Investigating Open Innovation Practices to Support Requirements Management in Software Ecosystems

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Abstract. Software ecosystems (SECO) affect requirements management when considering multiple actors (i.e., keystone, third-party developer, users) from different organizations using several communication channels such as issue trackers and forums. To deal with this scenario, professionals involved in requirements management in SECO have resorted to several open innovation (OI) practices. Our study aims to investigate OI practices applied to support requirements management in SECO. We conducted a field study based on interviews with 21 professionals involved in requirements management activities in SECO. We identified 10 OI practices to support requirements management in SECO and 14 communication channels to receive/provide requirements from/to external actors. OI practices identified in this study can help practitioners manage requirements in the SECO context in which they are engaged, making this process more informal, open, and collaborative.

Keywords: Open innovation · Requirements management · Software ecosystems · Field study

1 Introduction

Requirements management is a process that captures, traces, manages, and communicates stakeholder needs and changes throughout a project's lifecycle. This process is recognized as fundamental to ensure the delivery of adequate and quality software products [44]. However, new trends in software development, such as software ecosystems (SECO), have presented challenges for requirements management [20]. In SECO, multiple products are derived from a common technological platform based on a central architecture integrating other systems and forming a network of actors and artifacts [26].

The complexity and changing nature of SECO result in several new requirements based on ecosystem trends called emergent requirements that make requirements management difficult [20]. One reason is that multiple actors from different organizations communicate through multiple open communication channels [20]. In this challenging context, professionals involved in requirements management activities in SECO have resorted to open innovation (OI) practices such as co-creation, collaboration, and crowdsourcing.

Several works have addressed the relationship between OI and SECO and requirements engineering (RE) [9,21,24,25]. However, none identified which OI practices have been used to support requirements management in SECO. Implementing external requirements helps continuously to create more value for products and services in SECO [9]. In this work, we aim to investigate the use of OI practices to support requirements management in SECO. To achieve this goal, we conducted a field study based on interviews with 21 professionals involved in related activities in SECO.

Our results show that professionals commonly receive/provide requirements or requirements changes from/to external actors (e.g., customers, users, partners, third-party developers). We also identified that they use 14 communication channels to receive/provide these requirements and 10 OI practices to support requirements management in SECO.

The remainder of this paper is organized as follows: Sect. 2 presents the background and related work; Sect. 3 describes the research method; Sect. 4 presents our results; Sect. 5 present the discussion, implications, and threats to validity; and Sect. 6 concludes the paper with some final remarks.

2   Background and Related Work

Requirements management comprises comprehensive activities that record and maintain evolving requirements [16]. However, it is considered a challenge in SECO [42]. Opening requirements management to external actors is challenging because ecosystem professionals must keep requirements transparent between the keystone and external actors [17]. Hence, SECO represented a radical software engineering (SE) shift, influencing fundamental aspects such as openness, collaboration, and innovation [15,17]. Linåker and Wnuk [24] state that the OI paradigm may further explain this new context.

OI assumes that companies should use internal and external ideas and paths to market as they look to advance their technology [5]. Moreover, a majority of the innovation within a software has been increasingly reliant on OI [46]. In this scenario, RE needs to take the changes implied in the OI in regard and adapt to them [25]. Several OI practices have been used in software development, such as co-creation, collaboration, and crowdsourcing. These practices are classified into the main OI processes (inbound, outbound, and coupled) [4,31,38].

Linåker and Wnuk [24] propose a model for analyzing and managing requirements designed in the context of SECO that clarifies how requirements management can be adjusted to benefit from OI. Fernandez et al. [9] gauged how

common OI is in the RE practice and to what extent it is implemented. For the authors, receiving/providing requirements from/to external actors is common, but implementing requirements in an OI context can be challenging. Linåker et al. [23] propose a model that provides an operational OI perspective on what firms involved in open source SECO (OSSECO) should share, helping them motivate contributions by creating contribution strategies. Our study considers the OI practices cited in the related work presented in this section. Moreover, our study differs from them by investigating the perceptions of professionals involved in requirements management activities in SECO on using the OI practices.

3   Research Method

We conducted a field study as a research method to investigate the use of OI practices to support requirements management in SECO. A field study seeks to investigate how practitioners of some activity deal with the practice or solve problems within their respective contexts [34]. A set of techniques for data collection can be used in a field study, including interviews [33]. Hence, we performed semi-structured interviews based on recommendations for field studies [34] with professionals involved in requirements management activities in SECO.

Our research question (RQ) aimed to allow a researcher to obtain detailed information about participants' experiences, opinions, and perspectives on how they receive/provide requirements or requirements change from/to external actors in SECO and how they manage these requirements in OI context. Our RQ was: *How do OI practices influence requirements management in SECO?*

Data from semi-structured interviews are generally analyzed using qualitative analysis methods [32,34]. We applied coding procedures inspired by the initial Grounded Theory procedures [37] to analyze qualitative data and descriptive statistics to analyze quantitative data. We present the process for conducting the semi-structured interviews and our approach to analyze the results below.

3.1   Semi-structured Interviews

We initially developed an interview guide[1] with interview planning. Afterward, we conducted a pilot interview with one professional involved in requirements management activities in SECO. The pilot checked the questions' clarity and understanding and the estimated time to complete the interview. The pilot participant encouraged us to add the definition of each OI practice presented to clarify possible doubts of the interviewees. We point out that we do not use pilot data in our analysis.

We conducted 21 interviews between July and August 2023 with professionals involved in requirements management activities in SECO. Each interview lasted between 35 and 55 min. We used Google Meet[2] to record the interviews and

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[1] https://doi.org/10.5281/zenodo.10038855.
[2] https://meet.google.com/.

Google Docs[3] to transcribe them. We transcribed the interviews iteratively, and the researcher coded the interviews, always watching the original video during the coding process even though we automatically transcribed each recording. Hence, we ensured the best and most accurate interpretation possible of each interview. We also fixed errors in the transcripts generated automatically during the coding process. We divided the interviews into three parts:

i **Characterization of the participants**: We collected information about academic background and experience in industry;
ii **Presentation of the concepts used in the interview**: We presented the definitions of SECO, requirements management, and OI to ensure clarity and avoid any confusion or ambiguity about the meaning of each term;
iii **Questions about OI practices to support requirements management in SECO**: We asked participants about their familiarity with OI, whether they receive/provide requirements or requirements change from/to external actors, and how this happens. Finally, we asked what OI practices they use to support requirements management in SECO. In this last question, we used the strategy adopted by Greiler et al. [13]. Such strategy consists of initially obtaining answers without presenting any examples of OI practices (unguided impressions) and so obtaining them after presenting a set of OI practices identified in our related work (guided impressions). This set of OI practices encourages deeper discussion as well as encourages participants to consider practices not immediately remembered.

We adopted the concept of "saturation" to establish the number of interviews required in our study. A study reaches saturation when conducting a new set of interviews does not produce new emerging data [8]. According to Guest et al. [14], saturation can usually be obtained with at least 12 interviews. In our study, we interviewed 21 professionals. We reached saturation with 18 interviews, in line with the work of Guest et al. [14]. In each interview, we observed whether participants repeated earlier discussed topics. Interview recordings and transcriptions were continually revisited in an iterative process. As no new codes or insights emerged in three consecutive interviews, we realized our codes and insights were fully saturated and stopped recruiting new participants.

3.2   Characterization of Participants

We used convenience sampling to select participants for our study based on their being nearby and available [1]. However, we looked for diverse participants in terms of experience and contacted professionals involved in requirements management activities in SECO from our network by email and other communication channels (WhatsApp and LinkedIn). We also used snowball sampling, where early participants referred other professionals to participate in the study. In addition, we applied a questionnaire with the consent form and some questions

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[3] https://docs.google.com.

about the characterization of the participants[4]. All participants have experience in requirements management, SECO, and OI. This helps ensure that the selected sample is representative and relevant to the research goals. We assigned each participant a unique identifier (P1 to P21). Table 1 summarizes the information about the interview participants.

Table 1. Characterization of participants.

ID	Academic background in computer science	Experience in requirements management	Engagement in SECO	Participation in projects that use IO
P1	Master's degree	15 years	Yes	Yes
P2	PhD	25 years	Yes	No
P3	Specialization	10 years	No	No
P4	Specialization	10 years	Yes	Yes
P5	Specialization	3 years	I don't know	I don't know
P6	Master's degree	7 years	Yes	Yes
P7	Specialization	6 years	Yes	Yes
P8	PhD	9 years	Yes	Yes
P9	Specialization	10 years	Yes	No
P10	Master's degree	12 years	Yes	Yes
P11	PhD	5 years	Yes	No
P12	Master's degree	15 years	Yes	Yes
P13	Master's degree	8 years	Yes	No
P14	Master's degree	5 years	Yes	Yes
P15	PhD	30 years	Yes	Yes
P16	Specialization	13 years	Yes	Yes
P17	PhD	2 years	Yes	Yes
P18	PhD	2 years	Yes	Yes
P19	Bachelor's degree	10 years	No	No
P20	PhD	3 years	Yes	No
P21	Master's degree	15 years	Yes	Yes

Six (28,6%) of the 21 participants have between 2 and 5 years of experience in requirements management, eight (38,1%) have between 6 and 10 years, and seven (33,3%) have more than 10 years of experience. Some participants answered "no" or "I don't know" to questions about their engagement in SECO and participation in projects using OI. However, they confirmed involvement in these scenarios when we presented the concepts during the interviews. The participants had been engaged in 11 different SECO. We described[5] and classified them into proprietary[6] (7), open source[7] (3), and hybrid[8] (1) SECO.

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[4] https://doi.org/10.5281/zenodo.10038855.

[5] https://doi.org/10.5281/zenodo.10038855.

[6] In a proprietary SECO, organizations are concerned with keeping their assets protected by intellectual property [7].

[7] In an open source SECO, the keystone is an OSS community over a set of projects in an open-common platform [11].

[8] In a hybrid SECO, open source and proprietary practices are combined [26].

3.3   Coding Process

To analyze the interviews, we initially performed an open coding approach inspired by the initial procedure of the Grounded Theory [37]. During the open coding process, we divided the transcripts into coherent units (sentences or paragraphs) and added **preliminary codes** representing the key points each participant talked about. Subsequently, we defined a set of **focused codes** that captured the most frequent and relevant factors in the participants' perceptions. After performing open coding, we used axial coding described by Charmaz [3] to group the codes into **categories**. In these steps, we used the Atlas.TI tool[9] as support to create the codes and categories. Table 2 shows the example of the coding process for one transcript with resulting codes and categories.

Table 2. Illustration of the coding process.

Coherent unit: *"We have a collaborative flow in which cooperated members carry out this open innovation. They develop and ship the code to us. We can embed it in our code, but first, we understand, document, and specify that code."* (P11)

Preliminary code	Focused code	Category	Core category
We have a collaborative flow in which cooperated members	Collaboration	Coupled	OI practice

One researcher conducted and coded the interviews over in iterative cycles. The other three researchers, with more than 15 years in SE, double-checked the results and ensured the compliance of the final dataset. Moreover, we continuously revisited the interview recordings and transcripts in an iterative process.

4   Results

This section presents the results obtained in the semi-structured interviews performed in our field study that investigated the use of OI practices to support requirements management in SECO. We identified that most participants are familiar with OI, although some of them did not know it by such terminology. Moreover, participants use multiple communication channels to receive/provide requirements or requirements change and several OI practices to support activities related to requirements management in SECO. We detail our results next.

4.1   Communication Channels in SECO

We initially asked professionals about their familiarity with the OI concept. This question aimed "*to break the ice*" and verify the participants' perceptions about the subject. All participants rated their familiarity with the OI on a scale of 1 to 5, where 1 meant less familiar and 5 meant more familiar. One participant considered himself/herself in level 1, four in level 2, eight in level

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[9] https://www.atlasti.com.

3, three in level 4, and six in level 5. We identified many participants were unfamiliar with the term "open innovation". However, after we explained the concept at the beginning of the interviews, these participants reported they had already participated in projects that used OI. P13 highlighted: "*After your presentation, I realized I am quite familiar with the subject. I did not know it by that name, but I realized that we have this context of innovation in the ecosystem in which I participate*".

We also asked participants if they usually receive/provide requirements from/to external actors to the projects they have been involved in SECO. If yes, we asked how they received/provided them. In response, 20 of the 21 participants stated that they received/provided requirements or requirements change from/to external actors. Only one participant claimed never to have provided/received requirements or requirements change from/to external actors. However, this participant mentioned during the interview that they use a tool provided by keystone to clarify doubts, report bugs, interact with SECO members from other organizations, and send suggestions for improvements.

Regarding how the participants receive/provide requirements or requirements change from/to external actors, we identified 14 communication channels. Communication channels are mainly used to improve and maintain a project's presence in a SECO and ensure that projects share knowledge at the ecosystem level with several contributors distributed geographically that possess different interests [39]. Moreover, communication channels help enhance OI practices, connecting key stakeholders, such as customers, suppliers, or business partners, and collaborating in the development of new products and services [2]. We classify these communication channels into three categories: (i) open online communication channels; (ii) closed online communication channels; and (iii) face-to-face communication channels. We also added the number of participants who cited each code. Table 3 presents the codes and categories resulting from our analysis.

Table 3. Communication channels to receive/provide requirements or requirements change from/to external actors in SECO.

Open online	Closed online	Face-to-face
App store (2)	Emails (7)	Face-to-face meetings (6)
Forums (6)	Feedback systems (5)	Hackathons (1)
Issue/bug trackers (1)	Forms (3)	Product demonstrations (3)
Software repositories (1)	Help desks (3)	Technical visits (1)
	Instant messaging apps (3)	

Open online communication channels facilitate information flows between the multiple actors in SECO [20]. The open communication paradigm in SECO provides opportunities for 'just-in-time' RE [19]. Participants cited the use of forums, app stores, issue/bug trackers, and software repositories to

receive/provide requirements or requirements change from/to external actors in SECO. Forums, such as Stack Overflow, were mostly mentioned by the participants. P8 highlighted: "*We are looking at the Stack Overflow and are mapping if there are any requirements around a tool, a product, or a software that we will need to change*". According to Vevers et al. [43], to fully understand how a SECO works, the community needs to be studied as well, and this can be done by looking at issue/bug trackers and forums.

Closed online communication channels enable fast responses and can speed up decision making [35]. Participants also cited emails, forms, remote meetings, instant messaging apps, feedback systems, and help desks as channels to receive/provide requirements or requirements change from/ to external actors in SECO. Some participants highlighted the use of multiple closed online communication channels. P5 reported: "*For those who were not users of the tool, they contacted us in various ways, official letter, email, and even WhatsApp in an informal way*". According to Johnson et al. [18], helpful information could be obtained through analysis of these multiple channels in SECO, both by the platform provider and the partner apps in their innovation processes.

Face-to-face communication channels are stimulus rich, i.e., enable the use of senses (auditory, visual, tactile, olfactory, and gustatory) in verbal and nonverbal activities [28]. Participants mentioned face-to-face meetings, product demonstrations at conferences or for other organizations, technical visits, and hackathons to receive/provide requirements or requirements change from/to external actors in SECO. Some participants conducted hackathons to identify requirements from external actors in SECO. P8 shared: "*We run hackathons to obtain requirements that may be important for new products or products already on the organization's roadmap*". According to Valença et al. [40], a hackathon can be seen as a strategy to support SECO evolution, enabling a company to gather new developers for its ecosystem, assess the software platform by identifying bugs, and verify to what extent the requirements for applications are fulfilled.

4.2   OI Practices to Support Requirements Management in SECO

Our main objective was to identify OI practices to support requirements management in SECO through interviewing professionals. As described in Sect. 3, we iteratively coded their responses to the question: "*What open innovation practices have you used to support requirements management activities in software ecosystems?*" and grouped them into categories. Thus, we identified ten OI practices that support requirements management in SECO (Table 4). We identified eight OI practices in the unguided impressions, i.e., at least one participant mentioned the OI practice before we presented the set of OI practices. Only two OI practices (open source and coopetition) were mentioned exclusively in the guided impressions.

We categorize OI practices according to OI processes (inbound, outbound, and coupled) [38]. Inbound OI seeks knowledge from external sources (e.g., suppliers, customers, competitors, and partners). Outbound OI explores internal

knowledge externally. Coupled OI is a process where knowledge can flow inbound and outbound through active collaboration with partners to innovate. Table 4 shows the ten OI practices used to support requirements management in SECO, their categories, and the total number of participants that cited them. Below, we detail the OI practices identified in the study.

Table 4. OI practices to support requirements management in SECO.

Outbound	Inbound	Coupled
Open source (6)	Crowdsourcing (7)	Collaboration (17)
Venturing (1)	Hackathon (8)	Co-creation (6)
	University research grants (2)	Coopetition (3)
	Customer immersion (2)	
	Outsourcing R&D (2)	

Customer immersion is a collaborative innovation practice that focuses on the customer's experience of using products or services [38]. Participants highlighted intense interaction with customers at events or agile ceremonies to identify requirements or requirements change. According to Gassmann [12], customer involvement is the principal constituent of OI. P18 mentioned: "*For more important customers, they sent invitations to events where they would expose the platform or software and received feedback them*".

Hackathons are events with an element of competition, where participants work in teams over a short period to ideate, collaborate, design, rapidly prototype, test, iterate, and pitch their solutions to a determined challenge [10]. Some participants stated that hackathos are OI practices that support requirements management in SECO. These participants mentioned that they carry out or participate in hackathons to identify ideas, emerge and define requirements, create synergy between partners, and train different SECO actors. Hackathon is one key practice to enable OI [10]. P6 mentioned: "*When I want ideas or to understand a topic, I organize hackathons. Hackathon is cool because we listen to several ideas and select them*".

Crowdsourcing consists of outsourcing processes, traditionally carried out internally, to an indefinite, generally large group of people [38]. Participants mentioned that crowdsourcing allows several SECO actors to contribute to requirements management. P1 stated: "*We have crowdsourcing when several groups come together. Our ventures come together to fund ideas*". P18 commented: "*We used crowdsourcing to let the crowd say what was best about the system*".

Outsourcing R&D consists of R&D services hiring from other organizations [41]. Participants said they worked in organizations that provided R&D services to keystone. P9 highlighted: "*The company I work for was hired as responsible for credit-related systems. When I need to request a change in systems not under our supervision, for example, customer or internal code systems.*

I speak with [omitted] (keystone), but not with the companies responsible for these systems".

University research grants consist of funding external research projects by researchers and scientists in universities to access external knowledge [4]. Some participants shared that keystone offered research grants for SECO members to carry out requirements management activities. P9 shared: "*The government has a digital transformation project that has injected resources into [omitted] (keystone). So, [omitted] (keystone) opened a call for grants for analysts and developers from the other organizations that are part of the ecosystem to work on the development of some module*".

Venturing is defined as starting up new organizations drawing on internal knowledge, and possibly also with finance, human capital, and other support services from your enterprise [41]. Some participants reported that the companies they work for sometimes create new companies to meet specific requirements of the common technological platform or customers. P1 claimed: "*We have a group of ventures that support each other for innovation initiatives and initiatives to meet requirements and provide solutions for customers*".

Open source aims to reveal internal technologies without immediate financial rewards for indirect benefits to the company [45]. Some participants highlighted that they identify changes to product requirements they develop by participating in open source initiatives. P14 reported: "*I participated in a project that used open source last year. We had an algorithm that made this automatic match between investors and startups. So, we helped other developers because it was something nobody could do, and our company got feedback*".

Co-creation refers to the contribution provided by the consumer to the process of creating value for the company, allowing the consumer to actively contribute to designing, analyzing, controlling, and evaluating products and processes [38]. Some participants commented on the active participation of customers in requirements management in SECO. P1 shared: "*We have some key customers who contribute to our activities and give us feedback*". P14 stated: "*We are a design-driven company. Co-creation is what we do*".

Collaboration involves internal resources operating in different business areas and extends to integrating external resources to define and develop innovative projects [38]. Several participants mentioned that collaborating with other organizations allows identifying requirements change, clarifying doubts, and implementing new features. P10 shared: "*A partner institution came to us so that we could clarify some doubts about the functioning of the systems and make some business comparisons to implement new functionalities*".

Coopetition is characterized by a balance between cooperative and competitive forces [6]. Some participants reported that there are direct and indirect partnerships between competitors in SECO. Thus, some organizations need to compete in requirements prioritization. P18 mentioned: "*I observed coopetition when there were conflicting requirements between keystone's partners. They were indirect partners because they evolved the platform and used each other's solutions. However, they competed when it came to developing and sending add-ons*".

5   Discussion

From the answers obtained in 21 interviews with professionals who carry out requirements management activities in SECO, we identified how these professionals receive/provide requirements or requirements change from/to external actors and which OI practices are used to support these activities. We discuss our main results next.

Regarding the **communication channels** used to receive/provide requirements or requirements change from/to external actors in SECO, we identified that professionals use open online, closed online, and face-to-face communication channels. The relationship between open communication channels, requirements and SECO has already been investigated in the literature [20,22]. Knauss et al. [20] state that open communication channels allow transparent communication between developers and customers and are important for exploring RE practices in SECO. Linaker et al. [22] mentioned open communication channels, open requirements management, and active ecosystem engagement as resources to enable an open collaboration in SECO. Hence, open communication channels allow OI practices that influence open requirements management in SECO.

In our study, P8 cited that he analyzes forums such as Stack Overflow to identify possible requirements. In the same direction, Knauss et al. [20] stated that some internal stakeholders even actively track open communication channels of other actors to identify crosscutting problems without this task being formally assigned to them. For the authors, open communication channels have shown their value for building communities over healthy ecosystems. Moreover, these channels offer an exciting opportunity to improve scalability by facilitating decentralized "just-in-time" RE and supporting agile development.

Regarding **OI practices** to support requirements management in SECO, we observed that SECO and OI are related mainly to collaboration between different actors (including external actors) over a common technological platform. Jansen [17] defines OI as a focus area of SECO governance. The OI focus area is concerned with sharing knowledge across the ecosystem to feed external developers with new possibilities for improvement, also known as niche creation [17]. Hence, the OI focus area directly relates to requirements management.

Our results also show that OI practices influence how requirements management is carried out. Fernandez and Svensson [9] stated that OI as part of the RE process is becoming more and more fully explored from both the inbound and outbound. Several participants of our study highlighted the informality of OI practices to support requirements management in SECO. Linåker and Wnuk [24] considered RE in OI and presented the open RE concept. The open RE is informal, transparent, decentralized, distributed, and collaborative [24]. According to the authors, open RE is informal to different degrees, including the level at which requirements are managed.

5.1   Implications for Practitioners and Researchers

Implications for Practitioners. First, practitioners can identify in this study communication channels used to receive/provide requirements or requirements change from/to external actors in SECO. This can assist them in the development of strategies for using these communication channels to identify requirements or requirements change in the SECO they participate. Second, practitioners can identify in this study OI practices used to support requirements management in SECO. Hence, they can analyze whether they can use them in their context.

Implications for Researchers. We also identified implications for researchers in our study. First, the set of communication channels used to receive/provide requirements or requirements change from/to external actors in SECO identified in this study can be useful to researchers investigating requirements flows in SECO. Second, the set of OI practices to support requirements management in SECO presented in this study can be investigated in the context of other RE activities in SECO. Moreover, it can also be useful in research on emergent RE contexts such as crowd-based RE, open RE, and cross-domain RE.

5.2   Threats to Credibility and Reliability

In contrast to quantitative studies, qualitative studies are more prone to threats to credibility than to validity [13,29]. The matters of validity and reliability in qualitative research rely on the meticulousness, thoroughness, and honesty employed by the researchers throughout the data collection and analysis processes [30]. Thus, we outline the potential threats to external and internal credibility in the following.

Internal credibility refers to the credibility of interpretations and conclusions within the underlying setting or group [27]. Interpretive validity is a potential threat to the internal credibility of this study. During interviews and transcripts, there is a risk that researchers will impose their interpretations rather than understand participants' perspectives. We mitigated this threat by asking clear questions to participants and encouraging them to reflect deeply on their answers. In addition, while the first author of this study did the main coding, the other three authors, with more than 15 years in SE, were extensively involved in cross-checking the results and ensuring the compliance of the final dataset.

External credibility refers to the degree to which the findings of a study can be generalized across different contexts [27]. The number and experience of interviewed participants are a potential external threat to this study. We mitigate this following the same strategy of other works [13,29,36] that conducted field studies with software developers. These works considered the recommendations of Guest et al. [14] that saturation in semi-structured interviews can be achieved with at least 12 interviews. Hence, we conducted interviews until we reached saturation. We conducted 21 interviews, and we emphasize that no new categories or codes emerged in the last three interviews, indicating that saturation

was reached. In addition, we selected professionals with different background and experience in requirements management activities in SECO. This contributed to a more significant variety of information with different perspectives.

6   Conclusion and Future Work

This paper addressed the following RQ: *"How do OI practices influence requirements management in SECO?"*. We performed a field study based on interviews with 21 professionals to investigate the OI practices used to support requirements management in SECO. We identified that the use of multiple open communication channels by internal and external actors allows different OI practices, such as hackathons, crowdsourcing, co-creation, collaboration, and open source, which provides knowledge sharing across the ecosystem. Hence, we conclude that OI practices affect requirements management in SECO, making it more informal, open, and collaborative. As future work, we can investigate the impact of specific OI practices on requirements management in SECO, such as crowdsourcing. We plan to identify how crowd feedback affects requirements management in SECO. Furthermore, future work should consider the impact of the different types of SECO (open, proprietary, or hybrid) for using OI practices to support requirements management.

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