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Key Initiatives to Successfully Manage Collaborative University-Industry R&D: IC-HMI Case Study

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Abstract

This paper describes the results of a qualitative study to identify the key management initiatives in a successful university-industry (UI) collaborative funded program between the University of Minho (UMinho) and Bosch Car Multimedia Portugal (Bosch), named IC-HMI. The IC-HMI program embraced an overall investment of 54.7 M€ and involved around 500 people throughout the Program's duration (2015-2018). While the literature provides some advice on managing programs and projects, the specific context of UI R&D collaboration is being scarcely reported, demanding a strong research effort to produce effective guidelines. The IC-HMI is considered a successful program for several reasons, as evidenced by the decision of UMinho and Bosch partners to develop a subsequent R&D collaborative program from 2018 to 2021, doubling its investment. The success attained with the IC-HMI program could be somehow explained by key management initiatives adopted, such as the: creation of Program and Project Management Office, definition and communication of a Governance Model, creation of Project Charters, promotion of Alignment Stakeholders Workshops, Project Progress Meetings and creation of Project Transition Plans, among other key initiatives reported in this paper.

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Keywords: Key Management Initiatives; University-Industry Collaboration; Successful R&D Program.

1. Introduction

In recent decades, universities and firms have increasingly been encouraged to collaborate in research and development activities on the basis of Mode 2 knowledge production [1] and the triple-helix model (University-Industry-Government) [2]. In fact, the collaborative research between University and Industry is being perceived as a good approach towards enhancing innovation through knowledge transfer [3], as well as developing the 'right' sort of innovative competencies [4] towards enhancing the overall performance of the University-Industry (UI) collaboration ecosystem. Simultaneously, assuring the value creation through the proper entrepreneurial attitude development [5] and of the focus in a triple helix point of view among the different stakeholders.

There are several reasons that make companies want to engage in research collaboration with universities. Perkmann et al. [6] identified 4 main reasons: 1) many public funding R&D' programs request the involvement of universities; 2) companies need to have access to research and to critical skills, which allow them to reach the very edge of technology and to push them further; 3) companies aim to improve their problem-solving competences and academic researchers are hired to support them in this process of problem solving; and 4) these collaborations result in several other benefits, e.g., capturing talented collaborators and increasing the enterprise's reputation and visibility. While Tartari and Breschi [7] identified that the main motivations for researchers to engage with industry is to have access to equipment and additional research resources.

Nevertheless, these collaborations present several challenges, related to its creation, implementation, development and sustainability, which need to be properly addressed [8]. The adoption of the right management initiatives allows to overcome the typical barriers and obstacles of this kind of collaborations, and also may contribute to a combined path for mutual benefits realization [9]. However, a great number of critical factors needs to be considered in order to increase the likelihood of the success of an UI R&D collaboration [10]. The project success is a multidimensional construct that includes both the short-term project management (PM) success efficiency and the longer-term achievement of desired results from the project's effectiveness and impact [11]. Therefore, measuring the success of UI R&D collaborations requires the assessment of the program/ project after its conclusion, allowing to match the provided benefits with the expected ones [12]. Joslin and Müller [11] indicate the importance of having a comprehensive PM methodology and the experience to tailor it to the organizational context; namely understanding the organization's governance paradigm is part of the contextual positioning of how to apply a PM methodology [13].

Literature provides some guidance on how to manage programs and projects [14], however the specific context of collaborative UI R&D, with multiple stakeholders and a complex governance model, demands a strong research effort to produce effective guidelines [15], since PM is highly dependent on the organizational context [16], [17]. There are also some additional challenges to be addressed with a UI consortium structure [9]. UI collaborative research projects 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 and geographies [9], [18]. The cultural gap also presents a threat that can cause conflicts over ownership of intellectual property, like interfering with the academic freedom to publish the key results achieved, and somehow creates different priorities, time horizons and areas of interest [19]. Therefore, this research aims to contribute to practice by discussing key program and project management initiatives adopted in a UI R&D Program, named Innovative Car – Human and Machine Interface (IC-HMI), through its program management life-cycle. These key management initiatives can be used as a blueprint for other similar UI R&D contexts, although keeping in mind the need to always tailor these initiatives to the particular organizational context.

This paper follows a commonly used structure. The second section presents the relation to existing theories and work, namely by introducing the importance of key management initiatives in the UI collaborative R&D context, as well as the implementation of governance guidelines to support and increase the likelihood of success of collaborative R&D programs. The third section provides the research methodology applied, detailing the research methods followed. The fourth section presents the main reasons why the IC-HMI program is perceived as a success. The fifth section discusses the key initiatives that are advised to follow in future UI R&D programs or even in similar contexts in a benchmarking point of view. Finally, the sixth section presents the main conclusions,

limitations and future research.

2. Relation to existing theories and work

Due to the global international competition, and the continuous necessity to differentiate from competitors, organizations have the ambition to define winning strategies towards being established as those which prevail in the digital economy, throughout the development of key knowledge [20], and the proper innovation and technology management of the R&D programs performed towards guaranteeing the desired breakthroughs and performance [21]. For that reason, the collaboration between universities and industries is encouraged by governments as a mean of enhancing national competitiveness and wealth creation [22], as UI R&D collaborations are expected to play an important role through the development of innovative products, technologies and processes for industry [23].

With the increasing prevalence of collaborative research programs, as a particular form of UI collaboration [9], [24] and their importance to the future success of both organizations and to national economies, it is essential to develop new innovative approaches and methodologies to address the collaborations challenges. While the literature provides advice on managing projects and programs applied to business organizations in general [14], [25], [26], [27] the UI collaboration context requires specific guidance and a tailored approach, namely because of the particularities encountered in the R&D context, as well as due to the program and project management maturity differences of the involved entities [15]. Therefore, a research opportunity focused on the development of a methodology to manage UI collaborative R&D programs and projects, which could be important vehicles to operationalize UI partnerships [15]. For that reason, a new program and project management (PgPM) approach has been developed base on exploratory studies performed by Fernandes et al. [28], [29]. This new PgPM approach is especially devoted to support collaborative UI R&D funded contracts.

The PgPM approach distinguishes between programs and projects. A program covers a group of related projects which must be properly coordinated towards ensuring the creation of synergies between projects, so that those projects could generate greater benefits than they would if individually managed [14], [30]. As so, the program management encompasses several projects demands and requests in a combined manner and not to each project individually. Thus, the developed PgPM approach establishes a PM layer bellow the Program Management layer [28]. By establishing this, the PM life cycle occurs within the Program Management life cycle as presented at Fig. 1, being both cycles intimately related.

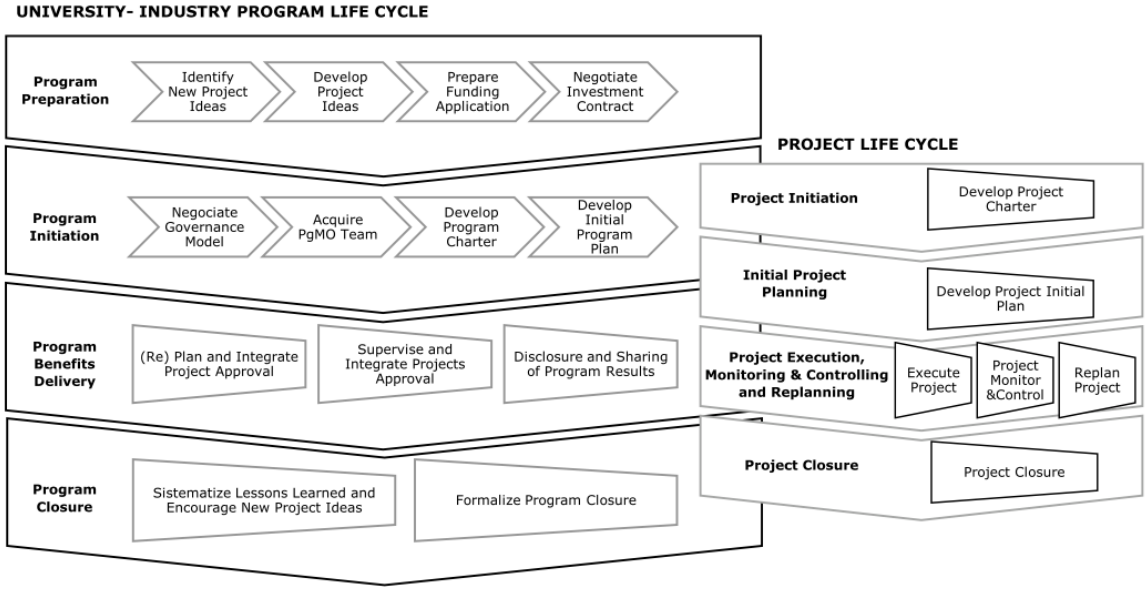

Fig. 1. PgPM approach: relationship between program and project management life cycles adapted from [29].

3. Research methodology

A three-year in-depth research study was conducted along a UI R&D collaboration. The research followed a single case study design, exploring the key management initiatives of one UI collaboration program, named IC-HMI, over its life cycle. The case study research approach is assumed as one of the most used research strategies by researchers following a qualitative approach [31]. By using case studies, the researchers can focus in a particular phenomenon and discover crucial knowledge that could not be disclosed otherwise [31]. The case study empirical data collection process was inductive in nature [32] rather than aiming to prove predefined hypotheses.

3.1 Case study background

The IC-HMI is a collaborative R&D program between Bosch Car Multimedia Portugal (Bosch) and University of Minho (UMinho). This program addressed the development and production of advanced Car Multimedia solutions. UMinho is a Portuguese University that has being consolidating its position as a research University; to support this, the UMinho has already a history of high-level collaborations with several industry players, proved by an average of 250 R&D contracts annually signed. Bosch Car Multimedia Portugal became one of the automotive industry's biggest suppliers and the leading plant of Car Multimedia division of Bosch Group. Since 2014, Bosch has doubled its turnover and achieved the milestone of the thousand millions of euros in global sales. Bosch has also achieved the 4th place among the largest exporters in Portugal last year (2018); and will continue to focus on the growth of Bosch among Bosch Group and the growth of the region.

The IC-HMI program had the duration of 37 months, starting at July 2015 and closing in July 2018. The IC-HMI program had €54.7 million of investment, and involved around 500 UMinho researchers and Bosch collaborators, including the admission of 94 new staff dedicated to R&D in Bosch and 173 new researchers in UMinho. This program was translated into 30 multidisciplinary R&D projects, targeting product development, quality control, and production management, which had as main technical-scientific areas: electronics and instrumentation, information technology, mechanical technologies and materials, industrial engineering and management, and optical physics.

Since it is a funded R&D program, there are outputs that are previously committed with the funding entity that must be assured during the program. Thus, the IC-HMI program had as main outputs: 417 deliverables, 20 innovative features and 22 patent applications until June 2018 and 72 technical-scientific publications until June 2021. Giving all the complexity involved in R&D program of this nature and dimension, UMinho and Bosch had perceived the value of PM to support the management of such collaboration [33]; therefore, a governance model was established based on a developed approach that is specially devoted to PgPM of UI collaborative R&D funded contracts, named as PgPM approach [28],[29] [34]. Hence, since the beginning of the partnership, UMinho and Bosch established a dedicated project management infrastructure, similar to a Project Management Office, designated as "Program and Project Management Office (PgPMO)". The main objective of the PgPMO structure [35], is to support both Program Coordination and Project Teams during the PgPM life cycle.The adopted program organigram is presented in Fig. 2.

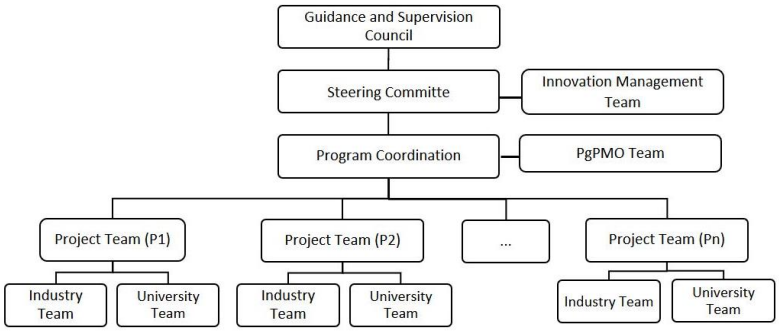

Fig.2. IC-HMI program organigram.

The PgPMO team takes responsibility for some of the Project Leaders' tasks in order to reduce the workload of individual Project Leaders and additionally allowing them to benefit from the accumulated expertise and

economies of scale. However, it also has some functions and responsibilities of monitoring, in some specific circumstances, the achievements of the project teams, since the PgPMO has to support the Program Coordination, periodically report the status of the overall program to the funding entity. The funding entity has a controlling role of the overall funded program [35]. The Program Coordination is composed of four people: two Program Directors, one from UMinho and another from Bosch, and two Program Managers, one of each institution, as well. In fact, each program organization role has always a representative from Bosch and another from UMinho. The Program Coordination is the organism responsible to guarantee the program benefits realization. Above Program Coordination is the Program Steering Committee, supported by an Innovation Management Team, and the Guidance and Supervision Council. The Guidance and Supervision Council involves a third party beyond the representatives from UMinho and Bosch, which has as main function to solve potential conflicts that might arise.

3.2 Research methods

The research design comprises the adoption of three research methods, namely: participant observation, document analysis and unstructured focus group.

The observation is a complex research method, notwithstanding, it played a vital role in the context of this research, especially by driving researchers to having a closer contact with the object under study in its native environment [36], [37]. Observation is characterized by being participative, since the researchers are inserted in the group and participate in the activities observed [37]. Researchers observed IC-HMI stakeholders in naturally occurring situations, namely during regular management and technical meetings. Therefore, through their participative and systematic observation, it was possible to realize and perceive the organizational context, and therefore to produce a more accurate analysis and closer to the real interpretation of behaviours.

The analysis of IC-HMI management related documentation was also conducted to better understand the case study context, namely the Bosch-UMinho partnership' efforts on improving management practices and the management practices adopted. Among the documents analyzed, the one that we can point out as being more relevant was the "IC-HMI governance model". This document detailed all the key roles, as well as the processes and practices that supported the program management and its constituent projects (e.g., project charters, performance reports, and technical and financial progress reports to the Funding Entity) of IC-HMI.

The unstructured focus group led by the research team combined the participation of six PgPM Officers, one Program Manager and two Project Leaders from IC-HMI. Note that the PgPM Officers' mission was to support the IC-HMI Project Teams and the Program Coordination. The unstructured focus group was supported by auxiliary materials, namely on the initially proposed PgPM approach for collaborative UI funded contracts [28]. The focus group strategy has, when compared to interviews and surveys, the advantage of easing the discussion and participation, since the answers of a participant can be complemented by another one, enriching the information [38]. This advantage was considered to largely compensate the drawbacks such as the risk of someone offsetting others, or someone being too shy to contribute, therefore the important role of the research team in an attentive moderation of the sessions. The group discussion was conducted without a strict and rigid structure, allowing free-flowing discussions, with the researcher team moderation, in order to seek convergence about the key management initiatives. The discussion was observed by several members of the research team, notes were taken, and these were compared and contrasted in other to produce a joint summary.

4. Success of IC-HMI case study

Globally, the IC-HMI program was considered a success by both partners. Program's scope, cost and quality plans were accomplished; in spite of the nine months delay of the program's planned kick-off date, the program closed only one month later when compared to the planned date. To support this: (a) all technical reports were presented and approved by the Funding Entity; (b) the technical and financial audits performed by external entities produced no remark; (c) the realization of public events for dissemination and results' sharing; (d) public speeches performed by Bosch and UMinho' representatives confirming the program success.

By the end of the program several of the mid and long-term planned IC-HMI program benefits were already achieved and exceeded, namely the 24 (of 22) patents submissions and 109 (of 72) scientific publications, as well as the incorporation in current Bosch´s processes and products of the R&D project results, especially those with the technologies with highest technology readiness level.

Due to the successful results achieved with the IC-HMI program, the UMinho and Bosch partnership decided to move to a third phase of investment, which involves three different R&D programs, duplicating the IC-HMI program investment. Besides, the UI Collaboration was also considered a success, due to the engagement of UMinho and Bosch partnership in a new funded program, running while IC-HMI was still in operation, to support the national suppliers competencies acquisition, training them to acquire competitive qualifications in order to allow the increasing incorporation of domestic suppliers in the Bosch value supply chain.

Other major benefit and recognition gained after the closure of the IC-HMI program, was the creation of new Bosch facilities to support the already engaged and future R&D efforts, therefore Bosch is no longer an ordinary production facility, but the first recognized Competence Centre in Portugal by Bosch Car Multimedia division for product and process development. Presently, Bosch in Portugal is being able not only to produce but also to contribute to the technological roadmaps of Bosch headquarters.

The IC-HMI program also created an economical boost in the region with the improvement of Bosch' commercial results, and consequently of all the stakeholders involved in the value chain. It has, also, created a growth spiral, which helped reversing the impacts of the financial crisis, and increased the number of qualified jobs among the youngsters.

And finally, the benefits are not limited to Bosch partner but also to UMinho. This UI partnership is helping the visibility and the reinforcement of the international recognition of UMinho as being a centre of competence of excellence in certain scientific domains, as well as attracting nationally other companies to similar cooperation programs. It has also increased the number of Master and PhD students, the number of publications in high ranked journals, as well as the number of patent submissions.

5. Key findings and discussion

From the participant observation and document analysis several initiatives were identified and discussed during the unstructured focus group, resulting in the identification of the top twenty key initiatives (KI) to successfully manage UI collaborative R&D funded program IC-HMI. By 'initiatives', the researchers, perceive not only a set of specific tools and techniques that are used to "execute a process", but also as a set of behaviours, routines and ways of working that are directed at improving collaborative UI R&D. Fig. 3 presents these key initiatives, without any specific order of importance, by the different phases of the program management life cycle adopted: 'Program Preparation', 'Program Initiation', 'Program Benefits Delivery' and 'Program Closure' [28]. They are subsequently discussed in more detail.

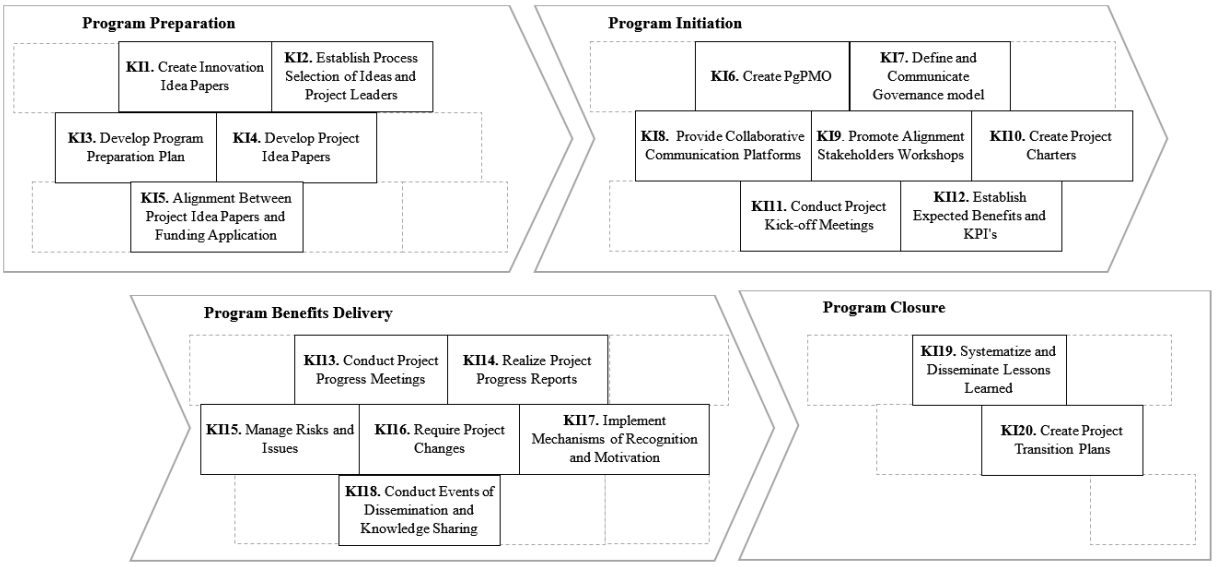

Fig. 3. Key initiatives to successfully manage collaborative university-industry R&D.

5.1 Program preparation

During the 'Program Preparation' phase a New Idea Register is created resulting from the current, or future needs of the Industry partner in face of the market evolvement and trends. The industry members develop a document that succinctly describes the problem and the objectives of each initial project idea (Innovation Idea Paper – **KI1**). These Innovation Idea Papers (**KI1**) are central in the process, because based on them, on the partnership's strategic vision and on its R&D roadmap established, both UI partners prioritized and selected the innovation ideas to develop into Project Ideas. These selected innovation ideas will be included in the Funding Application as R&D challenges to be accomplished by the UI partnership. Therefore, the establishment of a transparent Process Selection of Ideas and Project Leaders (**KI2**) is another key management initiative identified to avoid conflicts between members. The Project Leader is a key to ensure the achievement of the project's technical-scientific results as planned in the Funding Application and agreed upon in the Project Charter's sign-off. Project Idea Leaders must have technical competences in the project idea scope domain, but also should have PM competences.

In order to assure the proper development of the Funding Application it is critical to develop a Program Preparation Plan (**KI3**), which includes all processes, tools and techniques that must be executed and applied to assure the alignment of the members within the program and the submission of a feasible Funding Application. Part of this Program Preparation Plan (**KI3**) is the development of the Project Idea Papers (**KI4**) in collaboration between UI members. The Project Idea Papers (**KI4**) detail each project idea, namely, the problem scope, objectives and potential solutions; and they will be the main input for the Funding Application development.

Converging on the goal of the Program Preparation Plan (**KI3**) is the guarantee of the alignment between the 'Project Idea Paper' contents with the final content submitted in the Funding Application (**KI5**); which will assure the commitment of the Project Idea Leaders, regarding the project's expected outputs established.

5.2 Program initiation

Throughout the 'Program Initiation' phase, seven key initiatives had stand out. The first is the creation of a Program and Project Management Office (PgPMO) or similar structure **(KI6)**. The literature is still scarce about the adoption of management structures in the UI context. Nevertheless, the PgPMO Team has an upmost importance to actively supporting the Program Coordination and the Project Teams, which is perceived as a critical success factor [35].

The definition and communication of the Governance Model (**KI7**), which is mainly implemented by the PgPMO team, is also of extremely high importance by ensuring the consistency of the relationship among the different program governance bodies (Fig. 2); and by properly defining the roles and responsibilities of the different stakeholders involved, as well as clarifying the program and project management processes, techniques, tools and existing organizational procedures among partners. Furthermore, the Governance Model is implemented towards ensuring the four principles of governance: accountability, responsibility, transparency and fairness [39], in order to create the right context to nurture trust among partners. It is perceived as a key critical factor to accomplish successful results in UI context [40].

Therefore, providing Collaborative Communication Platforms (**KI8**), common to both parties, to facilitate transparent information sharing is seen as another key initiative towards guaranteeing consistency of data among partner members, as well as to create the right conditions to effectively manage the program and projects' execution.

During 'Program Initiation' the realization of Alignment Workshops (**KI9)** is another key initiative to guarantee the alignment of key stakeholders with the program objectives and to ensure the understanding of the interdependencies between the projects within the program; besides the contribution to the creation and growth of a project's team spirit, since it is common that people are working together for the first time. Furthermore, the transition between the submission of the Funding Application ('Program Preparation' phase) and its approval and Investment Contract's sign-off ('Program Initiation' phase) may exceed a year period. Accordingly, this considerable temporal lag somehow favours administrative and financial misalignments and technological market trends shifts. Therefore, the Alignment Workshops (**KI9**) also aim to align Project Leaders' expectations and objectives, as well as of the entire Program with the partnership's R&D roadmap established.

The conduction of the Alignment Stakeholders Workshops (**KI9**) are triggered for the creation of the Project Charters (**KI10**). Due to the lag between 'Program Preparation' and 'Program Initiation' phases, each Project Team, must reassess the project's objectives, deliverables and innovative features submitted in the Funding Application towards ensuring Project Leaders' full commitment with the challenges planned in the Funding Application and the proper resource balance for project's execution. So, the Project Charter establishes a baseline and a commitment between Project Leader's and Team with the Program Coordination. The involvement of the PgPMO team during the Project Charters creation (**KI10**) is fundamental to support the Project Team during its discussion and ensure that any of the previously accorded outputs in the Funding Application are not dismissed. In the 'Project Charter', it is also essential to identify the expected benefits and Key Performance Indicators for each Project (**KI12**) in order to measure in the future its success.

Once the Project Charters are created (**KI10**) and agreed among each Project Team, a project Kick-off Meeting (**KI11**) takes place for each project. This Kick-off Meeting counts with the presence of all members already assigned to the Project Team and the Program Coordination, and its agenda will include the presentation of the Project Charter (**KI10**) and its official sign-off. Additionally, a Kick-off Meeting has the goal to: (1) generate a common understanding among all parties involved; (2) demonstrate top management support (sponsorship) and (3) communicate the decisions made by the Steering Committee, such as the established Governance Model.

5.3 Program benefits delivery

In the 'Program Benefits Delivery' phase, six key practices were identified towards managing projects in a way that facilitates the overall intended benefits delivery. During 'Program Benefits Delivery' phase the PgPMO team conducts regular Project Progress Meetings **(KI13)** with each Project Team (minimum monthly/ maximum quarterly period), in order to support the team in the management of the project and to monitor each project to be able to report to the Program Coordination the project progress and consequently the program performance. The Project Progress Meetings **(KI13)** have an average duration of one hour, however, the PgPMO team may adapt the meeting's duration depending on the Project Team profile and their necessity to discuss project's matters, for example, to deepen a discussion about the project's risk identification and monitoring and control. Each Project Progress Meeting is recorded in a Project Progress Report (**KI14**), which is communicated to the respective Project Leaders so that its content can be formally validated by them. All information from the Project Progress Reports is compiled and feeds the Program's Performance Report to be presented to the Program Coordination, therefore the importance of this artifact in the management at the project level, but also at the program level is crucial.

Due to the UI R&D context, and the unpredictability of some project innovation activities, it is extremely important to Manage regularly the Project's Risks and Issues (**KI15**) during the Project Progress Meetings (**KI13**), by promoting the project's risks identification, risk qualitative assessment, and planning of risk responses and contingency actions. Risks and issues management is critical for the achievement of the desired project's goals, results and benefits, and it requires a joint effort among Project Teams, PgPMO team and Program Coordination, towards establishing the suitable conditions and management procedures to globally attain program' success.

Given that UI R&D programs are usually public funded, it requires the approval of the Funding Entity whenever significant changes to the scope of projects are necessary (**KI16**). Any project may Request a Change to the Project Charter (**KI16**) directly to the Program Coordination and PgPMO team or present it during a Project Progress Meeting. The PgPMO team analyses the impact of the requested change on project's scope, time and/or cost and communicate this analysis to the Program Manager. The Program Manager then, discusses it in the Program Coordination, towards assuring that the project's change request is feasible and does not jeopardize the program's planned results and expected benefits. Furthermore, the Program Coordination has filled the need to implement Mechanisms for Recognition and Motivation of their resources (**KI17**), in order to stimulate the recruitment and retention of talents during the whole program life-cycle. During IC-HMI, several Project Teams have lost talented project members due to more attractive employment invitations by other organizations, including for other positions in Bosch. Yet, one of the most motivational and alignment facilitator mechanism, during the 'Program Benefits Delivery', is the realization of Dissemination and Knowledge Sharing Events (**KI18**). These events provide the environment to share projects results between Project Teams and overall Program stakeholders and to root the sense of belonging to something greater than the projects by themselves, and potentially endorse synergies between projects that might exponentiate the program's benefits, and of course sharing publicly the results of the R&D program (which also is a Funding Entity requirement).

5.4 Program closure

In the 'Program Closure' phase, two key initiatives were identified. The Project Closure Meetings are conducted by the PgPMO Team with each Project Team, with two main purposes - to register all project outputs achievement, and to Systematize and Disseminate the Project Lessons Learned (**KI19**). The objective is to discuss what went well and, therefore, should be replicated in future programs, as well as what should be improved or avoided in the future. The systematized archive of lessons learned allows both UI partners to continuously improve. The lessons learned should be discussed towards being converted into best practice actions and improvements in the next Governance Model. Additionally, in the Project Closure Meetings it is also discussed the Project Transition Plan (**KI20**). This Project Transition Plan is needed to guarantee an efficient transfer and exploitation of project's results for the Industry take over. This requires putting into practice what has been developed in projects, i.e., ensuring that the potential process of industrialization of the results obtained throughout projects is naturally followed.

6. Conclusions

This paper aims to contribute to PM practice by sharing the key management initiatives adopted in a successful UI R&D program, and reinforcing that any management approach needs to be tailored to its organizational context. Therefore, this study enhances and expands the contingency theory by discussing about the key initiates in managing UI collaborations. In fact, this research supports both the image of PM as a field with relatively uniform generic practice, as well as showing differences across a different organizational context, as found by the study of Besner and Hobbs [16]. The research identifies some key management initiatives specific to the UI R&D collaboration context, such as the Project Idea Paper, the Alignment Stakeholders Workshops or the Project Transition Plan. However, other key initiatives identified are common or generic to any project, such as the Project Charter, Kick-off Meetings or Progress Reports.

The results of this article also have practical implications and bring a clearer vision of the key management practices in UI R&D programs. The twenty key initiatives identified (see Fig. 3) aimed to address the collaboration challenges of academics and industry professionals that are involved in such endeavors. The key initiatives cover the whole program management life-cycle and highlight the key aspects that may be followed by other similar UI collaborations. The results of this research can be used as a blueprint by academics and industry professionals who aim at establishing management practices in R&D collaborating contexts.

People play a capital role on managing such initiatives, and the case study shows the main initiatives that should be emphasized. The development of a combined strategy between partners to capture talented human resources is critical towards guaranteeing that the proper competencies and abilities are available throughout all program life cycle. Additionally, it was clear that the identification and collection of lessons learned is a key initiative that needs to have a rigorous methodology in order to systematize and properly disseminate the lessons learned.

In this case study, both partners felt the necessity of increasing the management rigor and have adopted these initiatives towards ensuring the program expected benefits. This was possible, mainly because of the recognition of the PgPMO role in supporting all Project Teams and the Program Coordination and in developing the required program and project management processes towards the enhancement of the success odds. Therefore, in this case study, it was noticeable that the key management initiatives played a central role in both program results and UI partnership sustainability. Bosch UMinho partnership is already in a third phase of public funding support.

The research was performed using only one case study which we acknowledge as a research drawback, as it limits the generalizability of the findings. Therefore, exploring more collaborative UI R&D cases would result in expanding the outcome of this research.

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