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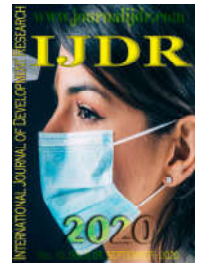
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RESEARCH ARTICLE

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## TOWARDS A SPONSOR'S ROLE FOR SUPPORTING REQUIREMENTS ENGINEERING PROCESS IN OPEN INNOVATION PROJECTS

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### ABSTRACT

Presently, globalization is causing companies to be more competitive, and one of the ways this can be achieved is through the use of Open Innovation Projects (OIPs). Although considerable research has been devoted to Open Innovation (OI), rather less attention has been paid to how the OIP sponsor deals with limited resources to implement the requirements of the OIP. The purpose of this paper is to investigate the concerns and challenges that the sponsor has in supporting the requirements engineering (RE) process to meet the OIP requirements. A qualitative study was conducted to investigate five companies in the automotive, steel, oil, health and electric power industries. The findings show that there is an evolving role for the sponsor to carry out the RE which is different from the OIP when the OIP first started. This is because the analysis of the requirements in OIP is constantly evolving during the project, and thinking about the requirements in the management phase of the OIP also needs to evolve to reach a solution. The findings can help future stakeholders to better set requirements for their OIPs as well as to proactively address problems of inadequate collaboration and empathy of the participants in OIP.

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### INTRODUCTION

Presently there is a great interest in private companies to undertake open innovation in order to become more efficient in their operations, and, thus, gain competitive advantage over their competitors. Open innovation is defined as a distributed innovation process based on purposely managed internal and external knowledge flows across organizational boundaries (Chesbrough and Bogers, 2014). But how to achieve a successful OIP is always an unclear path. There is no established playbook for open innovation. It is still described and practiced differently by different industries and individual teams (Gilbert and Holoubek, 2018). Some Open Innovation Projects (OIPs) include projects based on: 1) collaboration with innovation centers and research institutes, 2) start-up collaboration, 3) crowd-sourcing, and 4) competition of ideas. In this research, OIPs propose new ways for a company to operate or to solve its problems in six weeks and offer a practical experience for stakeholders as well to identify talent and provide a rapid prototyping environment for sponsoring companies. The final outcome of a successful OIP can result in improved technology, a better product, a more efficient concept for operations, a better idea how to solve problems, a new prototype or a new service, etc (Fernes-Walch, 2017).

Some recent studies have also focused on the past, present, and the future of open innovation (OI), for example in (Bigliardi et al., 2020) and (Fernandes et al., 2019). Those studies identified some thematic areas explored in OI, among which are OI management, OI and networks, OI in small and medium-sized enterprises, collaborative frameworks, organizational dimensions of OI, and external search for OI. Although considerable research has been devoted to OI, for instance in (Yin and Pfahl, 2017), (Yin and Pfahl, 2018), (Yin and Pfahl, 2019), (Linaker et al., 2015), (Linaker and Wnuk, 2016), (Linaker, 2011), (Fernandez and Svensson, 2017), rather less attention has been paid to the how the sponsor role is collaborative to seek the external ideas (outside firm) in the OIPs. This paper is to study how the sponsor role is collaborative to seek the external ideas that are considered promising and innovative in the OIPs. Every project is based on the requirements that define the needs of the stakeholders and form the basis for project planning (Dick et al., 2017). Requirement is defined as a condition or capacity necessary for a user to solve a problem or achieve an objective (IEEE, 1990). Although this definition has been applied to the context of software systems, it is general enough to also be applied in specific non-software situations (Loucopoulos and Karakostas,

1995). Some authors differ slightly in the number and the phases of RE. Sommerville declares that RE has five phases: 1) requirements elicitation, 2) requirements specification, 3) requirements validation, (4) requirements documentation and 5) requirements change (Sommerville, 2016). On the other hand, Lamsweerde asserts that RE has four phases: 1) domain understanding and requirements elicitation, 2) evaluation and negotiation, 3) specification and documentation and 4) requirements consolidation (Lamsweerde, 2012). Finally, Pressman claims that RE has seven phases: 1) inception, 2) elicitation, 3) elaboration, 4) negotiation, 5) specification, 6) validation and 7) management (Pressman and Maxim, 2015). There is growing interest in assessing open innovation at “human side” level than the company (Bogers *et al.*, 2018) as well as examine open innovation at the project level (Brunswick and Chesbrough, 2018), (Bagherzadeh *et al.*, 2019). Project success can be seen by analyzing improvements in budgeting, scheduling and performance of employees, and client satisfaction (Pinto and Slevin, 1988). Team effort can contribute to project success when the project sponsor's role is well understood. In some projects, the team does not even know who the sponsor is or what the project's success criteria are. Many sponsors are too busy to pay attention to their own project (Schibi and Lee, 2015). Causes of project failure are frequently due to inadequate sponsor support (PMI, 2014), a lack of stakeholder involvement (PMI, 2018), and inadequate cooperation between sponsors and stakeholders (Lhuillery and Pfister, 2009). Moreover, it is also necessary to deal with some challenges such as the “Not-invented-here” (NIH) problem (Bogers *et al.*, 2019), incomplete requirements (Chen *et al.*, 2019), new personnel competencies, e.g., facilitative leadership (Jantunen *et al.*, 2019), needs to focus on the social dimension of systems and their environments (Yu *et al.*, 2011).

A project can also fail to be successful because of its temporary nature and the ad hoc role of the project manager. His authority is typically insufficient to deal with organizational challenges to change. The sponsor needs to address this problem if the project is to succeed (Verzuh, 2016). A project sponsor needs to be a person or group that provides adequate resources and support for the project and is accountable for enabling success (PMBOK, 2017). Studies of the sponsor's role and his support to RE process in OIPs are scarce. For this reason, this qualitative study was conducted to investigate the role of the sponsor in supporting RE process in OIPs. It focuses on the automotive, steel, oil, health, and electric power companies with the propose of helping the OIP process to deliver solutions that have a real impact. The paper is organized in the following way. Section 2 presents related works. Section 3 describes the background of the OIP. Section 4 describes the qualitative study design. Section 5 presents the qualitative study execution. Section 6 reports a discussion about the findings. Section 7 suggests validity threats of this study. Section 8 presents the lessons learned, section 9 presents the conclusions and future work, and section 10 presents the references.

**Related Work:** The work in (Melo *et al.*, 2020) investigated how an organization can build an open innovation project management capability. That capability can be built through a process of four phases: closed mode, open driver, vanguard project, and project-to-organization. The work investigated the historical processes brought by the company's case and the insights they bring to project management (PM) and OI fields.

The work in (Sivam *et al.*, 2019) examined settings for the Open Innovation field and concluded that conditions, namely company's culture, leadership and strategy, are the main drivers for in the open innovation research, highlighting the role of company culture as the most important one. The work in (Brown and Townsend, 2013) studied strategies of how leading companies carry out OIP. The sponsor's role is of central importance for bringing about a shift in the company's culture regarding openness and collaboration with external partners. The study concluded that PM helps the innovation process to produce outputs that achieve productive organizational strategies and deliver the intended business results. The work in (Zheng, 2019) studied 655 Chinese manufacturing companies and found that the individual, organizational and environmental values of the CEOs influenced how the OIP results would be implemented in the company. That work investigated the “human side” in an OIP.

The work in (Yin, 2019) proposed a method called Open Innovation in Requirements Engineering (OIRE) to help software companies gain a better understanding of user needs and greater satisfaction with existing products. Requirements analysis is often used to determine which candidate requirements of a feature should be included in a software release. The work in (Zynga *et al.*, 2018) revealed that many organizations which have conducted open innovation pilot projects have often had good results from the implementation of the findings in the project, but only a few companies have succeeded in embedding OI in the entire organization as a regular practice. This work stated that a central reason for this failure may be due to a lack of understanding about how to develop open innovation competencies. The main contribution of our work is a model that describes a better understanding about the sponsor's role for supporting the RE process in an OIP, and we deal with the lack of open innovation competencies. We also focus on the importance of implementing the OIP requirements by the participants in order to have a successful project.

## Background

An open innovation project is a project developed by a company in which they contract a team of participants from the OIP institute for six weeks to execute a project to investigate how the contracting company can improve some aspects of its operations. Our OIP was performed from January 7<sup>th</sup> to February 15<sup>th</sup> in 2019. An OIP consists of a multidisciplinary team of participants, a project manager, a business mentor, a technology mentor, a design mentor, and a sponsor mentor from the company. At the end of the six weeks, participants present the final project in a pitch session which can be a physical or digital study or prototype of a solution for the sponsoring company's problem. OIP has the following steps: 1) definition of the target audience or customer, 2) identification of possible solutions, 3) definition of the solution, 3.1) definition of the approach, 3.2) unique value proposition, 4) status report, 5) final delivery and report, and 6) the pitch session (final presentation). In addition, OIP has other non-mandatory steps: value proposal canvas, validation of ideas, tests and validation of ideas, a minimum viable product (MVP), and a business model. In this context, our OIP had twenty-three team projects, ninety-two participants, eleven sponsoring companies, and one thousand registrations in this edition.

## Qualitative Study Design

OIP is an empirical endeavor because it consists of phenomena in the real world of business, not a theoretical textbook problem. It is appropriate to use qualitative methods for investigation in these projects. The approach for this qualitative study was based on Yin methodology (Yin, 2016).

This study begins with the definition of the research question (RQ): How does the sponsor support the requirements engineering process in an open innovation project (OIP)? Four questions needed to be answered, and their propositions and hypotheses also needed to be examined:

RQ1: What are the activities of the sponsor related to the requirements engineering process in the OIP?

Proposition for RQ1: The sponsor carries out activities of the elicitation, specification, validation, documentation, and management phases of RE.

Hypothesis for RQ1: Activities such as providing a clear problem, evaluating the OIP, and providing feedback help to understand the scope, volatility, and constant changes in requirements of the OIP.

RQ2: According to the sponsor, what are the challenges that influence the OIP?

Proposition for RQ2: The sponsor faces the challenges of interdisciplinary contexts that influence the OIP.

Hypothesis for RQ2: Challenges such as sufficient empathy, motivation, and collaboration among the participants are the sociotechnical aspects that influence the OIP.

RQ3: According to the sponsor, what are the important tasks in the OIP?

Proposition for RQ3: The sponsor supports important tasks for helping the OIP team to propose solutions.

Hypothesis for RQ3: Tasks such as motivation of the developers, engagement of all stakeholders, and evaluation of the OIP progress are correlated with the continuation of the OIP.

RQ4: What are the concerns in the OIP from the sponsor's point of view?

Proposition for RQ4: The sponsor deals with the concerns about the implementation of the proposed solution for solving the problems in the OIP.

Hypothesis for RQ4: Concerns such as the impact of the proposed solution, feasibility of the OIP, to application of the solution in the context of the company's culture, and the scale of the solution are all correlated with technical issues in the OIP.

A qualitative study was designed as shown in Figure 1. The sponsor of the OIP was chosen as the unit of analysis because the research question is directly related to the expression of phenomenon at the working level in the OIP.

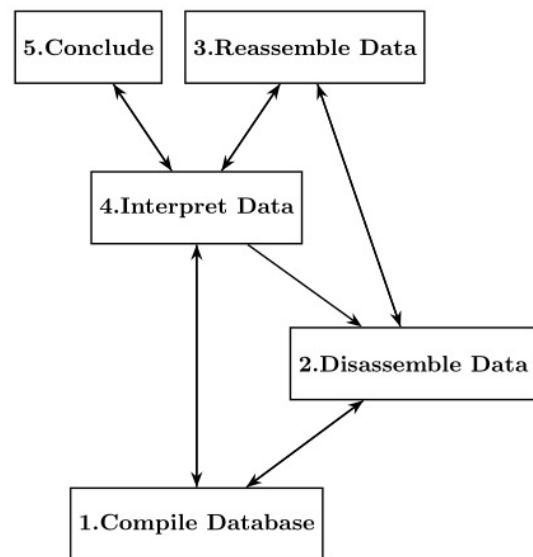


Figure 1. Phases of analysis and their interactions

We used a protocol for the interviews with twenty-eight general questions<sup>1</sup> and a questionnaire<sup>2</sup> in a five-point type Likert scale with eleven specific questions. The questionnaire was based on the tasks related to the pre-OIP, OIP in process and post-OIP phases, according to (Hjalmarsson et al., 2017). This study considered eleven tasks that are showed in the table 3 as well as the reliability calculation of the questionnaire used, e.g. Cronbach's alpha. According to Yin methodology, the minimal number of cases to be studied in a research project that can identify similar and different patterns in the data is 4 to 6 (Yin, 2014). This study interviewed five sponsors from different areas as seen in Table 1. The transcribed interviews from the multiple case studies were inductively coded and categorized with RQDA<sup>3</sup> tool and open coding. In this context, within-case analysis of each of the five sponsor's interviews were performed. Analysis with cross-case synthesis to select categories or dimensions was done, and then examination of similarities or differences between the data from the cases was undertaken (Eisenhardt, 1989). A potential threat to validity comes from observer bias. This study addressed that threat by participant reflections and reflections by external reviewers of the data (Tracy, 2020). Some excerpts from the member reflections can be seen in this link<sup>4</sup>.

Table 1. The sponsors of the OIP

Sponsor	Industry	OIP Type	OIP Theme	Age	Sex
alpha	steel	local	Efficiency of station.	23	M
beta	automotive	global	Non-testing regression.	38	M
gamma	oil	regional	ICT services.	34	M
delta	health	regional	Chronic patients.	38	F
epsilon	electric power	regional	Efficiency of system.	32	M

## The Qualitative Study Execution

**Phase 1: Compile Database:** The objective was to compile a database to organize the qualitative data in a systematic

<sup>1</sup> <https://github.com/FabrizioBF/research-data-project/blob/master/scripts/open-innovation-project-interview-script.htm>

<sup>2</sup> <https://github.com/FabrizioBF/research-data-project/tree/master/questionnaire-answers>

<sup>3</sup> <http://rqda.r-forge.r-project.org/>

<sup>4</sup> <https://github.com/FabrizioBF/research-data-project/blob/master/excerpts-from-the-member-reflections/excerpts-from-the-member-reflection.html>

fashion before formal analysis started. This phase was composed of: (1) a topic (what are you going to study? Answer: an open innovation project), (2) a data collection method (how are you going to collect the data? Answer: recorded interviews and questionnaire) and (3) a source of data (where are you going to get the data that are to be collected? Answer: from an open innovation project).

**Phase 2: Disassemble Data:** The second phase called for breaking down the compiled data into smaller fragments. In this phase, we used the following: RQDA tool and open coding. The process began with an open coding of the interviews which involved attaching in vivo codes to pieces of text that are relevant to a particular aspect of the study. After coding the transcriptions, the codes were reviewed in order to identify similarities. The codes arising from each interview were constantly compared to codes in the same interview. From the constant comparisons of the codes, we grouped them into categories that represented activities that were performed by the sponsor support requirement engineering in the OIP. An excerpt of interview from the alpha sponsor is the following: "In this new open innovation project, we have to be careful to develop a theme that people can understand and that they can come up with solutions for us in six weeks.". Excerpts from interviews with other sponsors can be seen in link<sup>5</sup>.

**Phase 3: Reassemble Data:** The third phase can be considered a reassembling procedure. The codes that emerged from all sponsor interviews after coding are related to his role in the OIP context. The hierarchical strategy was used for displaying the data according to Yin methodology (Yin, 2016).

**Phase 4: Interpret Data:** The data interpretation were produced in this fourth phase for the alpha, beta, gamma, delta and epsilon cases. After that, a meta-matrix table was used for drawing cross-case analysis. The principle activities and concerns of the sponsors in this study and what they see as the challenges as for them to address can be seen in Table 2. The sponsors see as the most important tasks in the OIPs as for them to address can be seen in Table 3. The data inform that OIPs have collaborative tasks between sponsors and participants. The sponsor undertook support RE process with activities and tasks that were discovered in different phases and stakeholders of the OIP, as shown in Table 4. Reliability analysis was conducted in order to assess the internal consistency of the questionnaire. The reliability of the tasks for the OIP as measured by Cronbach's alpha method is given in Table 3. Keeping in mind that the items measured in the OIP tasks are ordinal variables. A threshold value of 0.70 represents acceptable reliability. The majority of tasks exceed this threshold value.

**Phase 5: Conclude:** Five central categories<sup>6</sup> emerged from this study: sponsor, partner, activity, concern, and challenge which can interpret as a model to understand the sponsor's role in supporting the RE process in an OIP. The findings of this research show that there are different possible activities for participants in an OIP to define the problems in the RE. After a mutual understanding of the problems to be addressed, the sponsor and the partners then formalize a confidential partnership, and the proposed solutions which now become the responsibility of all the participants. The activities showed in the table 4 came from the interviews data.

Table 2. Cross-case analysis I

Case	Activity of the Sponsor	Challenge of the Sponsor	Concern of the Sponsor
alpha	To provide a clear problem(RE1), To prepare for the meeting(RE2), To study the artifacts(RD1), To evaluate the project(RV1), To align sponsor expectations(RE3).	To be open minded. Sufficient empathy. Lack of experience in OI. To have a culture of innovation. Sufficient level of motivation.. Sufficient collaboration. Willingness to take risks.	Traditional company. The impact of the solution proposed. Feasibility of OIP. Process of OI. To scale the solution.
beta	To adapt the open innovation(RE5), To evaluate the project(RV3), To provide feedback(RE6), To analyze lessons learned(RV4), To coordinate the team(RS3).	Budget restrictions. Lack of know-how. Market demand. Sufficient empathy. Lack of experience in OI. To have a culture of innovation. Sufficient level of motivation. Sufficient collaboration.	Continuation of the solution. Feasibility of OIP. To scale the solution. The impact of the solution proposed.
gamma	To present the problem(RE7), To provide information(RE8), To prepare for the project(RE9), To provide feedback(RE10).	Lack of clarity of the problem. Quality of the weekly results. Sufficient empathy. Lack of experience in OI. Sufficient level of motivation. To have a process of innovation. Sufficient collaboration.	Avoidance of bias in the solution. Continuation of the solution. Feasibility of the OIP. To scale the solution. The impact of the solution proposed.
delta	To identify the problem(RE13), To defend the business plan(RE16), To analyze the lessons learned(RV7), To prepare for the project(RE15), To prove the benefits(RE14).	Sufficient collaboration. Conflicts between personeel. Sufficient empathy. Lack of experience in OI. To have a culture of innovation. Sufficient level of motivation. Lack of multidisciplinary team.	Continuation of the solution. Feasibility of the OIP. To scale the solution. The impact of the solution proposed.
epsilon	To present the problem (RE19), To provide information(RE20), To prepare for the project(RE21), To provide feedback(RE22), To analyze lessons learned(RV9).	Adequate competency of the team mentor. Sufficient collaboration. Sufficient empathy. Lack of experience in OI. Sufficient level of motivation. Qualification of the partners. The company's commitment. To have a culture of innovation.	To apply the solution in the company. Continuation of the solution. Feasibility of OIP. To scale the OIP. The impact of the solution proposed.

The tasks showed in the table 4 came from the questionnaire data, which sponsors ranked some of them as the most important tasks in the OIPs.

## DISCUSSION

In the RE process of the OIP, the sponsor has many activities, tasks, concerns and challenges, see Tables 2 and 3. One rationale for this is that it is difficult to set requirements from the many different and complex contexts typically encountered in the field. The Table 4 presents the phases of the RE process available for the OIPs as well as activities and tasks identified that were positive in this type of project.

**Table 2. The reliability of the questionnaire in the OIP**

Task	Cronbach's alpha
t1:setting goals (RS1),(RS4),(RS7)	0.76
t2:engagingstakeholders (RE11),(RE17),(RE23)	0.72
t3:designing the OIP (RS2),(RS8)	0.77
t4:developing the support platform (RS9)	0.69
t5:motivating developers (RE4),(RE12),(RE18),(RE24)	0.75
t6:managing coordinated operations (RS5),(RS6),(RS10)	0.73
t7:evaluating the contributions of the OIP(RV6),(RV8),(RV10)	0.72
t8:evaluating the progress of OIP (RV2),(RV5),(RV11)	0.81
t9:developing a strategy for continuing the OIP (RC1),(RC2),(RC6)	0.81
t10:designing or adapting the a business model (RC3),(RC7)	0.68
t11:managing barriers to innovation (RC4),(RC8)	0.69

**Table 3. Cross-case analysis II**

Case	RE Phase	RS Phase	RV Phase	RD Phase	RC Phase
alpha	RE1,RE2 RE3,RE4		RV1, RV2	RD1	RC1
beta	RE5,RE6	RS1,RS2, RS3	RV3, RV4, RV5		RC2
gamma	RE7,RE8, RE9,RE10, RE11,RE12	RS4,RS5	RV6		RC3, RC4
delta	RE13,RE14, RE15,RE16, RE17,RE18	RS6	RV7, RV8		
epsilon	RE19,RE20, RE21,RE22, RE23,RE24	RS7,RS8, RS9,RS10	RV9, RV10, RV11		RC6, RC7, RC8

The sponsor also has other activities and tasks in the RS<sup>7</sup> and RV<sup>8</sup> phases of the OIP in almost equal numbers, however, with different objectives. One reason is that the focus is on the technical implementation and validation of the proposed solutions. The sponsor has few activities in the RD<sup>9</sup> phase due to the short duration of the OIPs, and his focus is to gain satisfactory results and does not include extensive documentation. Finally, the sponsor has other important activities in which they need to design strategies that fit their own business model in order to continue the OIP in the RC<sup>10</sup> phase, which is the requirements management planning. The sponsor's role in the OIP includes activities and tasks such as

shared interfaces similar to those of a business analyst, a requirements analyst, or a product owner. The project sponsor's role is not limited to the activities of the RE<sup>11</sup>, RS, RV, and RD phases that correspond to the defined ongoing requirements. Concomitantly, the project sponsor's role evolves in an environment of changing requirements in the RC phase of the OIP. There is an evolving role for the sponsor to carry out the RE process which are different at the start of the OIP and at end of the OIP. This is because the analysis of the requirements in the RE, RS, RV, RD phases evolve and the thinking about the requirements in the RC phase also need to evolve. The sponsor is central to building a true partnership in OIP activities in order to align the expectations of the sponsor with OIP. Regarding RQ1 sponsors need to define a clear problem, provide feedback to the partners, analyze lessons learned, provide clear information about the problem, defend the business plan and provide proof of the benefits for the company. These activities can help improve requirements elicitation, analysis and validation with the external partners and facilitate the implementation of successful solutions to defined problems.

Regarding RQ2, sponsors need to be aware of and should be focusing on the challenges that can influence OIP such as the receptiveness of the partners to new ideas, know-how of the partners, needs of the company's markets, need for a multidisciplinary team, needs to understanding innovation culture and the production of quality weekly reports. The focus on these things can reduce misunderstandings and conflicts, and facilitate the execution of new solutions and ideas. The company's genuine commitment to OIP is essential for building a culture of innovation. The essential tasks in every OIP should be known by the stakeholders and considered for application. In regard to RQ3, the five sponsors considered the following tasks very important. Setting goals, designing the OIP, evaluating the progress of the OIP, evaluating the contributions of the OIP, creating strategies to continue the OIP, motivating the developers, and engaging stakeholders in the OIP. These last three tasks differ slightly from a traditional paid project.

A rationale for this is that the OIP is open to participation to people from outside the company with different backgrounds, skills, and ages. Finally, regarding RQ4 concerns about OIPs for most companies investigated was not the available budget, but rather was the application of the new solutions proposed by the OIP to put into action. The cost of an OIP is not high and is easily available in the company's budget. The alpha, beta, gamma and epsilon sponsors were satisfied with the results (solutions) achieved in their respective OIPs. They also attributed the success of the solutions proposed to the collaborative work carried out with the participants as well the aligning with teams to meet the requirements during the weeks. Currently they also are internally working on the improvements of the solutions proposed in six weeks. However, the delta sponsor was not satisfied with the result achieved in the OIP. One reason for it is that a novice team was selected to work on the problem related to health industry. The team not attended the sponsor's expectations in the end of project. In this context is important to inform that that OIP has a rule that is not allowed to participate experienced professionals in favor to students and novice. Overcoming the rigid thinking of the traditional company culture, however, is a

<sup>7</sup>Requirements Specification

<sup>8</sup>Requirements Validation

<sup>9</sup>Requirements Documentation

<sup>10</sup>Requirements Change

<sup>11</sup>Requirements Elicitation

much bigger concern when trying to successfully implement the suggestions of the OIP. Traditional company culture usually does not encourage innovation in its operations. Frequently, there is a feeling that open innovation is only made by small and agile companies. Another important concern is the participants' bias in favor of their proposed solutions. The reason for this is that participants are not mature and savvy about solving real problems.

**Threats To Validity:** Threats to the internal validity of this study come from the influence of the human factor. The findings could be different if we analyzed the data related to military, aerospace, nanotechnology, and biotechnology industries because there is much classified information and secret processes. Threats to the external validity are related to the small sizes of the samples that limit the generalizations of the findings of this study. The results reported in this work are associated with the particular context of the sponsors in OIPs studied. The assumption of this research is that OIPs have similar settings, and thus, other researchers can benefit from the contributions of this paper. Construct validity refers to identifying correct operational measures for the OIP being studied. This work investigated how the sponsor supports the RE process in an OIP. This research used five sources, created a case studies database that consists of an evidentiary base and the researcher's reports about the cases. This study establishes a chain of evidence regarding the specific questions, propositions, hypothesis, as well as the interview protocol and questionnaire that helps answer the research question. The internal consistency value of the questionnaire was calculated as acceptable by using the Cronbach's alpha.

**Lessons Learned:** The OIP sponsor must understand and be able to clarify and summarize the results of the project for his colleagues if the OIP is going to be successfully executed. It is not easy to bring about big changes in a company's operations. Few works exist that describe changes actually put into practice because of suggestions made in an OIP at any level of detail. Therefore, this qualitative study explored the OIP phenomenon and uncovered ways of working with the OIP sponsor related to supporting requirement engineering. The following lessons are essential for researchers facing this OIP:

1. The importance of understanding the active and collaborative role of the OIP sponsor.
2. OIP presents challenges and concerns to requirements engineering phases.
3. OIP will push the sponsor out his comfort zone.
4. The participants must be empathetic with the problems facing the company.
5. The sponsor must take an active role in maintaining a high level of motivation for all participants to work on solving the company's problems.
6. The sponsor must take into account the collaboration of the external partners.
7. The sponsor needs to be receptive to feedback from the OIP.
8. The sponsor needs to consider the impact of the solution proposed for the company.

**Conclusion and Future Work:** There is a lack of understanding the nature of OIP requirements engineering, how it differs from the traditional project requirements engineering, and the challenges it raises, e.g. insuring the active role of the sponsor, the short lead time for delivering

results, participants with different backgrounds and skills, and the importance of empathy, collaboration, and motivation of the participants. Perhaps the biggest challenge is for the sponsor to work collaboratively with the project manager, and the business, technology, and design mentors to manage new and changed requirements in the OIP as it develops. For fulfilling the RQ, this study has identified that the sponsor needs to support requirements engineering through activities which include requirements elicitation, specification, validation and management phases for dealing with problems that arise. Active sponsor engagement in these phases can increase the team's ability to successfully fulfill the OIP requirements. The collaborative work with external partners in the OIP, especially from the science, technology, engineering, mathematics (stem) and humanities, arts, and social sciences (hass) need to be emphasized as well. In this study, the activities of the sponsor that supports RE process in the OIP and that answers the RQ1 are focused mainly on the requirements for the elicitation, specification, and validation phases. There are also essential activities focused on requirements for the management phase at the end of the six weeks of the OIP. There are a few activities for the sponsor in the requirements document phase. For answering the RQ2, this study identifies challenges that influence the human aspects of the OIP such as presence or lack of empathy, motivation, collaboration, and innovation culture. In addressing the RQ3, this study also identifies important tasks in the OIP. These tasks focus on requirements elicitation, specification, validation, and management phases. Finally, for addressing the RQ4, this study identifies the sponsor's concerns in the OIPs. These concerns are mostly the continuation and feasibility issues of the solution proposed during the six weeks. In addition, we highlight the following issues as future work: to investigate the motivation of the people to participate in OIPs, including the sponsors, the mentors, and novice, to study how to assess the work in progress in the OIPs, and to examine the level of sponsor's engagement in the effective application of solution proposed in the company.

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