al.*, 2018) or the identification of standardization gaps or proposals of new standards (e.g., Javed *et al.*, 2020). The so-called Workshop Agreements, such as a CWA as a result of a CEN Workshop, are documents of the standardization system that can be developed in relatively quickly and easily during a research project. Due to their characteristics as open workshops and temporary committees, they are considered a valuable tool for stakeholder engagement (Poustourli, 2016).

In summary, while there is some literature on the research topic, no comprehensive study has yet been conducted to analyse how standardization supports the engagement of stakeholders (internal and external) in research projects in general and on the topics of resilient or smart cities in particular.

3. Methodology

This research has three study variables derived from the research questions that relate to the FP projects studied: (1) the integration of standardization, (2) the project stakeholders participating in the standardization activities, and (3) the engagement of project stakeholders in standardization activities. To investigate the first two study variables, four FP projects on smart and resilient cities and crisis management, as well as the 10 CEN Workshops that emerged from these projects, were analyzed in a multi case study. The goal of this multi case study was to obtain information on how standardization was embedded in the project (e.g. related to project structure, deliverables, kind of standardization activities performed, and alignment to other project activities) and to gather information about the number and motives of the project internal and external stakeholders participating in the CEN Workshops. For the third study variable, the two city resilience projects from the multi case study were additionally analyzed in detail as two single case studies to gain deeper and more valuable insights into how standardization activities such as CEN Workshops fostered stakeholder engagement and how it can support project stakeholder management and project activities. The research team, consisting of three researchers to ensure the validity and reliability of the analysis carried out, was directly involved in the CEN Workshops of these two FP projects, allowing data to be obtained from direct observation and the projects' library, thus also reflecting the strengths of case study research mentioned by Meredith (1998). The case study method has been successfully used in cases investigating the role of standardization, for example, in a federal research institute to explain the motives and barriers to participation in standardization (Blind *et al.*, 2018).

In the multi-case study, the FP projects ARCH (Advancing Resilience of Historic Areas Against Climate-Related and Other Hazards), DRIVER+ (Driving Innovation in Crisis Management for European Resilience), Smarter Together (Smart and Inclusive Solutions for a Better Life in Urban Districts) and SMR (Smart Mature Resilience) are assessed (ARCH, 2022; DRIVER+, 2020; SMR, 2018; Smarter Together, 2021). These projects were implemented between 2015 and 2022 and lasted between three and five years. They were selected based on their integration of standardization as integral project part in a separate task or work package, the number of CWAs they developed, the access of the research team to relevant data and the research team's interest in the research topics. Furthermore, SMR and ARCH were chosen as case-studies as these were the only projects of this research that established or implemented a 5-step standardization approach on integrating standardization and aligned standardization with the projects' co-creation activities, thus integrating standardization more systematically and in depth in the project activities (Lindner *et al.*, 2021b). The number of partners in these research projects varies a lot - while SMR and ARCH respectively have 12 and 15 partners, Smarter Together and DRIVER+ respectively have 29 and 30 organizations in their projects. A total of 10 CWAs were developed in these projects, with each project having developed at least one CWA. Based on the outcomes of the multi-case study and the two case studies, a proposal was created that promotes stakeholder engagement through standardization activities in research projects. Figure 1 provides an overview of the research methodology, the sources used and the four research outputs, whose analytical steps and methods are then described in more detail.

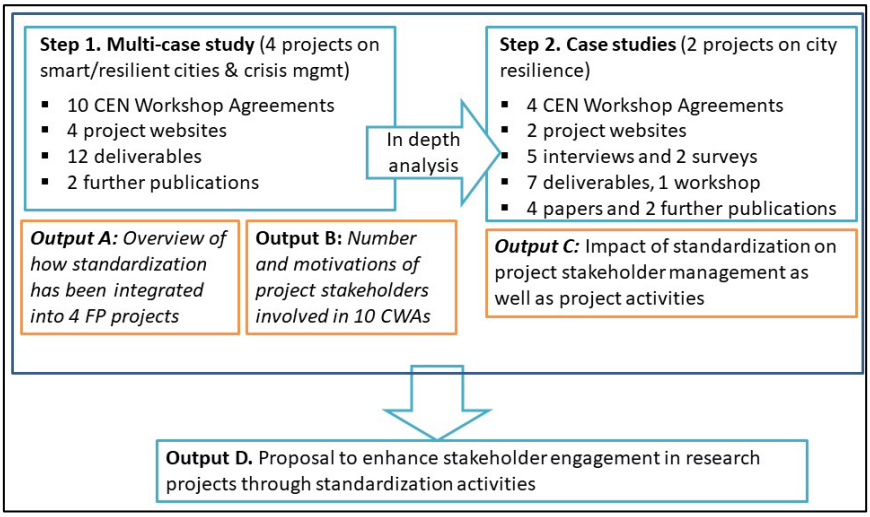

Figure 1. Overview of the research methodology

A mixture of qualitative and quantitative data analysis methods was used to examine the first two study variables. A total of 28 sources, including the CWAs themselves, project deliverables and websites, and scientific publications from these projects, were analyzed using content analysis (step 1 in Figure 1). The CWAs themselves were mainly used to collect quantitative (e.g. distribution, background) data on the project internal and external stakeholders who participated in the CEN Workshops. The resulting data was analyzed using Microsoft Excel to compare the number and type of actors and organizations (i.e. cities, research, businesses, consultancy, associations and policy), internal and external to the project, that were involved in the CWAs of the different projects and thematic areas. Furthermore, project deliverables and scientific publications of these projects supported in particular the collection of qualitative data on the stakeholder's motivations to participate in the CEN Workshops and the analysis of how standardization was integrated into the projects (outputs A and B in Figure 1).

In contrast, only a qualitative data analysis method was chosen for the investigation of the third study variable, which deals with the two case studies on the FP projects ARCH and SMR (step 2 in Figure 1). This analysis with a total of 27 sources (14 on SMR and 13 on ARCH), also considered, using content analysis, some other sources pertaining to these projects compared to the multi-case study, such as a survey within each of the projects, the results of a public workshop within ARCH and five interviews with ARCH project partners. Here, project deliverables and scientific publications supported the review of the standardization activities carried out, while the surveys and interviews were mainly used to collect direct feedback from project stakeholders on the impact of standardization on project stakeholder management and project activities. The survey within SMR was conducted online in 2018 at the end of the project and aimed to reflect the projects' standardization activities. It was answered anonymously with a response rate of 35% by 21 CEN Workshop members of 13 cities, six researchers, and two consultancies (Lindner *et al.*, 2021a). The survey had a dedicated part with 6 closed and 1 open question focusing on the experiences of taking part in the CEN Workshops, which provided valuable quantitative and qualitative information related to project stakeholder engagement. The overall results of this survey were published in a lessons learned publication (SMR, 2018). As part of the ARCH project, a workshop during the stakeholder dialogue held in June 2022 in Thessaloniki, Greece, was used to collect the opinions of the participants on the 5-step standardization approach implemented in ARCH. A total of 42 participants, including 34 representatives of cities or city networks, attended the interactive session of about 2 hours to share good and bad practices on standardization in research in general and for city resilience in particular. Furthermore, during the final event of the ARCH project in July 2022 in Hamburg, Germany, a written survey with seven questions (6 closed and 1 open) on the relationship between standardization and stakeholder management was distributed to the 57 participants. A total of 26 responses from 18 project internal and eight project external stakeholders were collected on the same day, which corresponds to a response rate of 46%. During the final event of ARCH, furthermore, five interviews with a total of eight project partner representatives from ARCH were conducted to gather dedicated further information on the role of standardization for stakeholder engagement. Each interview consisted of 1-2 open questions, the content of which depended on the specific role of the interviewees in the project and standardization activities, e.g. a researcher as tool developer, the chairman of the CEN Workshop or a city as end-user of the resulting CWA. The results from the survey and interview were transcribed into one document and used together with the other results of the two case studies to provide lessons learned on standardization activities for project stakeholder management and project activities as well as to relate them with relevant research (output C in Figure 1).

Finally, a proposal is made from the analyzes to improve project stakeholder management by considering standardization in the different phases of a research project (output D in Figure 1). The results are enriched by good practice references from the four assessed FP projects.

4. Results

4.1. Overview of how standardization has been integrated in four FP projects

The four FP projects Smarter Together (STO), DRIVER+ (D+), SMR and ARCH integrated standardization activities to foster, among others, the dissemination and exploitation of project results. Each of these projects involved a national standardization body that led the standardization activities. These activities varied in scope depending on the priority given to standardization in the project (e.g. as a work package or task), the amount of resources available for standardization in the project (e.g. number of project deliverables) and the alignment of standardization activities with other project

activities (e.g. with co-creation). As one of the main outcomes of the standardization activities, at least one CWA was developed in each project. Table 1 provides an overview of how standardization was embedded in the four FP projects assessed.

Table 1. Integration of standardization in four FP projects

Project	*SMR*	*ARCH*	*STO*	*D+*
Structure	*Work package*	*2 Tasks*	*1 Task*	*1 Work package*
# of Deliverables	*5*	*2*	*1*	*3*
Standardization activities	*3 CWAs*	*1 CWA*	*2 CWAs*	*4 CWAs*
Relation to other project activities	*Systematically aligned with co-creation activities*	*Systematically aligned with co-creation activities*	*Partly aligned with project events*	*Partly aligned with project events*

SMR and D+ are the two projects where standardization was integrated as a separate work package and the projects with a higher number of deliverables related to standardization (five and three respectively) and CWAs (three and four respectively). In contrast, the standardization work in ARCH and STO was split into one and two separate tasks, respectively, the results of which led to fewer deliverables (two and one respectively) and CWAs (one and two respectively). Of the total of 10 CWAs, four were on the topic of 'City Resilience' and initiated by the SMR and ARCH projects, two on 'Smart Cities' initiated by the Smarter Together project, and four on 'Crisis Management' initiated by the DRIVER+ project.

The two city resilience projects, SMR and ARCH, have aligned their standardization activities more systematically with the project by combining them with co-creation activities (Lindner *et al.*, 2021c). They used the above-mentioned 5-step standardization approach established in SMR and already partly validated in ARCH. It includes an analysis of relevant standards, a comparison of end-user needs with these standards to identify standardization potentials, the definition of a project standardization strategy, the initiation of standardization activities, and the dissemination and exploitation of the standardization activities (Lindner *et al.*, 2021b). It is also possible that the smaller number of project partners in ARCH and SMR facilitated the coordination of the standardization activities with other project activities such as co-creation. Here, the systematic and transparent process for developing a CWA can support the engagement of project stakeholders and the joint development of project outcomes in the co-creation activities. In contrast, standardization activities in D+ and STO were only partially aligned with other project-related events, potentially limiting greater stakeholder engagement in these projects.

4.2. Number and motivations of project stakeholders involved in 10 CWAs

The development of CWAs from the four FP projects required the support of project stakeholders who, compared to standards committees, could directly participate in the standards development without necessarily representing a broader or national interest (Poustourli, 2016). In summary, a total of 175 contributions were made to the 10 CWAs assessed, meaning that on average 17.5 individuals contributed to the development of a CWA. As for the professional background of these individuals, almost half were researchers and around a quarter each were representatives of cities or public bodies. Although more than half of the total contributors were project internal stakeholders, the majority of total contributing organizations were not from within the projects. In addition, the participation of

project external organization varies greatly between the CWAs with one quarter to almost three quarter. These projects deal with highly complex issues such as (city) resilience, so they need to include a variety of stakeholders. Thus, it can be acknowledged that 58% of the total contributors developed the four CWAs on 'City Resilience' initiated by SMR and ARCH projects, and just under a third provided input to the CWAs of D+ related to 'Crisis Management'. On average just fewer than seven project internal organizations contributed to a CWA. Furthermore, the involvement of project internal stakeholders is also influenced by the topics - while on average around 75% of the project internal organizations were involved in one of the CWAs on 'City Resilience', only between 16% and 17% of project internal organizations participated in a CWA on 'Smart Cities' or 'Crisis Management'. This may also be related to the total number of project internal organizations per project, which is about twice as high for the STO and D+ projects as for SMR and ARCH. Table 2 summarizes the quantitative results of the assessment of the CWA contributors.

Table 2. Assessment of contributors to the 10 CWAs

CWA number	**17300**	**17301**	**17302**	**SMR**	**17727**	**17381**	**17382**	**STO**	**17335**	**17513**	**17514**	**17515**	**D+**	**Sum**		**Sum***
Project (P)	**SMR**			**total***	**ARCH**	**STO**		**total***	**D+**				**total***	**%**	**Ave**	**%***
Contributors total	**34**	**23**	**9**	**50**	**35**	**12**	**7**	**18**	**17**	**17**	**11**	**10**	**48**	**175**	**17,5**	**151**
City/Public body	18	9	3	21	7	3	3	6	2	1	1	0	3	27%	4,7	25%
Research	8	8	4	17	21	6	2	7	12	10	7	2	27	46%	8	48%
Businesses	1	3	1	3	2	2	0	2	2	4	1	7	13	13%	2,3	13%
Association/Network	6	3	1	8	5	1	2	3	0	2	1	0	2	12%	2,1	12%
Consultancy	1	0	0	1	0	0	0	0	0	0	0	1	1	1%	0,2	1%
Policy	0	0	0	0	0	0	0	0	1	0	1	0	2	1%	0,2	1%
# P-Internals (INT)	**22**	**16**	**7**	**33**	**15**	**9**	**2**	**10**	**5**	**10**	**8**	**5**	**23**	**99**	**9,9**	**81**
# P-Externals (EXT)	**12**	**7**	**2**	**17**	**20**	**3**	**5**	**8**	**12**	**7**	**3**	**5**	**25**	**76**	**7,6**	**70**
% P-Internals	65%	70%	78%	66%	43%	75%	29%	56%	29%	59%	73%	50%	48%	57%		54%
% P-Externals	35%	30%	22%	34%	57%	25%	71%	44%	71%	41%	27%	50%	52%	43%		46%
# P-INT-Organizations	**11**	**12**	**6**	**12**	**9**	**7**	**2**	**8**	**3**	**8**	**6**	**3**	**11**	**67**	**6,7**	**40**
# P-EXT-Organizations	**9**	**6**	**2**	**13**	**13**	**2**	**5**	**7**	**8**	**4**	**3**	**3**	**16**	**55**	**5,5**	**49**
% P-INT-Organizations	55%	67%	75%	48%	41%	78%	29%	53%	27%	67%	67%	50%	41%	55%		45%
% P-EXT-Organizations	45%	33%	25%	52%	59%	22%	71%	47%	73%	33%	33%	50%	59%	45%		55%
Total % P-INT-Organ.	**92%**	**100%**	**50%**	**100%**	**60%**	**24%**	**7%**	**28%**	**10%**	**27%**	**20%**	**10%**	**37%**	**78%**		**47%**

*Legend: * = removing double entries; Ave = Average*

The participations in the CEN Workshops also depended on the approach for standardization in the projects themselves and the individual motivations. As seen above, projects like ARCH and SMR, which have used standardization in a more systematic and integral manner, have a significantly higher participation of project stakeholders in the CEN Workshops. Furthermore, the motivations for participation in the CEN Workshops were diverse, such as (each including an example):

- Having individual interest in the topic and being involved in developing a standard: one D+ project internal organization linked its participation to another project (DRIVER+, 2020)
- Exchanging experiences, challenges and good practices with others, enlarging the network, being invited to project events, transferring theoretical concepts into practical guidelines: respondents of the SMR lessons learned highlighted these and mentioned CEN Workshops as a protected space for exchange (SMR, 2018)
- Getting further input to research results and fill a standardization gap: as it was the case with the CWA 17727 on the DRM/CCA framework of the ARCH project (ARCH, 2022)
- Disseminating and exploiting the results of the research projects in a sustainable way: the Wiki on Smart City Solutions developed in the STO project was transferred to CWA 17381 in order to use it beyond the project (Smarter Together, 2021)

The analysis of the 10 CWAs has shown that standardization supports the integration of project stakeholders during the development, enhancement or validation of specific project results. Especially when it comes to complex and relatively young topics such as 'City Resilience', the number of project stakeholders within the CEN Workshops is relatively high, which shows that this topic is of interest for a large number of stakeholders and has potential for further research. However, the data also shows that in topics such as 'Smart Cities' or 'Crisis Management', the majority of project internal stakeholders aren't always part of the standardization activities. The lack of knowledge about the standardization process and the limited amount of resources for the project may be two reasons for this.

4.3. Impact of standardization on project stakeholder management and project activities: the cases of the SMR and ARCH projects

The previous section has shown that more stakeholders participated in the CWAs on 'City Resilience' than in the others. The SMR and ARCH projects have integrated standardization as an essential part of the projects' co-creation activities. Each of the five standardization steps carried out there brought benefits for the project stakeholder management, but also for project activities in general.

SMR project

As main outcome, the SMR project developed an operational framework for cities to provide guidance on local resilience planning and to support the cities' ambitions towards building resilience, with a focus on critical infrastructure interdependencies, climate change adaptation and social dynamics (Marana *et al.*, 2019). In order to enhance and validate the five project tools, a co-creation approach was implemented with support of several project internal research organizations, academic institutions and a city network to engage the seven project internal cities in the projects' pilot implementation and peer-reviewing phase. Furthermore, this circle of sharing and learning included seven project external cities that are already active in resilience networks to support the validation of the project tools (Lindner *et al.*, 2021c). These and further cities as well as other city resilience stakeholders were invited during project internal and external events to the projects' standardization activities, which were conducted in alignment to the co-creation activities. Due to the CEN Workshop process, it was possible to involve interested organizations easily throughout the whole standards development. For example, during the publication of the project plan of the CEN Workshop every interested organization could register for the kick-off meeting. Furthermore, participants of events organized by SMR like a stakeholder dialogue or an European Workshop on City Resilience, which included also the projects funded under the same call, could join directly the ongoing standardization activities without any hurdles. These activities led to the involvement of in total 50 representatives of cities and city networks, research organizations, and consultancies within the development of a CWA 17300 series on 'City Resilience Development'. In addition to all project internal organizations, more than half of the participating organizations were external, some of which came from sister projects and standardization committees. Additionally, as part of the projects' standardization activities, public and local communities were involved in city-level workshops with several city stakeholders to discuss, among others, the content of the CWAs. Both aspects prove that the standardization activities have fostered the integration of project stakeholders (Lindner *et al.*, 2021a). However, it was recognized that the later interested organizations joined the CEN Workshops, challenges such as constantly necessary introductions to the project tools and the overall resilience framework or the integration of results from other project external research arose. In summary, the combination of the standardization activities and the co-creation approach used in the SMR project ensured the engagement of

stakeholders in the development, enhancement and validation of project tools. Moreover, the entities involved within several workshops, survey and interviews were experts from local or national governments, academic institutions as well as public and private companies, thus representing the variety of stakeholders needed to address the complex topic of city resilience.

A lessons learned survey conducted at the end of the project provided among others information on the experiences of the CEN Workshop members. In comparison to the results of the multi-case study, it can be acknowledged that SMR was the only project in which all project internal organizations participated in the standards development. However, the CEN Workshop members highlighted in the survey the method of combining co-creation with the standardization activities, as 90% of the responses favored the successful interaction and exchange of experiences on city resilience between the project stakeholders during the small groups work. In addition, other benefits of participating in the CEN Workshops were mentioned with between 55% and 65% of the answers, such as a) widening the own network, b) sharing good and bad practices among the members, and c) getting to know other approaches for city resilience (SMR, 2018).

As specific lessons learned, the respondents stated, among others, the positive effect of standardization to understand common needs for city resilience and with the resulting CWAs to push other people of their organizations and networks to work towards city resilience more systematic.

ARCH project

The main result of ARCH is the combined Disaster Risk Management and Climate Change Adaptation (DRM/CCA) framework, which integrates all project tools to support resilience building for historic areas in response to effects of climate change and natural hazards. The project consisted of four project internal cities and several research organizations as well as a city network, which supported co-creating the project tools. Furthermore, another 12 cities were engaged in a mutual learning approach to foster the exchange of knowledge and good practices among the participating cities as well as to test and apply the resilience tools in these cities (Lindner *et al.*, 2021b). Similar to the SMR project, the CEN Workshop should be conducted in line with these co-creation activities and thus to provide the possibility to involve further stakeholders to enhance and validate the ARCH DRM/CCA framework. A total of 35 contributors approved the CWA 17727 on 'City Resilience', of which 20 were representatives of project external organizations such as experts from standardization committees. However, due to the pandemic situation the project internal organizations and CEN Workshop members could mostly only work remotely. In particular with regard to project internal organizations, it was challenging to engage them in the CEN Workshop, resulting in a participation rate of only 60%. Nevertheless, activities such as the stakeholder dialogue and final project event, both of which took place in person, enabled the exchange with all project internal and further project external stakeholders. In addition, a city-level webinar was conducted in a project city under the umbrella of the standardization activities with city stakeholders as well as public and local communities to collect feedback on the draft CWA 17727 (ARCH, 2022).

The survey within the ARCH final event has provided insights to the relation between standardization activities and project stakeholder management. About 60% of the respondents have stated that the standardization activities such as the CWA supported them quite a lot or very much to better understand the project tools (see Figure 2a). Especially the development of the CWA on the ARCH DRM/CCA framework has led to a fine-tuning of the project tools and was very useful for discussing and improving the framework itself. In total, 44% of the respondents agreed that standardization fosters the stakeholder engagement in general. However, almost half of the

respondents had no clear indication of whether standardization fosters stakeholder engagement or not (see Figure 2b). One of the reasons being, that many stakeholders are hesitant to participate in standardization due to it being a relatively unknown activity. It was perceived positively to get involved project external organizations from different backgrounds in the standardization activities, so that they could assist in the improvement and validation of one of the main project results. More than 50% of the respondents confirm that standardization can encourage the interaction with the public and local communities (see Figure 2c). Especially within the complex topic of city resilience, this can be seen as benefit, as the engagement of local stakeholders has previously been a difficult endeavor. However, 22% of the respondents think that standardization has only little impact on the engagement of this target group. As reasons for this were mentioned the lack of awareness of local communities on standards and the standardization process itself, or the specific topics of the standardization activities that not always affect these stakeholders at first glance.

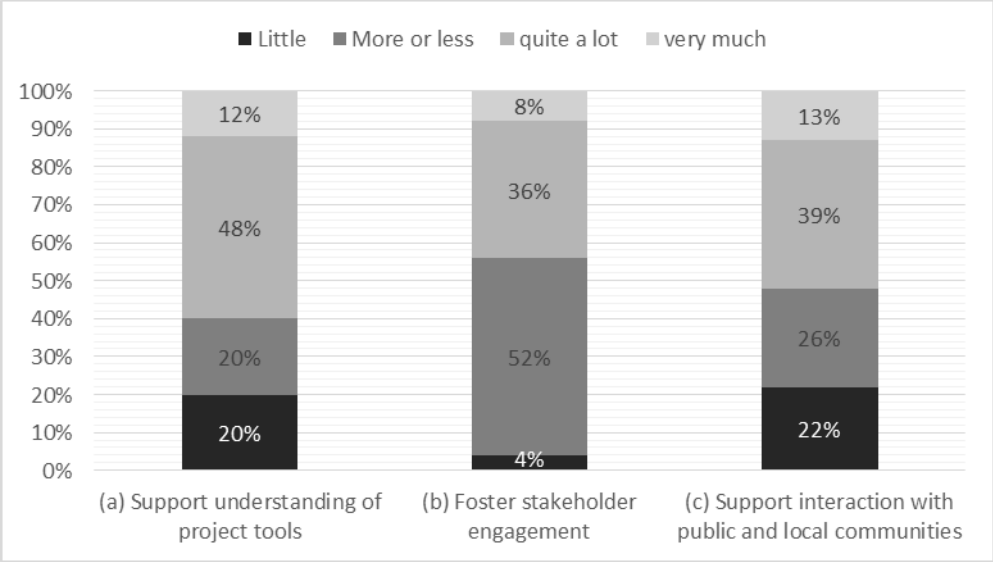

Figure 2. Different aspects standardization can support in research projects

With regard to the question, if the standardization activities support managing “of” stakeholders (as instruments to meet project goals) or managing “for” stakeholders (as source of ideas), 80% of the respondents stated that the standardization activities support the managing “for” stakeholders approach, which makes stakeholders feel more valued and encourages more open discussion. However, almost one third (32%) of the respondents think that both approaches are supported by standardization. Furthermore, the respondents stated that the selection of the approach highly depends on the different objective and case studies of the research project. As achieving the project goals is core for research projects, almost half of the respondents (48%) have favored the managing “of” stakeholders approach.

That standardization supports interaction between project internals and with project external stakeholders was confirmed by 46% of the respondents. Whereas, about a quarter each (27%) answered that standardization supports interaction between internals rather than externals, and vice versa. However, a critical perception was that it is often unknown to what extent the interaction is used by the project. Nevertheless, respondents rated the high proportion of project external cities that were involved in the development of the CWA as positive in terms of stakeholder interaction.

The five interviews with eight selected ARCH project partner representatives underlined the relevance of the standardization activities for stakeholder engagement and the co-creation of project

tools. With regard to the stakeholder engagement, the standardization activities supported the invitation of local city stakeholders to discuss the project results. The publication of the CWA in native languages such as Spanish and Italian also fosters collaboration with relevant stakeholders in these countries. For example, by having the CWA 17727 in their native language, the potential users of the tools described in this document, can easier understand its content and the value each tool has in the overall framework of establishing resilience for historic areas. In general, the dissemination activities are triggered by these translations, which will support the knowledge transfer and replication to other city stakeholders. The development of overarching documents such as the CWA 17727 have supported to bring the stakeholders of CCA and DRM together, which are usually disconnected and work separately from each other. Thus, the development of the CWA supports breaking the existing silos of a city. However, the challenges for cities of knowing who the main stakeholders and decision makers are on the specific topic, and how the standardization system and contributions to standardization work, persist. Furthermore, the interviewees stated that the projects' co-creation activities as well as the project tool developments could benefit from including standardization, especially at an early stage. Especially on complex topics such as city resilience, face-to-face meetings were seen as crucial to get more feedback on the project results and to foster interaction and networking between project stakeholders. Online meetings often lacked this kind of interaction, which was a serious issue during the Covid-19 pandemic in the last years (e.g. Köpsel *et al.*, 2021). However, it was mentioned that standardization has been identified as an appropriate tool to discuss project results in a set frame, which made the engagement with relevant internal and external stakeholders easier. The relatively high number of project external participants in the standardization activities was seen as little time-consuming, due to limited knowledge on the project tool in the beginning. Another issue was that the ARCH DRM/CCA framework was already available before the CEN Workshop started, so the project external CEN members could only react to this complete work and might be reluctant to make major comments on the main structure or to propose too many new elements.

Lessons learned from SMR and ARCH standardization activities for project stakeholder management and activities

Although both case studies faced different challenges, a similar approach was taken considering the 5-step standardization approach previously described (Lindner *et al*., 2021a). From the revision of these steps within the two case studies and within the workshop with project internal and external organizations carried out during ARCH's stakeholder dialogue, it was possible to extract the impact that each step has on project stakeholder management as well as project activities (see Table 3).

Table 3. Impact of 5-step standardization approach on project stakeholder management and activities

Standardization Activity	Impact on project stakeholder management	Impact on project activities
Step 1: Analysis of standardization landscape	Become aware of project external stakeholders from relevant standardization committees; identify the knowledge of project internal stakeholders in standardization	Definition of relevant terms supports creating a common understanding within the project; standards list as source of state-of-the-art and for new ideas to follow up
Step 2: Identification of end-user needs and	Supports relationship to and understanding of (different) views of end-users/project stakeholders to which project results are targeted to; identify further project external	Align the project activities with the overall project goal; re-assessment of (envisaged) project outcomes; identify further research topics

Standardization Activity	Impact on project stakeholder management	Impact on project activities
standardization gaps	stakeholders through standardization committees	
Step 3: Definition of standardization strategy	Using the standardization process to plan detailed engagement of stakeholders and align it with innovative engagement approaches	Increased value of co-creation activities by aligning with standardization activities
Step 4: Initiation of standardization activities	Foster interaction among internal stakeholders and with external stakeholders; involvement of all relevant stakeholders, thus having multiple perspectives on the project results chosen	Flexible tool for transfer project results to the market that can be implemented during the project duration; increased understanding and validation of project tools
Step 5: Promotion and exploitation of standardization activities	Translations of standardization outcomes supports engagement with further stakeholders and wider uptake of these standards; using standards supports benchmarking and comparison with other stakeholders	Further tool available to promote and exploit project results; increased opportunity to receive an award due to good standardization work conducted; ensures sustainability of project results

In addition, the results of the case studies and especially from the ARCH final survey provide recommendations to integrate the topic of standardization in project stakeholder management theories. For example, Huemann *et al.* (2016) presented the stakeholder management philosophies management "of" stakeholders and management "for" stakeholders and described their differences. Especially the management "for" stakeholders approach can be seen as appropriate for projects on city resilience, in which sustainability of developed tools is essential. Furthermore, this philosophy has significant relations to the way standardization activities such as CEN Workshops see stakeholder engagement in their processes. Similar to standardization, for example, is the view that this approach includes all relevant stakeholders to reach a win-win situation or consensus among them. The integration of the topic of standardization in this approach ensures that all relevant stakeholders are reached, their needs are taken into account and the transfer of project results to them or from research to practice is significantly supported. However, the ARCH survey shows that standardization supports both approaches, whereby the majority agreed that standardization supports mostly the managing "for" stakeholder approach. The managing "for" stakeholders approach increases the quality of project outcomes, but faces risks of high complexity due to managing different opinions of many stakeholders in a professional way (Huemann and Zuchi, 2014). Standardization activities such as CEN Workshops follow a systematic approach that promotes easy stakeholder involvement and builds on the long-established standardization system, which is why it is a suitable method to deal with the complexity. In addition, standardization saves human and financial resources needed when pursuing the managing "for" stakeholders approach, such as communicating with stakeholders and managing relationships with them, and supports gaining a competitive advantage, which is based on assessing the value of stakeholders (Harrison *et al.*, 2010), by gathering the knowledge of all different stakeholder during the consensus building process.

With regard to project internal and external stakeholders, Derakhshan *et al.* (2019) explained the different relationships of stakeholders, i.e. among internal stakeholders and between internal and external stakeholders, the role of the society's opinion in different types of projects and the lack of

studies on the relation among internal stakeholders with specific focus on commitment. Standardization addresses these issues and supports to the achievement of project goals to create value for the project organizations and society as a whole. Within research projects, each organization usually focuses first on its own tasks and the results to be achieved, which sometimes means that the overall project goal is lost from sight. Therefore, it is crucial to create value for internal stakeholders by addressing their demands and concerns, as well as gathering their knowledge and disseminating it appropriately (Derakhshan *et al.*, 2019). The standardization activities bring the internal stakeholders together, for example, to assess the different project results in terms of their maturity and market potential. In addition, the standardization system, with the public commenting possibilities, offers the general public an opportunity to express their individual needs and opinions on a specific topic, which can have a direct impact on the project results transferred to the standard. Especially when it comes to complex topics such as city resilience, it is important to involve the whole society (McClelland *et al.*, 2022), which the standardization process supports. The ARCH survey results confirm the importance of standardization in the relationships of the internal and external stakeholders.

Parts of the society are the local communities, which play a large role in the topic of city resilience and whose interaction with them is sometimes difficult to achieve. Including the opinions of local community at different project stages can help improve project performance, elsewhere there is a risk to project success if stakeholders' needs are not fully addressed (di Maddaloni and Davis, 2017). Complex topics such as city resilience in particular have global relevance and approaches to involving local communities and using different participation forms differ between different countries and in the different project phases (Xie *et al*., 2017). Therefore, the success of engaging local communities depends on a recognized, transparent and easily accessible approach. Integrating the above 5-step approach for standardization in research projects supports the capture of stakeholder needs as well as taking into account existing standards, both of which support the development of project outcomes. In addition, the standardization system operates globally, giving each country a voice if they are interested in the specific topic and want to get involved.

Besides positive effects on project stakeholder management, standardization in research projects can also have a negative impact. At first, it should be noted that this is an additional work in the project, the benefits and process of which are unknown to most project stakeholders and therefore a certain commitment to support may be lacking. Furthermore, the European standardization system may not allow the development of a specific standard when there is a conflicting standard on the same subject (Cornish and Christie, 2021). Potential ambitions of project stakeholders towards standardization can therefore be limited. In addition, the standardization process is transparent and ensures the involvement of all types of stakeholders, including the general public and society at large. Stakeholders' opinions, for example on format, content or general necessity, can lead to conflicts in the standards development, which can make standardization difficult and time-consuming (Heras-Saizarbitoria *et al*., 2017). With regard to research projects and their limited duration, however, conflicts in the standardization process can entail the risk of achieving the respective project goals in good time or losing focus on one's own research through being distracted by other research.

4.4. Proposal to enhance stakeholder engagement in research projects through standardization activities

Based on the analysis of the multi-case and two case studies, a proposal can be derived how standardization can support achieving the stakeholder engagement goals within the different project phases. Similar to the four assessed FP projects, typically five project phases are carried out for

achieving main project results (i.e. tools or solutions), covering project initiation, preparation, development and validation of the envisaged project results as well as their dissemination and exploitation. Project stakeholders play an important role in each of these phases, and standardization activities can help achieving the objectives of engaging them. Table 4 shows how standardization activities can enhance project stakeholder engagement.

Table 4. Standardization support to stakeholder engagement activities in the different project phases

Phases in research projects	**Required stakeholder engagement activities**	**Standardization support**
Phase A: Project start (setting the basis)	Create a common understanding of project topic at all project internal stakeholders; identify project external stakeholders	Create glossary for relevant project terms; identify relevant standardization committees
Phase B: Prepare tools development (assess end-user needs)	Verify project internal stakeholder needs and demands; gather needs from project external stakeholders	Contact relevant standardization committees, get the view of their experts, and establish an official liaison to strengthen relationship
Phase C: Tools development	Foster engagement of all project internal stakeholders; integrate especially end-users	Liaise with experts of standardization network; assess tool for transfer to a standard
Phase D: Tools enhancement and validation	Include besides project internal especially project external stakeholders like further end-users as well as public and local communities	Use standardization process in a co-creation method; including experts from standardization committees
Phase E: Dissemination and exploitation	Promote internally and to further external stakeholders	Sustainable global availability of standard; translations; regular revisions

In the beginning of the project, it is important to create a common understanding of the project topic among all project internal stakeholders to exchange project related theories, gain a similar knowledge level and have a shared vision on the project goals. This kind of setting the basis includes usually a state-of-the-art review, typically assessing literature, other research or recent relevant societal or environmental changes. Furthermore, project external stakeholders should be identified at this stage for future engagement. An assessment of the standardization landscape, including standards, ongoing standardization work and standardization committees relevant for the project, support the development of a glossary of key project terminologies that can be derived from existing standards (e.g. DRIVER+, 2020) and the identification of external stakeholders, as a variety of stakeholders are part of the standardization committees.

As next project phase, the needs of end-users of the envisaged project results need to be reviewed from the project internal stakeholder and verified by project external stakeholders. A part from considering the content of standards as state-of-the-art technology for the tool developments, the wide network of standardization provides a possibility to gather and verify the needs of project external stakeholders and in particular of potential tool end-users. Furthermore, project liaisons with relevant standardization committees are beneficially to foster the interaction with these committees (Lindner *et al*., 2021a). In addition, presenting the project goals and envisaged outcomes to the experts of the standardization committees prepare future joint standardization activities.

Within the tool development phase, all project internal stakeholders and especially end-users should be integrated to a certain extent ensuring that they all will benefit from the project tools. At this stage, standards with project relevance can be used and if needed contact to the ones having developed the standards can be established. Furthermore, standardization supports the assessment of the project tools and exchange with research projects working on a similar content (e.g. SMR, 2018). With its neutral position and its broad network, standardization fosters bringing the respective project internal and external stakeholders together. Based on the results of these exchanges, a standardization process such as a CEN Workshop can be initiated to transfer project tools into a standard.

In order to enhance and validate the project tools and prepare them for a future transfer into practice, further project external stakeholders and especially end-users as well as public and local communities need to be engaged. The standardization process can make a significant difference for this very important step, as it offers various possibilities to foster the engagement with a variety of stakeholders. During the initiation phase of a CEN Workshop, for example, the envisaged standardization activities are promoted and provide an easy to access possibility for any kind of stakeholder. The flexible and transparent format of a CEN Workshop allows further integration of stakeholders at any time and in different formats. In the topic of city resilience, for example, it is very important to exchange with the cities and with public and local communities, which both can be strengthened through the standardization activity in side-events such as webinars during the public commenting phase of the draft CWA (e.g. ARCH, 2022). Besides fostering the engagement between project internal and external stakeholders, which favor to share best and bad practices in a neutral environment, also experts from the standardization committees can be a significant trigger to relate project tools with existing standards or ongoing standardization work.

The sustainability of project results is of high importance, which is why appropriate dissemination and exploitation activities play a major role to allow implementation of project tools beyond the project. After finalization of the project tools, the outcomes need to be promoted within the project internal organizations and to further project external stakeholders. The nature of standards, to which some project tools have been transferred to, ensures that the tools are described such as it is needed by their end-users. Furthermore, the standard itself is globally available and will be regularly revised (e.g. Smarter Together, 2021). In addition, standardization can support the translation in different languages, which is fostering the uptake of the standards as it is often important for the end-users that the tool, respectively the standard, is described in their native languages.

5. Conclusion

This research has shown that standardization supports the engagement of project stakeholders in general and creates a framework to interact with project stakeholders, which positively answers the research questions posed. For example, the multi-case study has shown that through standardization activities like CEN Workshops, the involvement of project internal and external organizations to enhance and validate project results could be significantly increased. In some CEN Workshops, the participation of project external stakeholders reached more than 70%. However, the participants of project internal and external stakeholders differ between the assessed CEN Workshops and their topics ‘City Resilience’, ‘Smart Cities’ and ‘Crisis Management’. The two projects on ‘City Resilience’, which have integrated standardization more deeply in the project and have used the 5-step standardization approach (see Lindner *et al*., 2021a), have engaged much more project stakeholders as the other two projects. This increased incorporation of standardization in these projects may lead to the assumption that projects following such an approach are more engaged in standardization and can benefit from

more stakeholder involvement. Within the CEN Workshops initiated by SMR project, for example, all SMR project partners have participated in at least one of them, whereas in the Smarter Together project not even one third of the project partners contributed to either of their two CEN Workshops. The analysis of the two case studies, the ARCH survey and interviews has proven that standardization fosters project stakeholder engagement, thus confirming the outcomes of the multi-case study analysis. In general, the CEN Workshops on the topic of 'City Resilience' deriving from SMR and ARCH projects have benefit to different extents from their alignment with the projects' co-creation activities. Public events, such as the Workshop conducted in SMR with projects funded under the same call and further interested stakeholders, support to raise awareness on standardization in general and to gather interest for the upcoming project standardization activities. Furthermore, the analysis pointed out that standardization has dedicated impacts on project stakeholder management and supports related theories, such as from Huemann *et al*. (2016), di Maddaloni and Davis (2017) and Derakhshan *et al*. (2019), which can be enriched by including the standardization topic. Especially in complex topics, like city resilience, the engagement of stakeholders, and moreover the interaction with public and local communities, plays a crucial role for the projects' success. Standardization fosters the engagement with these stakeholders, which has been proven by the case studies. Furthermore, the summarizing proposal on how standardization can support stakeholder engagement in different project phases forms the basis for future research and project implementations.

In addition, due to the increased mention in calls of FPs, standardization as a tool to transfer project results into practice may move further into the spotlight. Consequently, FP projects might receive additional support through side effects of standardization, such as from assessing end-user views in preparation of the standardization activities or from interacting with further stakeholders via liaisons with standardization committees. Furthermore, successful project stakeholder management may become even more important, as FP research topics become increasingly complex and involve a variety of stakeholders. Common dissemination and exploitation activities for project results, such as conferences, workshops, scientific publications, patents, or online platforms (e.g. Blessing and Seering, 2016), are not enough to strengthen the relationship with stakeholders. A framework such as standardization provides a possibility to easily integrate and interact with project stakeholders and to support the transfer of project results into practice. However, as standardization within FP projects is quite a young topic, most researchers are not aware of the benefits it is providing. Therefore, awareness raising activities, such as the code of practice for researchers on standardization, may provide guidance on how to best use standardization for FP projects (EC, 2023). However, practical insights from FP projects that have implemented standardization as an integral part are even more crucial and urgently needed to exploit the standardization benefits for research projects. The literature on project (stakeholder) management will soon have to take up the topic of standardization more in-depth, which this research is contributing highly towards, as well as to research of how project stakeholder management can benefit from standardization, which there currently are no assessments of.

In summary, standardization can be an appropriate instrument to tackle challenges of project stakeholder management by, for example, support to identify and engage the right stakeholders as well as to avoid losing them (see Gramberger *et al*., 2015). However, due to limited standardization knowledge by project partners, which may hinder participation or in-depth contributions, and conflicting views that can enlarge the consensus process, which may be a big challenge for time-limited research projects, standardization in research projects can also be seen critical. The study has also some limitations, such as the limited amount of cases reviewed and the specific focus on CEN

Workshops for the stakeholder engagement analysis. However, as research lacks on studies showing the impact of standardization for project stakeholder management, this research can provide major implications for further research. It is novel and will fill the gap in the literature on research on the integration of standardization in research projects with a particular focus on stakeholder management.

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