Risk Response Strategies for Collaborative University-Industry R&D Funded Programs

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Abstract. Universities are centers of knowledge in our societies and their role when it comes to innovation has become more important over the years. Companies have several reasons to engage in research collaborations with universities, namely to gain access to innovative technologies. University-Industry R&D collaborations are expected to play an important role in regional economies, and to fulfill the industry's demand for innovative products, technologies and processes. However, the knowledge on what are the potential risks resulting from these collaborations and the risk response strategies to reduce the negative risk impacts and to enhance positive risk impacts is still limited. Thus, this paper aims to fill the gap in literature when it comes to risk identification and risk responses' planning, by identifying, based on a case study analysis, 19 potential risks and 53 potential risk response strategies.

Keywords: University-industry collaboration, Risk identification, Risk responses, Program and project management, R&D funded programs

1 Introduction

University-Industry (UI) Research and Development (R&D) collaborations have been increasing over time, especially in the last couple of decades, accompanying the globalization of economy and the increased complexity of industrial systems [1, 2]. These are encouraged by the government as a mean to increase national competitiveness and wealth creation [3]. Several reasons make companies want to engage in research collaboration with universities. Perkmann et al. [4] identified 4 main reasons: 1) many public programs for R&D funding request the involvement of universities; 2) companies need to have access to research and critical skills, which allow them to reach the very edge of technology and to push it further; 3) companies aim to improve their problem-solving competences and academic researchers are hired to resolve problems; and 4) these collaborations result in several other benefits, e.g., capturing talented collaborators and increasing the enterprise's reputation and visibility. Tartari and Breschi [5] identified that the main motivations for researchers to engage with industry is the access to equipment and additional research resources.

adfa, p. 1, 2011.

While the literature provides some guidance on how to manage programs and projects [6] and on Risk Management (RM) [7, 8], the specific context of UI collaboration, with multiple stakeholders and a complex governance model, demands a strong research effort to produce effective guidelines. There are additional challenges to be addressed with a UI consortium structure [9], since PM is highly dependent on the organizational context [10]. UI collaborative research projects face various challenges, since they are generally associated with high uncertainty and risks, significant pressure in terms of creativity and innovativeness, individually-oriented employees, and project members which are settled at different locations [1, 11]. The cultural gap also presents a threat that can cause conflicts over ownership of Intellectual Property, interfere in academic freedom to publish, and create different priorities, time horizons and areas of interest [12].

This paper aims to present and discuss the results of an exploratory study applied to a case study R&D program that covers several projects, and that has joined a company and a university in a research and technological development initiative targeting critical R&D regarding the development and production cycle of advanced multimedia systems for the automobile industry, in order to answer two research questions: (RQ1) What are the potential risks in UI R&D collaborative funded programs? (RQ2) What are the key potential risk response strategies to manage the identified risks?

This paper follows a commonly used structure. The second section discusses RM concepts. The third describes the research methodology applied in this study. The fourth section presents the main findings that emerged from this study. Finally, the conclusions and suggestions for future work are discussed.

2 Risk Management

The Project Management Institute (PMI) defines risk as "an uncertain event or condition that, if it occurs, has a positive or a negative effect on a project's objectives" [13]. The definition of risk includes both uncertain events which could impact the project negatively (threats), as well as those which may cause positive effects on the project's objectives (opportunities) [8]. However, this study focuses only on the negative risks.

The researchers focused on two RM processes in this study: (a) Identify Risks and (b) Plan Risks Responses. The (a) process aims to determine which risks may affect the project, as well as document their characteristics [13]. Key stakeholders should participate in risk identification activities to define responsibilities over the risks and their planned responses. During the project life cycle, some risks may evolve, and other may arise, so it is necessary to meet with key stakeholders on a regular basis [13]. The (b) process goal is to develop strategies to reduce negative impacts and enhance positive impacts on project objectives. It addresses the risks according to their exposure, adding activities and resources to the budget and adjusting the project schedule [13].

3 Research Methodology

An exploratory research was carried out in one UI R&D collaborative program case study, aiming to learn from the experience of program and project managers and other program stakeholders. The research methods applied to the case study were document analysis, participant observation and unstructured focus groups.

The analysis of several documents was conducted to better understand the case study context and to identify risks, namely the established governance model, the management register that holds the identified risks and issues, among other aspects of the program, as well as several documents that supported the management of the program and its projects.

Participant observation plays an important role in the context of this research. It is a complex research method because it often requires the researcher to assume different roles and use several techniques to collect data, without forgetting her/his primary role [14]. The observer enters the social world of those to be observed and attempts to participate in their activities by becoming a member of their workgroup, organization or community [15]. Different stakeholders were observed during regular meetings. It was hence possible to understand the organizational context and identify its risks.

The unstructured focus groups consisted in gathering a group of experts to collectively identify the risks of this program typology and collect their opinions on the risk responses that should be performed [16]. Two sessions were conducted without a strict structure, allowing free-flowing discussions, with the researcher's moderation. The first focused on risks identification and the later on risk responses. The preparation and the conduction of the focus group sessions are similar to those of interviews, as they involve formulating questions in advance and providing feedback [17]. The first session was prepared taking in consideration the results obtained from documents analysis and participant observation, while the preparation of the second session took in account the results obtain from the first session. Focus groups' advantage over interviews and surveys is the ease of discussion and participation, enriching the information collected [18]. Both sessions had the participation of 8 experts – the Program Manager, 4 Program and Project Management Officers, 2 Program and Project Management Communication members and 1 Project Team member.

4 Results

Several potential risks were identified as a result of this case study (Table 1).

Risk categorization is a good RM practice [13]. Thus, the researchers tried to assign each risk to one of the 3 categories presented by Krane et al. [19]: operational, short-term strategic, or long-term strategic risks. However, the researchers agreed that this categorization was not adequate to risks related to UI collaboration, despite suiting well megaprojects' risks [19]. The researchers decided to associate risks with the phases when they can occur, and followed the Program and Project Management (PgPM) approach for collaborative UI R&D funded programs created by Fernandes et al. [20]. The PgPM approach is easily comprehensible and applicable, and is proven to deliver

successful results, which makes it a suitable approach for the risk categorization. PgPM distinguishes between programs and projects. In programs covering a group of related projects, their management must be coordinated, and synergies must be created, so that projects can generate greater benefits than they would if managed individually [21,22]. Nevertheless, the management of a program encompassing several projects demands the management of them all. Thus, PgPM establishes a PM layer bellow the program management layer [20].

The life-cycle of the program management layer is divided into 4 phases: Program Preparation (A), Program Initiation (B), Program Benefits Delivery (C), and Program Closure (D). The lifecycle of PM layer is divided into 4 phases as well: Project Initiation (E), Project Initial Planning (F); Project Execution, Monitoring and Controlling, and Replanning (G), and Project Closure (H) [20].

Table 1. Potential risks identified and potential proposed response strategies.

Phase	Risk Description	Proposed Risk Response
A, B, C, D	R1. Inadequate program stakeholders' engagement.	(1) Create a sense of belonging, and define the program's vision, mission and values; (2) Communicate the benefits arising from participation in UI R&D collaborations for the career development; (3) Assign a maximum of 3 projects to each project leader, to avoid work overload; (4) Demonstrate the importance of the of the program expected benefits; (5) Promote moments of sharing program results among stakeholders.
	R2. Program governance mechanisms are not fully implemented.	(1) Disclose the governance model among all program stakeholders; (2) Formally create all the governance mechanisms; (3) Demonstrate the value of a fully implemented governance model.
	R3. Disturbances in information flows and communication between stakeholders.	(1) Establish different communication channels for different stakeholders; (2) Develop team building activities; (3) reinforce the supporting role of program managers requiring the teams to provide them with reliable information.
	R4. Non-exploitation of the generated knowledge.	(1) Develop talent management policies to keep the key human resources (HR); (2) Collect, analyze, archive and disclose the lessons learned, risks and issues for future use in new R&D collaborative programs.
	R5. Strategic misalignment.	(1) Frequent meetings between stakeholders to analyze the strategic alignment; (2) Develop a contribution matrix for each project and frequently register the cumulative percentage of agreement with the desired outputs; (3) Clarify the hierarchical structure of program management decision making to all stakeholders.
	R6. Significant changes in the project/program environment.	(1) Frequent monitorization of the external environment, economic, technologic, etc.
A	R7. The effective start date differs from the official kickoff date.	(1) Prepare the consortium for self-funding until the funding contract is signed; (2) Prepare the funding application 12 to 18 months prior to the planned start date in the funding application.

Phase	Risk Description	Proposed Risk Response
C	R8. Delays in program financial execution.	(1) Plan the investments in equipment and materials attending to the organizational financial restrictions; (2) Monitor the procurement processes to initiate them as soon as possible.
	R9. Conflict in the attribution of the authorship of Intellectual Property.	(1) Establish explicit pre-agreements on Intellectual Property rights, identifying the rightful authors; (2) Involve all stakeholders to ensure that there is an agreement.
	R10. Delays in HR recruitment.	(1) Improve the visibility of available research grants; (2) Improve employment contract conditions.
	R11. Conflicting objectives between projects.	(1) Promote workshops among projects in the same area of knowledge; (2) Create a subprogram level of management.
D	R12. Failure to comply with the contract's clauses.	(1) Implement a contract clauses' monitoring system.
E, F, G, H	R13. Lack of project sponsorship.	(1) Nominate a project sponsor; (2) Clearly communicate the program and projects benefits; (3) Link the program and project objectives to the partner organization strategic objectives.
E, G	R14. Impossibility to achieve results according to the industry guidelines.	(1) Propose the participation of the project members in the definition of the industry guidelines in development; (2) Report to the program coordination to develop the inclusion mechanisms to meet project needs.
G	R15. Non-innovative project results.	(1) Operationalize a program innovation management team; (2) Consult the program innovation management team on a regular basis on the technology roadmaps, to adapt the final product to the market's needs; (3) Hire senior research fellows; (4) Request project sponsorship; (5) Require scope changes when necessary.
	R16. Key HR leave the project during its life cycle.	(1) Create employment contracts for key researchers to fill the precariousness of research fellowship contracts; (2) Create a professional career perspective at industry and/or continue their research work on new projects at university; (3) Promote collaboration among team members; (4) Provide better working conditions; (5) Integrate research fellows in university degree cycles; (6) Provide technical training; (7) In the case of early departure, provide a period for the transmission of knowledge to the new resource; (8) Archive the developed knowledge.
	R17. Failure to adopt PM practices in projects.	(1) Agree previously standardized practices with stakeholders, to adapt them to the needs of stakeholders, and involving them in the decision-making process; (2) Promote workshops about PM.
	R18. Misalignment between the plan and the project execution.	(1) Identify the project leaders as soon as possible, ideally during the funding application development; (2) Guarantee the commitment of the project responsible with the set of deliverables planned in the funding application; (3) Identify the necessary changes to the project as early as possible, minimizing its impact in the project.
G, H	R19. Failure to meet the project's requirements.	(1) Develop an explicit and detailed research plan; (2) Request the project scope's change to the funding entity.

After the identification of potential risks, the researchers performed a root cause analysis to plan the risk response strategies. Each strategy falls into one of these 4 types: 1) Take actions required to avoid the risk, 2) Transfer the risk to a third party, 3) Mitigate the risk to decrease its probability and/or impact, 4) Accept the risk and take no action unless it occurs [8]. The planned responses are presented in Table 1.

5 Discussion and Conclusions

Identifying risks in UI collaborative R&D funded programs and planning its responses demands a strong effort to produce effective strategies to reduce the risks' negative impacts. Therefore, this case study gives answer contributions to two relevant questions: What are the potential risks of UI R&D collaborative funded programs? What are the key potential risk response strategies to manage the identified risks?

A total of 19 potential negative risks were identified (see Table 1), such as "Inadequate program stakeholders' engagement", and "Lack of project sponsorship"; each one of them was assigned to PgPM [20] phases. Program Benefits Delivery and Project Execution, Monitoring and Controlling, and Replanning phases present a larger number of potential risks when compared to other phases, which was expected, as they have longer duration than the others and require higher effort.

The researchers planned a total of 53 recommended potential response strategies to reduce or eliminate risk impacts. For each risk, at least one response strategy is identified (see Table 1). As an example, for the potential risk: "Lack of project sponsorship", three risk responses were identified: "Nominate a project sponsor", "Clearly communicate the program and projects benefits", and "Link the program and project objectives to the organization strategic objectives". Although researchers have only focused on 2 RM processes, Identify Risks and Plan Risk Responses, the other processes are also relevant and will be studied in future work, in order to create a full RM methodology for UI R&D collaborations, such as the one proposed by Peixoto et al. [23] for an electric energy organization. As future work, the researchers also aim to perform a qualitative risk assessment to identify critical risks.

6 Acknowledgments

This work was supported by the FCT - Fundação para a Ciência e a Tecnologia (SFRH/BPD/111033/2015); and by the Portugal Incentive System for Research and Technological Development. Project in co-promotion nº 36265/2013 (Project HMIExcel - 2013-2015).

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