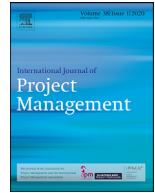




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Benefits management in university-industry collaboration programs

Gabriela Fernandes, Assistant Professor^a, David O'Sullivan, Full Professor^{b,*}^a University of Coimbra, CEMMPRE, Pólo II| Rua Luís Reis Santos 3030-788 Coimbra, Portugal^b National University of Ireland Galway, University Road, H91 TK33 Galway, Ireland

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ABSTRACT

Current knowledge of benefits management is mostly limited to single organisations. This paper investigates benefits management applicable to large university-industry collaboration programs – a particular form of inter-organisational relationship. It presents a holistic, structured and customisable framework for how benefits can be managed, using the structured analysis and design technique. The research has been informed and validated in a major case study. The case study involved a R&D collaboration between a university and a large industry in Portugal over a six-year period with a total investment of more than 70 million Euros. The paper discusses the challenges of implementing benefits management among two organisations who have distinct and sometimes competing long-term benefits. This empirical research corroborates current theoretical approaches to benefits management and presents a number of new insights on how challenges may be effectively managed from a technical and social perspective, for example, the ownership of benefits realisation should change overtime, from Program Managers to Line Managers of each organisation partner. Finally, the proposed BM.UIC framework can be used as starting point for development of a systematic benefit management process in any major project and program.

1. Introduction

Program success, involving a set of interrelated individual projects, is highly dependent on the management and realisation of the expected benefits of multiple stakeholders (Musawir et al., 2017). In the past, success was mainly measured by the *triple constraints* of time, cost and quality (Zwikael and Smyrk, 2011). More recently however, success criteria have focused on a broader range of benefits that include some that are often intangible (Lechler et al., 2012). Research has demonstrated that many programs and related projects do not achieve their potential benefits mainly because they are not aligned with organisational strategy (Badewi, 2016). Common examples include poor project selection, projects not aligned with the organisational goals, projects with excessive risks or those approved based mainly on the political strength of the stakeholders (Jenner, 2014). Poorly selected projects waste scarce resources that could be redirected towards better-aligned projects that would bring benefits to the overall program and hence the organisations involved (Patanakul and Shenhar, 2012).

Current literature recognises the importance of Benefits Management (BM) as a critical enabler of benefits realisation. However, there appears to be limited empirical evidence on how BM can be effectively applied (Badewi, 2016; Breese, 2012). BM can be defined as a process that includes the identification, planning, measurement and follow-up

of the benefits of a program or project (Serra and Kunc, 2015). These benefits can be registered, analysed, classified, planned, pursued, and transferred to stakeholders (PMI, 2017). A benefit is understood to be a measurable improvement that derives from the outcomes obtained (Payne, 2007) and perceived as positive through the eyes of a stakeholder (Breese, 2012; Jenner, 2014). Benefits can be defined as strategic, i.e. how can they contribute to the long-term improvement of organisational performance (Zwikael and Meredith, 2018).

BM frameworks or the method of managing benefits is still in its infancy (Zwikael, 2016) and more research is needed to help develop an underlying theory (Breese, 2012). Some have been discussed more recently, by Zwikael and Meredith (2019), who document several BM frameworks focussed around support practices and tools mainly within single organisations. Practice as “the actual application or use of an idea, belief or method” (Oxford dictionary definition).

This paper is focussed on BM applied to large university-industry collaboration (UIC) programs (Badewi, 2016; Breese, 2012) – as one particular form of inter-organisational relationship that involves multiple stakeholders who bring together very different cultures, benefits requirements and approaches. Many UIC's are single projects with well-defined objectives and potential benefits. Increasingly, such collaborations involve a program or portfolio of R&D projects over a prolonged period, all aimed at achieving a broader set of strategic benefits, often

* Corresponding author.

E-mail addresses: gabriela.fernandes@dem.uc.pt (G. Fernandes), david.osullivan@nuigalway.ie (D. O'Sullivan).<https://doi.org/10.1016/j.ijproman.2020.10.002>

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different than the sum of the individual projects (Pellegrinelli, 2011). While the current literature on BM mainly applied to individual projects provides some advice, UIC organisations require unique guidance on systematic approaches (Nomakuchi and Takahashi, 2015). Against this background, the purpose of this research is to bring forward ideas for a systematic framework for BM in major UIC programs. UIC brings its own complexity to BM, since they involve two or more separate organisations, within a temporary consortium, with different cultures, motivations and distinct benefits for each partner (Barnes et al., 2006; Perkmann et al., 2011b).

This paper contributes to a gap within the existing research literature on the phenomenon of inter-organisational BM involving UICs. The paper presents an understanding of the types of benefits that need to be managed and some of the key BM activities and tools necessary. More specifically, this paper seeks to answer the research question: *How can organisations effectively manage the benefits of major university-industry collaborations?* To address this question, the authors present a longitudinal case study involving a university and a major industry in Portugal. This case study involved a collaboration over six years, from 2013 to 2018, with a total investment of more than 70 million Euros.

This paper begins with a review of the research literature on BM approaches and then presents an initial conceptual framework for BM especially developed for inter-organisational UIC. This theoretical background is then used during ethnographic research of the UIC case study to help develop the BM framework explicitly applicable to UICs and similar inter-organisational relationships. The main findings emerging from the study are discussed, followed by conclusions and empirical propositions for future work.

2. Background

This section focuses on a review of literature on the approaches and frameworks used for BM and concludes with the development of an initial conceptual framework for BM devoted to inter-organisational UIC. Individual partners engage in UIC programs knowing that there are several clear expectations regarding benefits from both sides (Soh and Subramanian, 2014). The differences between the parent organisations arise from the diverse intentions, motivations and responsibilities of the collaborators (Nomakuchi and Takahashi, 2015). This assertion is summarised in the concept of the 'cultural gap' coined by Barnes et al. (2006). Accordingly, the success of an inter-organisational collaboration can be challenging due to the incompatibilities between the expected benefits of UIC partners (Tartari and Breschi 2012). Therefore, a systematic approach to BM in UIC programs becomes even more critical for the program success.

2.1. Benefits management approaches

Breese et al. (2015) argued that BM is a recent movement having emerged from consultancy firms and business-orientated university departments, in the 1990s, and focused on developing methods to address the failure of IT business change programs (e.g., Remenyi et al., 1997; Ward et al., 1996). Benefits, in this regard, are most commonly leveraged through organisational change rather than technology functionality (Badewi and Shehab, 2016) and may be achieved through the adoption of socio-technical design processes, since these explicitly address the need to redesign organisational processes and behaviours (Doherty, 2014).

BM is a field of growing interest within program and project management (APM, 2012; Axelos, 2011; Breese, 2012; PMI, 2017) since the focus on benefits improves the success rate of projects (Breese et al., 2015; Musawir et al., 2017). Zwiakael and Meredith (2019) identified a list of nine organisational tools for setting 'target' benefits in a single organisation. These include (i) benefits maps (dependency maps); (ii) business case; (iii) lessons learned; (iv) investment logic map; (v) benefits realisation plan (benefits management plan); (vi) benefits checklist;

(vii) three column analysis; (viii) benefit distribution metrics and; (ix) benefits profiles. Recently, the Project Management Institute published the first version of the practice guide for BM realisation (PMI, 2019).

Several BM frameworks are recognised in the literature (Badewi, 2016; Hesselmann and Kunal, 2014; Sapountzis et al., 2011). For example, Ward, Taylor, and Bond (1996) present the 'Cranfield' model, which comprises five phases: (1) Identify and structure benefits; (2) Plan benefits realisation; (3) Execute benefits plan; (4) Review and evaluate results; and (5) Assess the potential for further benefits. This model is interactive and continues to be implemented beyond the end of the project, exploring the possibility of future benefits and initiating a new plan for all the unexpected benefits that occur (Ward and Daniel, 2012).

The 'Standard for Managing Successful Programmes' from Axelos (2011) perceives BM as a continuous activity that starts before the program is accepted. The BM process takes into account the identification, monitoring and execution of benefits throughout the whole program, even after its closure. It begins with the vision statement and progresses through the following five phases: (1) establish and maintain a BM strategy; (2) identify and map benefits; (3) plan benefits realisation; (4) execute benefits realisation; (5) review and evaluate realisation; and (5) optimise and look for other benefits.

The 'Standard of Program Management' from the Project Management Institute (PMI, 2017) highlights that the prospective benefits should be registered, analysed, classified and planned in detail, pursued and transferred using a five-stage process: (1) benefits identification; (2) benefits analysis and planning; (3) benefits delivery; (4) benefits transition; and (5) benefits sustainment. One of the features of this five-stage process is it aligns with the three stages of the program management life cycle. The first stage is performed during the definition of the program phase, the second and third stages during the program benefits delivery phase, and the last two stages focus during the program closure.

The BM model from Jenner (2014) encompasses five cycle practices: (1) Identify and quantify, which includes identifying benefits approaches, such as benefits discovery workshops, benefits mapping and 'customer' insight; (2) Value and appraise, including value benefits in monetary terms and valuing non-financial benefits in financial terms; (3) Plan the benefits realisation; (4) Realise, including tracking, taking corrective action, and importantly stakeholder engagement; and (5) Review, as a basis for learning and continuous improvement. The author emphasises that the effectiveness of these BM practices is dependent on seven critical principles: (i) align benefits with strategy; (ii) start with the end in mind; (iii) utilise successful delivery methods; (iv) integrate benefits with performance management; (v) manage benefits from a portfolio perspective; (vi) apply effective governance and; (vii) develop a value culture.

Ward et al. (1996) is an academic framework, while PMI (2017), Axelos (2011) and Jenner (2014) are professional frameworks. From these four frameworks, several common key BM practices can be identified, and these are illustrated in Fig. 1. The academic and the professional frameworks are not significantly different. Jenner's (2014) framework gives particular focus to the additional seven principles of BM, and Axelos (2011) and PMI (2017) emphasise the link between BM and program management.

Existing literature on BM frameworks does not address the specific challenges of inter-organisational collaboration programs, such as the R&D consortia between universities and industry (i.e. UICs). Therefore, the frameworks found in the literature (e.g., Axelos, 2011; Jenner, 2014; PMI, 2017; Ward et al., 1996) were used as a starting point for the initial conceptualisation of a new framework for UICs.

Inter-organisational UIC programs 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 resident at different locations (Brocke and Lippe, 2015; König et al., 2013). Additionally, UIC programs are subject to two different organisational structures with their

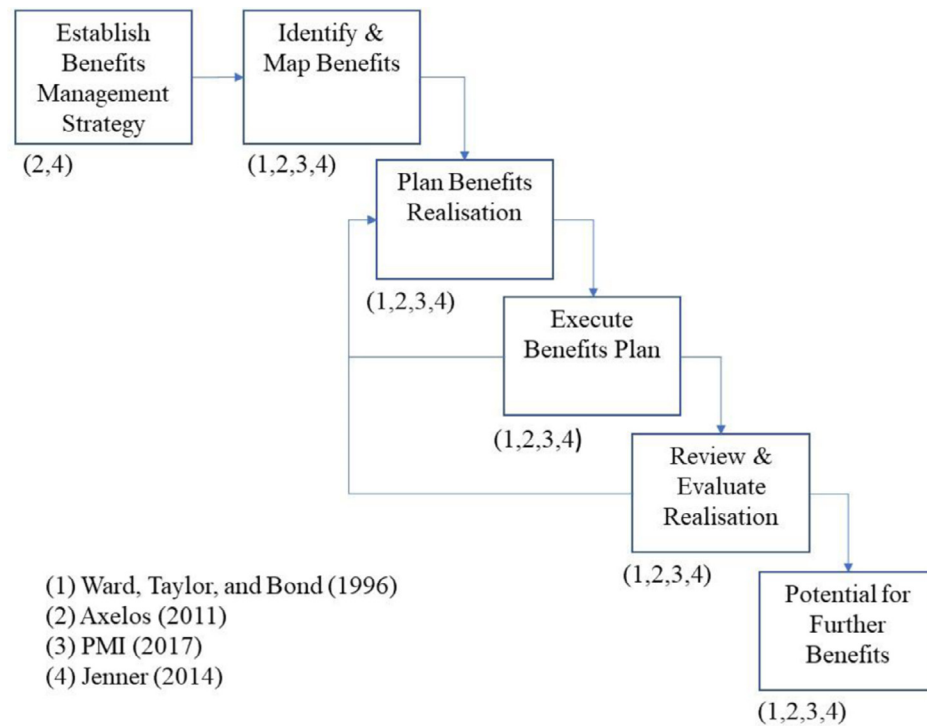


Fig. 1. Common key BM practices

own cultures (Barnes et al., 2006). They also have very distinct benefits requirements for each partner (Ankrah and Al-Tabbaa, 2015) and are usually joined together to pursue a set of contracted benefits with a public funding agency. Such public funding is typically conditioned by the agency based upon the realisation of benefits to society (Huang and Chen, 2017). The number of stakeholders involved in this type of program implies pursuing several distinct and sometimes competing benefits (Tartari and Breschi, 2012).

2.2. Benefit management framework conceptualisation

The authors have adopted the theoretical perspective of the PDCA cycle (Plan, Do, Check, Act) (Deming and Edwards, 1982) to develop an initial conceptualisation for the BM framework devoted to inter-organisational UIC. The PDCA perspective provides well-established management procedures and is widely used as a basis for the development of management standards and frameworks including ISO 9001, ISO 21500, ISO20000, ISO, 27001; ISO, 31000 (Asif et al., 2011; Nawaz and Koç, 2018). The adoption of the PDCA perspective also facilitates the use of a set of activities, interdependent in nature, that imply human resources, procedures and information that, when applied efficiently, translate into value for stakeholders. The adoption of the PDCA cycle emphasises the recursive nature of BM activities, which in the case of inter-organisational UICs is particularly relevant by emphasising high uncertainty and risks and significant pressure in terms of creativity and innovativeness that might imply changes in the stakeholders expected benefits. Using the BM frameworks analysed from literature earlier (i.e. Ward et al., 1996; Axelos, 2011; PMI, 2017; Jenner, 2014), four key BM activities have been defined for the conceptualisation of the BM framework to support inter-organisational collaborations:

- A1: Identify Expected Benefits
- A2: Plan Benefits Realisation
- A3: Pursue Benefits Realisation
- A4: Transfer and Sustain Benefits

These proposed activities have been linked to the Program and Project Management (PgPM) lifecycle for UIC funded contracts developed by Fernandes, Pinto, Machado, Araújo, & Pontes (2015a), since

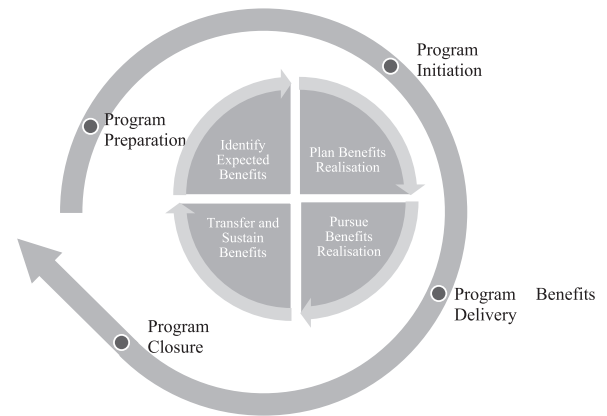


Fig. 2. BM framework conceptualisation.

the linkage between program management practices and BM practices is essential to understand the overall BM context (Badewi, 2016). This linkage is portrayed in Fig. 2. The initial conceptualisation is based on the continuity and natural progress between the different activities and the chronological lines of action. The figure is only systematised in the form of a pictorial diagram. Therefore, elements used in the construction of the figure have no operational semantics.

This conceptualisation can be said to be underpinned by ‘process theory’ (Hernes, 2014) that the authors believe is suitable to BM in inter-organisational collaboration. Hernes argued that “process is a constitutive of the world” (2014, p.44) and presents the process as having two perspectives: technical, such as the key BM activities and tools, and social. In this regard, there is a need to include social and human aspects in the study since there are multiple stakeholders, with often different and competing benefit expectations.

UIC programs are built on interactive relationships that require considerable trust and commitment between partners to create reciprocal benefits over time (Plewa et al., 2013). They need a high commitment from all partners to assure that benefits are harmonised and consolidated

(Perkmann et al., 2013), and therefore the engagement of all program stakeholders is critical (Jenner, 2014). These technical and social aspects retain the plurality of perspectives to capture the complexity found in the phenomenon of BM in inter-organisational collaboration programs. The research described in this paper aims to make a contribution in the BM field, by developing a systematic framework to help organisations to effectively manage the benefits of major university-industry collaborations, identifying a set of controls, inputs, outputs and resources that need to be managed under the four main iterative activities (Fig. 2) having a more technical perspective on BM, while simultaneously exploring a social perspective.

3. Methodology

How organisations effectively manage the benefits of major university-industry collaborations is not an objective reality, and, epistemologically, the interaction with the participants to investigate the problem is particularly important. Ontologically, the reality behind the research problem is seen as subjective, which led researchers to an ethnographic research method. Ethnography was adopted, entailing the exploration and interpretation of a large case study to generate in-depth knowledge for theory building by the lead researcher who was also physically present in the field over a long period (Welch et al., 2011). Project participants behaviours can be best captured through a longitudinal case study (Goetz and LeCompte, 1981). Longitudinal case studies provide a similar level of detail to other qualitative methods, through the emphasis of the experiential perspective (Van Maanen, 1979). Immersing researchers within organisations provide excellent potential knowledge acquisition. To reach this knowledge, "the researcher needs to study the organisation longitudinally and across the different levels in which the activity is embedded" (Lundin and Steinhórrsson, 2003, p. 247). Moore (2011, p. 656) highlights that ethnography "combines the detailed, experiential perspectives of multiple groups within a social unit, by developing an overarching narrative through participant observation in these groups, to obtain a fragmented and integrated perspective on the social unit", which makes ethnographic research strategy suitable for studying BM in UIC programs.

The lived practices of BM in UIC were studied over four-and-a-half years between June 2014 and November 2018. One lead researcher or fieldworker (Bartunek and Louis, 1996) spent an average of two days per week following the collaborative program and had her physical workplace, close to the Program and Project Management Office (PgPMO) team. The observations of the researcher included daily BM practice of the different actors. A second researcher acted as outsider reflecting on observations from a distance (Bartunek and Louis, 1996).

3.1. Case study description

In 2013 the University of Minho (UMinho) and Bosch Car Multimedia Corporation (Bosch), both in Portugal, embarked on a major UIC program co-funded by Bosch, UMinho and the Portuguese government. The UIC program comprised two separate phases of work activity between 2013 and 2015 and between 2015 and 2018 respectively. The first phase involved an investment of €20m on 14 R&D projects and 300 researchers. The second phase involved an investment of €54m on 30 R&D projects and circa 500 researchers. Both phases together produced over 570 deliverables that included 36 patents and 104 technical and scientific publications. The scientific application domains were information technology, electronics and instrumentation, optical physics, mechanical technologies and materials, and industrial engineering and management.

The collaborators established a governance model based on a purposely developed approach specially devoted to program and project management of UIC funded contracts (Fernandes, Pinto, Machado, Araújo, & Pontes, 2015a). UMinho and Bosch invested in a dedicated PgPMO, which had a serving role (Fernandes, Pinto, Araújo, & Machado,

2020a) since its main objective was to support both the Program Coordination and Project Teams during the program and project lifecycle.

Program Coordination comprised four people: two Program Directors and two Program Managers, one each from UMinho and Bosch. In fact, each program organisation role always had a representative from Bosch and another from UMinho. This inter-organisational form brought unique challenges for accountability of benefits realisation, as in the case where some benefits were shared. Program Coordination is the organisation accountable to guarantee the realisation of the overall Program benefits. Above Program Coordination is the Steering Committee, supported by an Innovation Management Team, and the Supervisory Body. The Supervisory Body involves a third party beyond a representative from UMinho and Bosch, and whose primary function was to solve potential conflicts that might arise, and where both partners were unable to resolve alone due to potential conflicts of interests regarding benefits expectations.

In the first phase of the program, the first time that Bosch and UMinho were collaborating, maturity in both program and project management and BM was very low. The main concern was on managing the *triple constraints* of time, cost and quality. However, in the second phase, interest shifted to BM of both program and projects. The Program Steering Committee recognised the value of BM towards program success and therefore wanted to implement a systematic BM process. This decision might have been influenced by this research study, which raised awareness of the critical role that a systematic BM process plays on the program success and consequently in the Bosch and UMinho partnership sustainability. Therefore, the Program Steering Committee, the Program Coordination and the PgPMO team continuously supported this study, as they expected to benefit from its results.

During the 'program initiation' phase, key stakeholders were involved in *Alignment Workshops*, organised by the Program Manager, and supported by the PgPMO, to align the project expectations and objectives of the collaborators prior to receiving funding. During these workshops, the benefits of the projects were identified. Then, the formal *Program Charter* and the *Project Charters* for each project were created by the respective PgPMO Officers, for aligning the overall program objectives and expected benefits with the project objectives and benefits. These *Project Charters* included all the primary benefits identified in the *Funding Application* and agreed with the government funding entity and also benefits later identified during the *Alignment Workshops*. Defined benefits were included in the *Project Benefits Register* and consequently integrated with the *Program Benefits Register*.

During 'program benefits delivery' phase, *Progress Meetings* were held monthly between the respective PgPMO Officers and project teams, resulting in *Project Progress Reports* that included up to date information about the project benefits. These benefits were integrated into the *Project Benefits Register* and later incorporated in the *Program Benefits Register*. During 'program benefits delivery' phase there occurred various *Results Sharing Events* with the objective of sharing with stakeholders the expected and realised benefits by each project. Table 1 summarises the top five expected benefits initially identified for the second phase of the program by each key stakeholder – UMinho, Bosch and Government and society. These benefits are well recognised in UIC literature, namely in the works of Ankrah and Al-Tabbaa (2015), who highlighted a deficit in specific UIC related BM research and De Fuentes and Dutrénit (2012) who focused on the best channels of UIC interaction for long-term benefit.

Some of the benefits expected from government funding agencies, which, based on the history of political philosophy, typically also represent societal benefits (Klosko, 2013), might also be common with those of universities and/or industry, such as to enhance the regional/local economic development, increase the recruitment of students, i.e. employment creation (Ankrah and Al-Tabbaa, 2015) and reinforce of the knowledge transfer from universities to industry (De Fuentes and Dutrénit, 2012).

There were no conflicts among the top expected benefits between the university and industry stakeholders. The conflicts that did arise were

Table 1

Top UIC stakeholders' expected benefits.

Stakeholder	Expected Benefit	References
Industry (Bosch)	Increase in market competitiveness through the ability to attract innovative industrial projects Economic growth and wealth creation, resulting from new products development and increase of efficiency Improve cost-effective research	Ankrah and Al-Tabbaa (2015); Chin et al. (2011); De Fuentes and Dutrénit (2012) Ankrah and Al-Tabbaa (2015)
	Access to new knowledge (state-of-art), reinforcing companies internal competences in its different business areas Solving technical problems (e.g., products packaging, products storage, products identification, etc.)	Ankrah and Al-Tabbaa (2015); Davey et al. (2011); De Fuentes and Dutrénit (2012) Ankrah and Al-Tabbaa (2015); De Fuentes and Dutrénit (2012); Teixeira and Mota (2012) De Fuentes and Dutrénit (2012); Sijde (2012)
University (UMinho)	Increase the funding to hire human resources and equipment	De Fuentes and Dutrénit (2012); Perkmann et al. (2011a), Wright et al. (2008)
	Increase recognition of the university in the academic community, as the holder of knowledge concerning the technologies and methodologies, developed in the different R&D projects	Ahrweiler et al. (2011); Ankrah and Al-Tabbaa (2015); Davey et al. (2011); De Fuentes and Dutrénit (2012)
	Affiliation with a safe environment to receive feedback on ideas/results/theories	Ankrah and Al-Tabbaa (2015)
	Reinforce the university's know-how in certain subjects, due to the intrinsic industry's characteristics Increase the capacity to attract new students	Ankrah and Al-Tabbaa (2015); Arvanitis et al. (2008); De Fuentes and Dutrénit (2012) Ankrah and Al-Tabbaa (2015); Chin et al. (2011); De Fuentes and Dutrénit (2012); Sijde (2012) Ankrah and Al-Tabbaa (2015)
Government and society	Enhance the regional/local economic development, namely through the direct and indirect increase of production of goods and services and export orientation of regional/local companies Increase the recruitment of students (employment)	Ankrah and Al-Tabbaa (2015); De Fuentes and Dutrénit (2012); Lee (2011); Mindruta (2013) Mindruta (2013)
	Increase technological breakthrough (e.g., human-machine interface, noise cancellation sensors)	Ankrah and Al-Tabbaa (2015); Perkmann et al. (2011a); Sijde (2012)
	Increase learning/continuous professional development	Ankrah and Al-Tabbaa (2015); Perkmann et al. (2011a); Sijde (2012)
	Reinforce the knowledge transfer to industry	De Fuentes and Dutrénit (2012)

mainly related to patents and publications. Industry members preferred patent submissions while university members preferred to publish papers as soon as possible. However, when a project result did have the potential for a new patent, university members agreed not to publish papers until after patent submission. These agreements were moderated by the Program Coordination and supported by the PgPMO team, which played an important role in facilitating the communication among partners and thus avoiding major conflicts.

3.2. Data collection and analysis

Data collection involved observation and participation, as well as the analysis of several documents to better understand the case study context and the evolving efforts for improving BM practice. Among the most relevant documents analysed included the governance model, as well as several documents that supported the management of the program and its constituent projects (e.g., project charters, technical and financial progress reports, benefits realised, and the lessons learned register).

Observation provided the insider researcher with access to the actualities of the world of meaning (Alvesson and Sköldborg, 2017). Observations were conducted on daily work routines, celebrations, workshops and meetings at all organisational levels, as well as informal gatherings during the daily BM activities. Numerous written field notes were made during the observations. Each of the records consisted of numerous informal interactions with the program participants during the day. Observations included more than 400 formal and informal meetings. Questioning and listening program participants conversations provided information on the emerging BM practices and tools. Particularly, the *Alignment Workshops* allowed participants to identify the expected benefits, and the *Results Sharing Events* allowed them to acknowledge both expected and realised benefits.

Observation is commonly criticised for a potential lack of reliability (Saunders et al., 2019). However, coupled with other qualitative methods, observation is a crucial holistic research method, enabling researchers to gain a better understanding of the insider's perspective

(Baker, 2006). Therefore, in addition to observation and participation, the fieldworker conducted unstructured focus groups, which ran without a rigid structure and were performed by several free-flowing discussions. The insider researcher led the focus groups. They had the participation of eight experts, selected based on their role and experience in program and project management – the Program Manager, four Program and Project Management Officers, two Project Leaders, and one project team member, who collectively provided their opinion on the BM activities during the program management lifecycle.

The preparation of the focus group sessions involved deciding on some questions in advance, such as 'what are the main challenges of managing benefits in UIC programs?', to begin and guide the discussion, as well as to prepare the researcher to be ready to provide feedback on what was said (Langford and McDonagh, 2003). During the sessions, the focus group moderator (insider researcher) used auxiliary materials, such as the list of UIC benefits (Table 1) and the BM framework conceptualisation (Fig. 2), as well as explanatory notes on the Program and Project Management approach (Fernandes, Pinto, Machado, Araújo, & Pontes, 2015a). Fig. 3 summarises the data collected over time.

The central premise of this study was to move away from a high-level approach to BM to identify a systematic set of key activities to be performed and supported by specific BM tools. One major issue of in-depth longitudinal case studies is the large amount of data collected during the observations and other qualitative data approaches used. Therefore, an interpretive sense-making strategy for data analysis was used (Van Marrewijk et al., 2016). In such a strategy, the fieldworker's claims are strengthened with the support of the data embedded in the case study (Yanow, 2007).

Modelling the BM process, using the case study approach, required a rigorous and structured methodology to help identify key controls, inputs, outputs and resources for the various activities involved. In this regard, the researchers decided to utilise a widely regarded process or activity modelling methodology: Structured Analysis and Design Technique (SADT) (Ross and SchomanRoss, 1977). SADT utilises two principles of modelling derived mainly from general systems the-

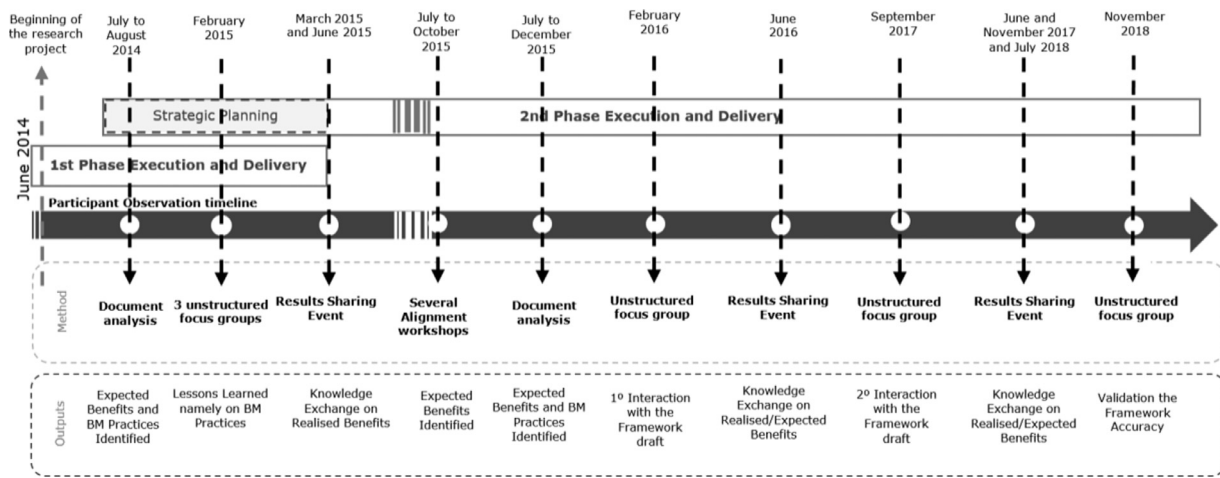


Fig. 3. Schematic illustration of the data collected over time.

ory (Boulding, 1956). Firstly, all activities are represented as boxes that have three primary types of input: (i) 'controls' that enter the top of the box and upon which the activity is dependent, (ii) simple 'inputs' that enter the left face of the box and (iii) 'resources' that enter the bottom face of the box. All 'outputs' exit the right face of the activity box. The second principle is hierarchical decomposition, where all activity boxes can be both a 'child' and a 'parent' of other activity boxes. Hierarchical decomposition allows for stepwise exposure of details as the reader progresses more in-depth into the SADT model or, a more holistic perspective as the reader navigates to the higher levels of the framework. The definition and later validity and reliability of the data used in the framework was informed using the 'reader-author' cycle defined as part of the SADT methodology, i.e. the researchers create various drafts as 'authors' of the SADT model and then pass these on to multiple participants. The latter, as 'readers' then validate the accuracy of the model. Therefore, the framework was developed collaboratively among the eight experts involved in the focus groups; and in this respect, it can be said that, this research influenced the BM approach adopted in the UMinho and Bosch collaborative R&D program.

The construction of the BM framework was managed iteratively. As Fig. 3 shows, at the end of the first phase of investment, focus groups were conducted with the objective of collecting lessons learned, namely on the BM practices and tools adopted. But, it was only when the second phase of investment had begun, that we had the first focus group on the framework development based on the initial conceptualisation. Around the middle lifecycle of the second phase, a second interaction was made, and then at the end of the program, a validation of the final framework was conducted.

The SADT guidelines include agreeing a modelling 'perspective' that guides the development of the framework and also limits the amount of detail exposed at a different level in the framework hierarchy. Another SADT guideline included the limitation of 'scope', and in this context, the researchers agreed to limit the scope of the framework exclusively to the BM process and not include all of the other project management activities that were outside the scope of this research. The modelling method aimed to distinguish itself by: (i) rendering the decision-making process based upon facts, (ii) stimulating the engagement of all stakeholders, (iii) promoting teamwork, and (iv) focusing on the optimisation of the different methods involved in the framework.

Lastly, in the final focus group, in order to show the link between the BM practice and the program management lifecycle, the eight participants were also asked for their perception of the percentage of effort, from 0–100% (PMI, 2017), which they had put into the four key BM activities during the program management lifecycle, and the answers were collected in an EXCEL spreadsheet, resulting in Fig. 8.

4. Results

The framework for BM in inter-organisational UIC (from now on termed 'BM.UIC' for brevity) is now presented. The BM.UIC framework is underpinned by the conceptualisation developed earlier and based on knowledge obtained from the literature review (Fig. 2). The conceptualisation provided a foundation for the development of the SADT activity framework. The first SADT 'actigram' in the framework is presented immediately below with the contextual description of BM, and this is followed by a partial framework of the BM.UIC obtained from data obtained in the case study analysis.

4.1. Manage program benefits (context)

The top-level diagram of the BM.UIC framework is presented in Fig. 4 and comprises three significant activities or processes. Each activity is the potential parent for other sub-activities lower in the hierarchy. Only the activity 'Manage Program Benefits' (A0) will be decomposed further into a child diagram in the sections that follow for brevity.

Govern Program Benefits: This activity represents the actions and decisions of the various stakeholders through the governance board of the program. There are many inputs, outputs, controls, and resources involved with this activity, but within the scope and context of the BM.UIC framework, the principle outputs are *Stakeholder Requirements* that generate the need for feedback from the other activities in the form of a live *Benefits Register* and independent periodic *Review Recommendations*. *Stakeholder Requirements* include various missions, visions, risks and opportunities of the different stakeholders. They also include endorsements of, for example, the expected and agreed benefits of the program. Funding is typically conditioned upon benefits realisation, which implies that all stakeholders, although with different organisational structures and cultures, have as an ultimate goal the realisation of program benefits.

Manage Program Benefits (A0): This activity is the primary focus on the BM.UIC framework and is controlled by *Stakeholder Requirements*. Principal inputs include 'benchmarks' of potential benefits identified from the literature that when combined with *Stakeholder Requirements*, lead to the *Benefits Register*. The second primary input is the independent *Review Recommendations* that are converted into actions within the *Benefits Register*.

Review Benefits Realisation: The last activity at this contextual level of the BM.UIC involved an independent review process of the *Benefits Register* and the management process. This review conducted periodically by a panel of independent experts, that also include independent members from both the university and industry, is informed by stake-

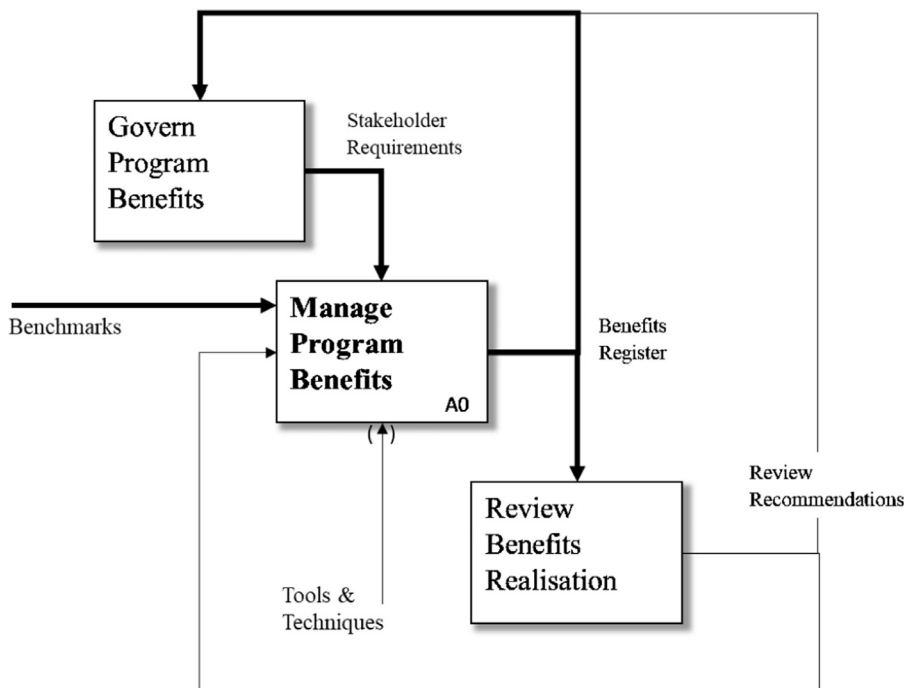


Fig. 4. Manage program benefits (context).

holder requirements in the form of agreed program documentation including the *Benefits Register* and delivers recommendations for change that can improve compliance and that lead to improvement actions.

4.2. Manage program benefits (A0)

Manage program benefits (A0) is the first child diagram to be decomposed from the context diagram 'Manage program benefits (context)'. Fig. 5 presents the SADT 'actigram' for the BM.UIC framework arising from the qualitative analysis, unstructured focus group discussions and validation using the SADT 'reader-author' cycle. The 'actigram' illustrates all significant controls, inputs, resources and outputs at this level of the framework hierarchy. Each child of this activity is now described.

4.2.1. Identify expected benefits (A1)

The first activity from the parent activity 'Manage program benefits (A0)' is 'Identify Expected Benefits' (A1), and this was subsequently decomposed into four child activities:

- A11: Define Program Strategic Vision
- A12: Establish BM Plan
- A13: Collect Expected Benefits
- A14: Describe Benefits Metrics

Describing the control, inputs, resources and outputs of each child diagram is beyond the scope of this paper. However, some critical observations found during the research will be outlined. It was clear from the focus group discussions that the primary goal of this first activity is to identify the benefits expected by all stakeholders and gather them in a *Benefits Register*. During this activity, managers found it challenging to identify benefits due to high uncertainty and risk associated with R&D projects and significant focus on fuzzy aspects of creativity and innovativeness (Brocke and Lippe, 2015). During the observation, the researchers noticed that more than half of the Project Managers and their teams were unable to identify the expected benefits for their projects. Even the word 'benefit' was not fully understood, and this is also recognised in the literature (Breese et al., 2015). Therefore, it was suggested to create a benefit breakdown structure (similar to Table 1) to act as 'benchmarks' in the development of agreed benefits. The benefit break-

down structure is a hierarchical representation of benefits under different categories used to facilitate planning and controlling of benefits realisation (Fernandes et al., 2020b).

Many organisations claim that project benefits are very hard to measure (Zwikael and Smyrk, 2011), and this was also one of the central claims of the focus groups participants. Therefore, it was suggested that the established expected benefits should be SMART – Specific, Measurable, Attainable, Realistic, and Time-bounded (Bjerke and Renger, 2017). Researchers also identified as necessary the definition of the *Program Strategic Vision* of the established collaborative program, so its concepts could lay the groundwork for common behaviours and actions, thus bringing about decisions and practices aligned with the strategic vision (Jenner, 2014). Furthermore, during the unstructured focus groups, the importance of establishing the *Benefits Management Plan* for the program was strongly emphasised. This plan would encompass the processes and tools for managing benefits, and used for guiding the program stakeholders during the whole program lifecycle (PMI, 2017). As mentioned by one participant, "we need clear and standardised guidelines on how to manage benefits". The key elements for the *Benefits Management Plan* are presented in Fig. 6.

The core elements of the *Benefits Management Plan* comprise (i) Benchmarks, (ii) Benefits, (iii) Indicators, (iv) Actions and (v) Benefits Maps. Benchmarks is a list of all possible benefits mainly informed from the research literature. The Benefits list comprises selected benefits informed by the benchmarks and approved by stakeholders. The Indicators list are a shortlist of key performance indicators (KPIs). The Actions list contains critical action to be executed to assure that benefits are realised. This Actions list is also informed by two separate activities that produce, firstly, a list of critical Risks and associated mitigations or actions and, secondly, an independent review that provides a list of Recommendations and related actions. The Benefits Maps are matrices that show the relationships or simple connections between Benefits vs Indicators, Benefits vs. Actions and so on. Other elements in the *Benefits Management Plan* include a list of information exchange Events, a Transition Plan, a list of Lessons Learned and Future Actions beyond the lifetime of the program. Each of these elements will be explained further in the sections that follow.

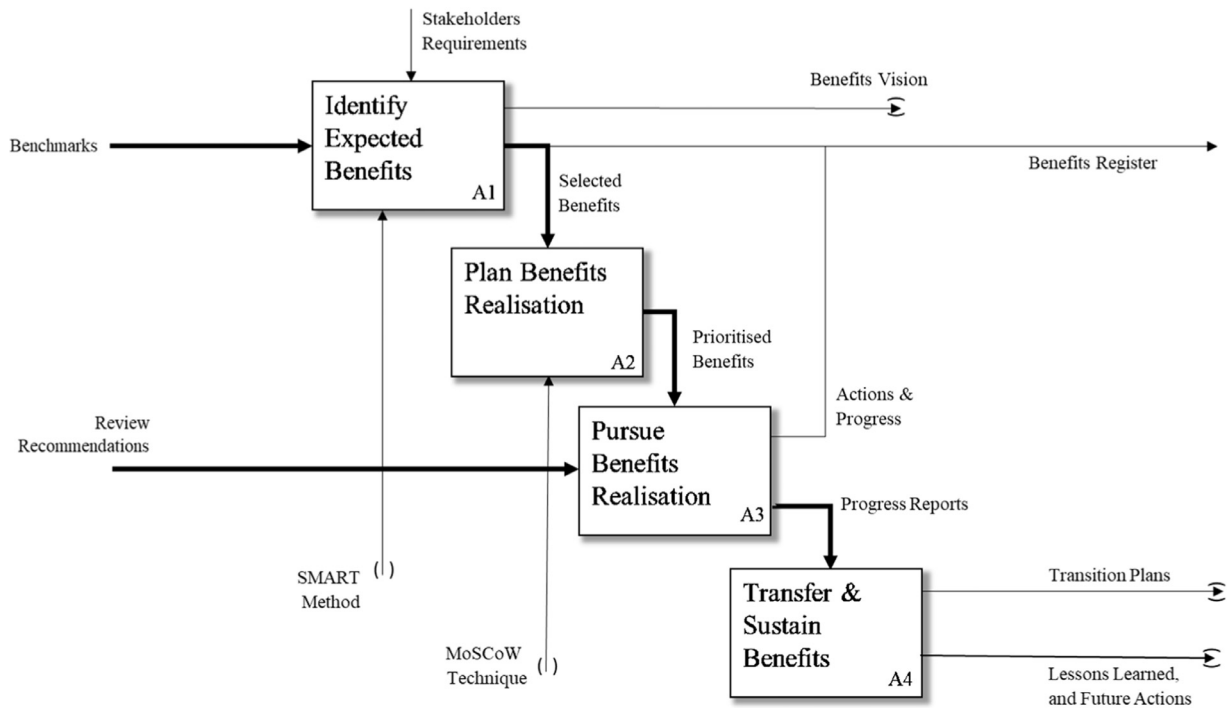


Fig. 5. Manage program benefits (A0).

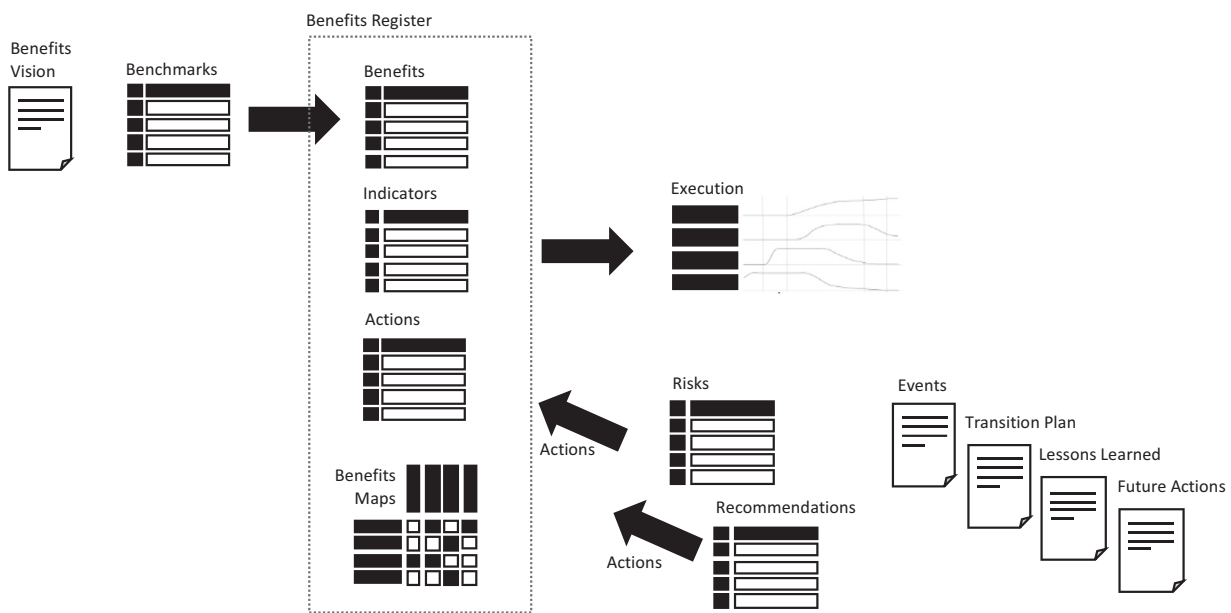


Fig. 6. Benefits management plan.

4.2.2. Plan benefits realisation (A2)

The second activity from the parent activity 'Manage program benefits (A0)' is, 'Plan Benefits Realisation' (A2), and this was subsequently decomposed of four main sub-activities.

- A21: Categorise Benefits
- A22: Prioritise Benefits
- A23: Link Benefits
- A24: Develop Benefits Realisation Plan

During the focus groups, the importance of categorising the expected benefits in the *Benefits Register* was highlighted, and it was suggested that it could be done by using a benefit breakdown structure. As mentioned by one participant, "the benefits categorisation would facilitate

the planning and control of benefits realisation". The prioritisation of the expected benefits in the *Benefits Register* was also highlighted since there are several expected benefits. Jenner (2014) highlights the importance of focussing on the top three to five benefits, since people are not able to focus on too many variables; and that Pareto analysis can be used for this purpose.

UIC programs have high levels of risk, uncertainty and success volatility (Brocke and Lippe, 2015). To maximise benefits, it is essential to focus on unexpected situations that potentially can impact positively or negatively on the expected benefits of the program (Lechler et al., 2012). Managing benefits should be shaped around debate forums, with regular meetings and the presence of all different working and man-

agement groups involved in the program, to promote a discussion of their expectations, desires, goals, as well as priorities (Jenner, 2014). This activity is crucial to identify, prioritise and manage expectations and, therefore, to cultivate strong working relationships between all the people involved (Plewa et al. 2013). In this regard, one participant suggested the use of a prioritisation method, adapted from the MoSCoW technique, due to its ease of use and high user confidence (Vestola, 2010).

Another activity mentioned by one focus group participant and agreed upon by all the others was the benefits mapping between the projects or the program as a whole, so that the sources of each identified benefit can be pursued. It was suggested that the benefits mapping should also be included in the *Benefits Register*. Lastly, it was discussed that the definition of critical factors for benefits' realisation would be an essential input for the meaning of actions to leverage the realisation of each expected benefit, to develop a *Benefits Action Plan*, thereby establishing when and how the benefits will be delivered. A cost-benefit analysis between the effort necessary to leverage a benefit critical factor and the payback of the benefit generated was also suggested. When discussing the *Benefits Action Plan* content, all participants agreed on the importance of identifying, for each benefit, a person responsible and accountable for its realisation, as also emphasised by Chih and Zwikael (2015). It was observed that the accountability for the realisation of benefits at both project and program level was the responsibility of the Program Manager. The Project Managers were responsible for delivering the project outputs agreed with the Program Manager from Bosch and UMinho in the *Project Charter*.

4.2.3. Pursue benefits realisation (A3)

The next child activity of the BM.UIC framework from the parent activity 'Manage program benefits (A0)' is named 'Pursue Benefits Realisation' (A3), and this was subsequently decomposed in five main sub-activities.

- A31: Implement Actions
- A32: Monitor Benefits
- A33: Evaluate Risks and KPIs
- A34: Report Measurements
- A35: Provide Corrective Actions

The focus group participants agreed that the main objective of this activity was to carry out the necessary actions to pursue the expected benefits realisation by implementing the *Benefits Action Plan* and thus triggering critical factors for benefits realisation. These actions should always be established by the organisation partners, bearing in mind the trade-off between the effort of implementation versus the gains obtained. This activity is regarded as promoting a value culture (Jenner, 2014). During this activity, the *Benefits Register* must be updated with the record of the actions taken to trigger the above-mentioned critical factors. The researchers observed that this activity comprises sub-activities related to the encouragement of interactions between the teams working on the program management and BM, and to the onset of the necessary changes to promote the realisation of the expected benefits. Therefore, it is essential to monitor organisational environments, internal and external factors (Coombs, 2015), as well as program objectives and benefits to ensure the program benefits remain aligned with both partners' strategic objectives (Jenner, 2014). This results in the update of the artefact *Benefits Register*, and the production of the *Benefit Audit Reports*. For example, a critical internal factor is to monitor absorptive capacity, which is seen as "crucial for the successful creation of innovations within university-industry collaborations" (Kobarg et al., 2018, p. 6) since it promotes knowledge absorption and transformation. Therefore, the higher the absorptive capacity of industry, the higher are the benefits from UIC (De Fuentes and Dutrénit, 2012). In parallel, the researchers observed that an evaluation of the program's risks, that might impact benefits realisation and KPIs, might be carried out in the *Benefits Register* so one can monitor the delivery of benefits. KPIs play a vital role in BM to understand how the benefits are cascaded down and

measured bottom-up (Badewi, 2016). Tools might also be implemented to promote the analysis and the sharing of data regarding BM and provide the opportunity to conduct internal audits to review and assess the status of the BM practice (Project Management Institute, 2017).

During the focus group discussions, it was clear that the participants assign great importance to the reporting of benefit measurements so that stakeholders can take appropriate actions to ensure successful benefits delivery. As outputs of this activity, focus group participants referred that the existing *Cockpit Chart*, that provided to the respective stakeholders a summary report of the status of each project and the program as a whole, should also include benefit status. The existing Results Sharing Events can also provide each project team involved in the program with insights and knowledge exchange about expected and realised benefits. During the execution of the case study, these Results Sharing Events were taking place twice a year; however, the periodicity of these events should be adjusted to each program's context.

Finally, the researchers observed that the 'pursue benefits realisation' activity lays the groundwork for continuous improvement and leaves space for amendments whenever necessary (Jenner, 2014). Therefore, the required corrective actions should be provided to achieve the expected benefits. This results in *Benefits Action Plan* modifications and updates whenever necessary, along with the lifespan of the program lifecycle. Also, there is a need to update the *Benefits Register* with the record of the corrective actions taken.

4.2.4. Transfer and sustain benefits (A4)

The last child activity of the BM.UIC framework from the parent activity 'Manage program benefits (A0)' is 'Transfer and Sustain Benefits' (A4), and this was subsequently decomposed in four child activities.

- A41: Transfer Results to Organisations
- A42: Track Benefits and Benefit CSFs
- A43: Identify Gaps
- A44: Continue Benefits Monitoring

The focus groups' participants agreed that the main objective of this activity is to transfer the program's results into both participating organisations, ensuring that the results obtained within the program are being properly exploited and seized-upon by both partners. Therefore, the need to develop *Transition Plans* to facilitate the ongoing benefits realisation was acknowledged. This included a list of members, within each organisation, accountable for the exploitation, and the handover of all the necessary information to allow for the proper exploitation of the program's results.

It was also agreed that this activity also keeps track of the expected benefits and critical factors for benefits realisation, by using a *Cockpit Chart* containing the benefits status, as well as a benefit critical factors *Dashboard* containing all critical factors for the realisation of each benefit. To accurately track benefits, it was suggested that there should be close control of how and when the benefits will be delivered. Established metrics should thus be assessed, not only during 'program benefits delivery' and 'program closure', but also during the 'post-program'. These tools facilitate stakeholder engagement in pursuing benefits realisation (Jenner, 2014).

As to the 'program closure' and 'post-program', one participant raised the importance of identifying gaps by analysing if each defined benefits realisation measure meets the planned target and, if not, then listing all missed opportunities, as well as reporting *Lessons Learned* hence ensuring that the handover of knowledge and insights acquired during the program lifecycle is achieved. This raised the argument that an analysis of the level of accomplishment of the stakeholder's expected benefits should also be made. Therefore, the participants proposed that benefits should be rated by the respective stakeholders, in a scale of 1 (low) to 4 (high), to analyse the degree of benefits realisation and, whether or not the stakeholder's expectations had been met, resulting in a *Review Report* identifying the stakeholder's expectations accomplishment (PMI, 2017).

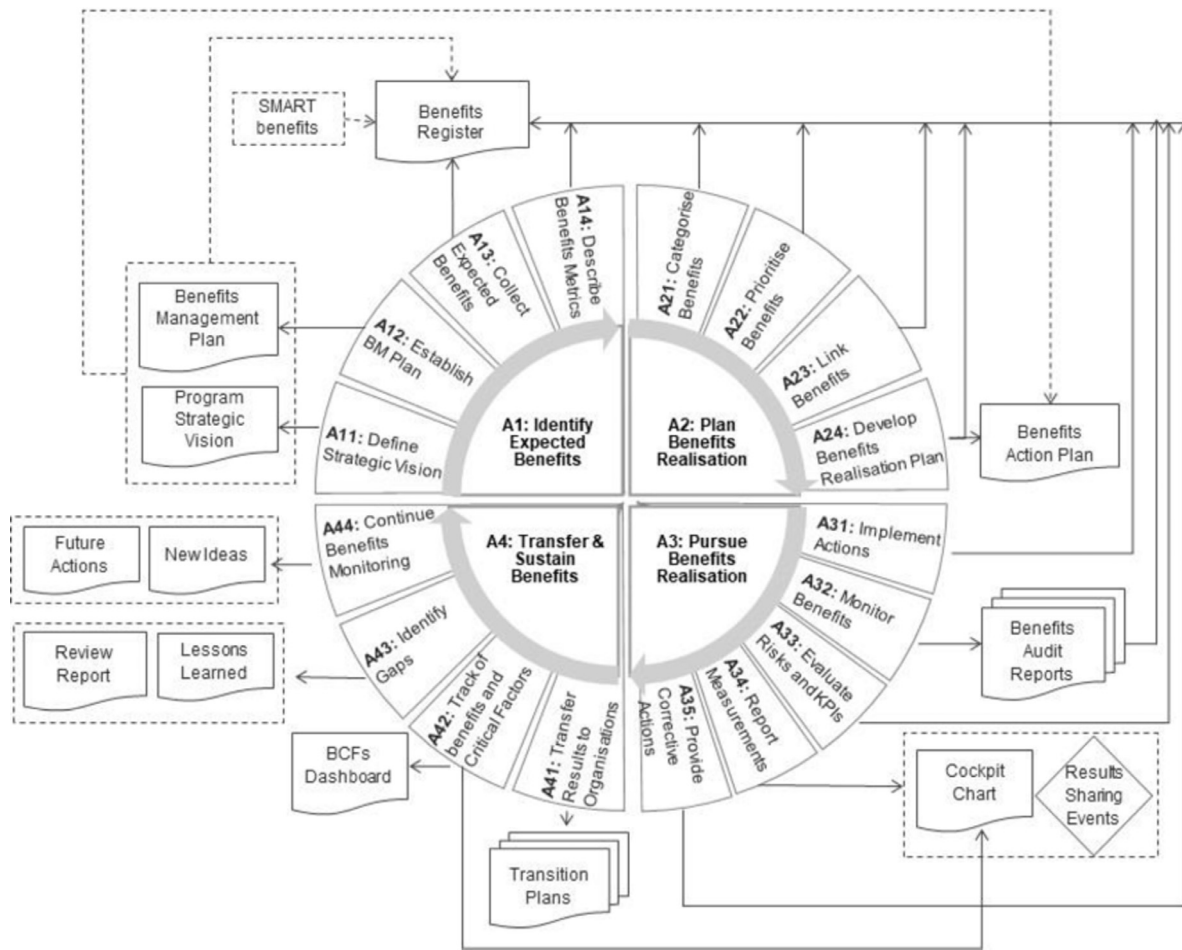


Fig. 7. The BM.UIC framework to manage program benefits (FEO).

Finally, during the researchers’ observation, it was noticed that there are benefits that can only be perceived and/or achieved after the end of the program – ‘post-program’. Therefore, it is essential to ensure that benefits continue to be monitored even after the program closes and that the BM practice only ends when all the expected benefits are achieved. Therefore, the researchers recommended the implementation of a system for communicating *Future Actions* to accomplish benefits whose timeline surpasses the ‘program closure’, as well as having an available platform to collect *New Ideas* to support the development of future program collaborations.

The SADT modelling method also allows for the creation of what are called ‘for information only’ (FEO) diagrams. The SADT hierarchy is rigorous in exposing details gradually as the reader navigates down the framework. However, some perspective may be lost due to hierarchical representation, and so in this regard, the use of an FEO diagram can have value for the reader. Fig. 7 presents a more holistic FEO diagram of the ‘Manage Program Benefits’ (A0) activity. This diagram overcomes some of the loss of interaction between activities experienced with the formal hierarchical layout and illustrates linkage to some of the critical tools.

4.3. Linkage to program management lifecycle

The analysis of the case study revealed that the operational parameters required to systematically undertake the essential elements of BM, and the inter-relationship of those parameters, has been largely ignored, in much the same way as the integration of BM in the program management lifecycle. Therefore, it was discussed, during the last focus groups,

that the four key activities established for applying the BM.UIC framework and the timelines of action of the adopted program and project management (PgPM) lifecycle (Fernandes, Pinto, Machado, Araújo, & Pontes, 2015a) should be combined, through a Rational Unified Process (RUP) diagram (Kruchten, 2004).

In Fig. 8, the horizontal axis depicts the passage of time along the program management’s lifecycle; the vertical axis shows the different key BM.UIC activities. As argued by Musawir et al. (2017), BM takes place before, during, and after the program’s lifecycle. Fig. 8 intends to portray an abstract concept, which is the level of effort put into the different activities of the BM.UIC framework throughout a program management lifecycle, based on the experience of the focus group’s participants, they pointed their perception of the percentage of effort, which they had put into the four key BM activities during the program management lifecycle. Each key activity of the BM.UIC framework fits differently in the PgPM lifecycle:

- ‘A1: Identify expected benefits’ – occurs during the whole PgPM lifecycle, with higher effort during ‘program preparation’ and ‘program initiation’;
- ‘A2: Plan benefits realisation’ – begins its implementation at ‘program initiation’ (where the main effort takes place) but also comprises all phases of the PgPM lifecycle, since planning is implied and taken into account in every process of program management;
- ‘A3: Pursue benefits realisation’ – begins its implementation only during ‘program benefits delivery’ and its effort is extended to ‘post-program’; and
- ‘A4: Transfer and sustain benefits’ – also initiates its implementation during ‘program benefits delivery’ and its effort increases, progres-

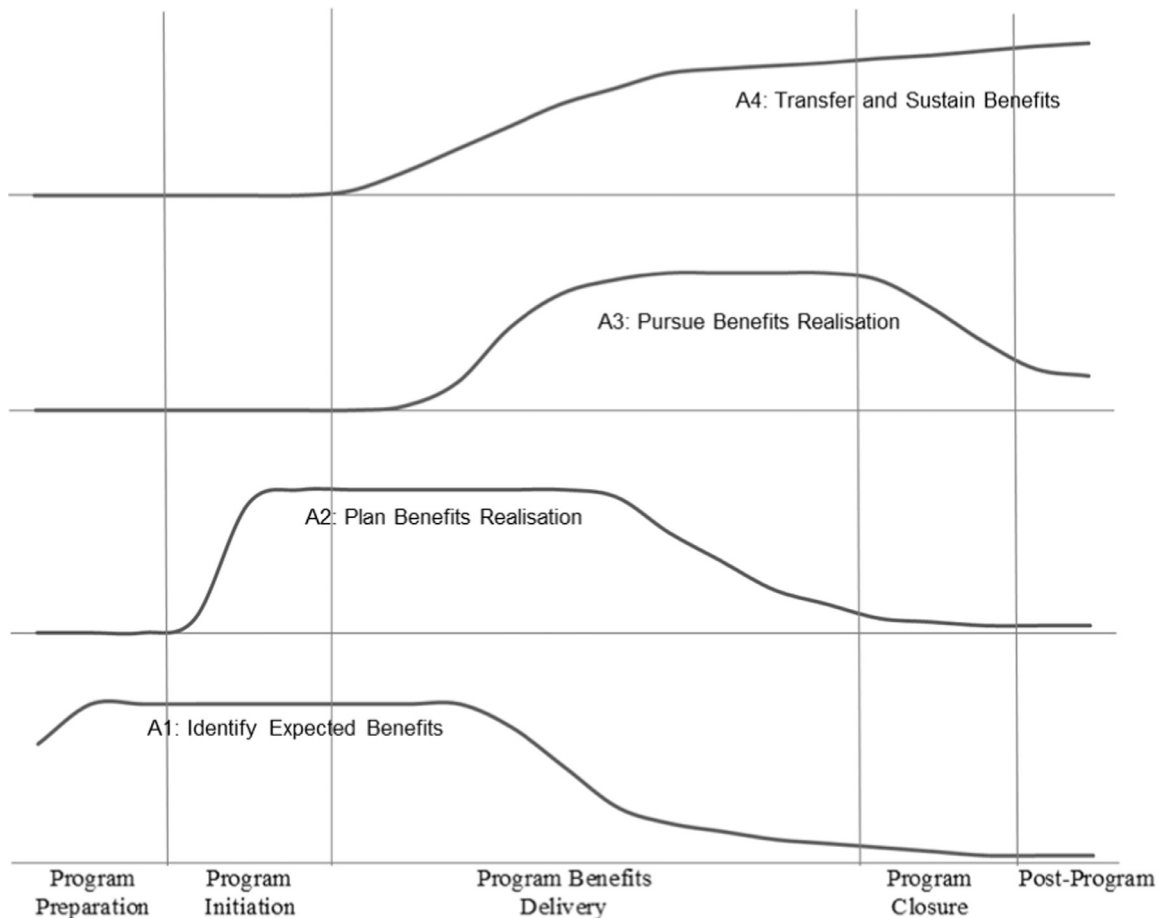


Fig. 8. RUP-like diagram of the BM.UIC framework.

sively, reaching its peak during 'program closure'. Unlike other activities, 'transfer and sustain benefits' as well as 'pursue benefits realisation' continue their efforts beyond 'program closure' (PMI, 2017), the last phase of the PgPM lifecycle (Fernandes, Pinto, Machado, Araújo, & Pontes, 2015a)

5. Discussion

This research has focussed on answering the research question: *How can organisations effectively manage the benefits of major university-industry collaborations?* During the study of a major UIC, various generalisable technical and social BM practices and tools have been mapped using a structured analysis and design technique. In the discussion below, four practices in particular will be explored. These BM practices have been articulated as propositions, of distinct emerged best practices in the case study, but to become more generalisable to other UIC contexts or even other industry contexts they may require further research.

BM is a process that involves both technical and social elements (Jenner, 2014; Hernes, 2014). It is beyond the scope of this paper to explore all the technical and social elements of BM within UIC. It instead addresses the technical and social elements that naturally arose during the case study analysis. The so-called technical elements include processes such as setting goals, strategy, methods, policies and tools used for the execution of BM to mention only a few. The social elements include culture (e.g., norms, values, and behaviours), organisation, leadership, skills, competencies and motivation, also to mention only a few. In this context, the following discussion of research results is divided into two perspectives: technical and social.

5.1. Technical perspective

During the focus groups, researchers noticed that participants mostly focused on the BM technical aspects, such as BM activities and tools. These technical aspects are also the most emphasised in the literature, e.g. Benefits Management Plan (Benefits Realisation Plan), the Benefits Register or the Benefits Transition Plan (Axelos, 2011; Jenner, 2014; PMI, 2017, Ward et al., 1996). However, two additional BM tools also emerged, the use of a benefit breakdown structure to support benefits identification and the use of benefit critical factors to pursue benefits realisation.

The identification of benefits resulting from inter-organisational UIC was a significant challenge during the case study analysis, and this is also recognised in the literature (Breese et al., 2015). In UIC programs, organisational complexity arises from different and sometimes even conflicting requirements and needs of the various partners (Ruuska et al., 2011). Aligning benefits are essential determinants for program success (Zwikael et al., 2017). In this regard, the creation of a benefit breakdown structure served as a critical part of the benefits identification activity and later converted into a benefits checklist. The benefit breakdown structure helped the stakeholders to look at many sources from which program benefits may arise. During case study, the benefit breakdown structure had been reviewed continuously, to incorporate newly identified benefits for use in future UIC programs. This insight led to the first of two empirical propositions which require further research:

Proposition 1: The activity 'Identify Expected Benefits' should be supported by a benefit breakdown structure to act as 'benchmarks' in the development of agreed benefits among different stakeholders.

Another critical challenge was in pursuing benefits realisation and in particular, the adoption of a critical success factor approach during the essential activity 'Plan Benefits Realisation'. The concept of success factor is usually credited to Daniel (1961), who introduced it concerning the 'management information crisis'. This approach has many other supporters, also in the area of project management (Cooke-Davies, 2002).

During the program, links were established between benefits and the critical factors for their realisation. Therefore, it was possible to perform an appropriate selection of actions that trigger those specific essential factors of success and consequently, the corresponding stakeholders' expected benefits. They have been considered, by the Program Manager, as a necessary input for the definition of actions aiming at enhancing the critical factors to pursue benefits realisation. This insight led to the proposition:

Proposition 2: The activity 'Plan Benefits Realisation' should take a critical success factor perspective. For each benefit, there should be identified, the critical factors for its realisation and actions need to be planned and decided to leverage the benefit critical factors identified.

5.2. Social perspective

The UIC program had two different organisations with their structures and cultures, and none conducive to BM (Ankrah and Al-Tabbaa, 2015). A low level of maturity was observed around BM among key stakeholders. This presented a significant challenge to the implementation of BM practices. In this respect, several key embedding factors (Fernandes, Ward, & Araújo, 2015b) were taken into account by the PgPMO applying activities such as (a) Demonstrating the value of BM through periodic communication; (b) Identifying opinion leaders mandated to raise BM issues at key meetings; (c) Raising awareness about the need to realise benefits so further collaborations would be funded in the future and; (d) Specific training to key players on benefits and BM.

The collaborative R&D program was partially funded by the Portuguese government, Bosch, and UMinho. At a strategic level, decisions regarding BM by the Program/ Project Owner were not an issue for the UMinho and Bosch consortium, since it was a requirement from the funding agency that the industry partner takes the program/project leadership. Therefore, Bosch took the lead in delivering the benefits identified during the 'program preparation' phase. Nevertheless, the program did have multiple funders, with their own benefit expectations (see Table 1). Therefore, the inter-organisational form of UICs brought unique challenges for accountability of benefits realisation, as the accountability of some benefits were shared (e.g., benefits for society). Therefore, at an operational level, it was necessary to identify who will play the role of the Program Owner. Looking at the program organisation and following the definition of Project Owner by Zwikael and Meredith (2018, p. 485) the Program Owner is "the senior manager who is held accountable by the funder for realising the business case. The Project Owner acts on behalf of the funder throughout the project, seeking to ensure that their interests are being served", the Program Coordination played the role of the Program/ Project Owner during the program management life-cycle, as mentioned during the case study description, the Program Coordination is the organisation accountable to guarantee the realisation of the overall program benefits, i.e. the Benefits Owner, the responsible for the realisation of benefits (Jenner, 2014). So, in this particular case study context, during the program management lifecycle, the Program/ Project Owner and Benefits Owner were the same.

The governance structure adopted ensured that in all organs of the program organisation had representatives from both industry and the university. So, the Program Coordination had a Program Manager representative from industry and a Program Manager representative from university, although the benefits realisation of overall program benefits was shared by both, each representative was responsible for pursuing each benefit relevant to their own organisation.

Therefore, the findings of the study highlight that the responsibility of BM should fall on the Program Coordination's shoulders, according to PMI (2017) Program Managers. However, after 'program closure' phase, the burden of program benefits realisation should be handed over to the respective Line Managers of each partner (Dupont and Eskerod, 2016). Line Managers are middle managers for a particular part of the industry or university organization, for instance, a function, as R&D, Operations, Marketing, or an organisational unit, as branch, faculty, research centre. Zwikael and Smyrk (2012) also point out that the ownership of benefits realisation in the post-implementation is not the responsibility of Project or Program Managers. The clarification of roles and responsibilities during the BM process is critical since it influences the effectiveness of BM (Hesselmann and Kunal, 2014). In Jenner's (2004) work the key BM roles, and their BM responsibilities are well-detailed. This insight led to the first of two propositions which require further research:

Proposition 3: The Benefits Owner (i.e., the accountable for the benefits realisation) should be the Program Manager during the program execution; however, after program closure, the burden should fall on the Line Managers' shoulders of each organisation.

It is critical to have someone specifically accountable for delivering benefits (Meredith and Zwikael, 2020) and in inter-organisational collaboration programs context this accountability changes overtime. Therefore, the transition of responsibility from Program Managers to Line Managers of each organisation is vital for realising all program benefits.

This is even more important in inter-organisational programs funded by multiple partners, where different benefits are expected by each partner. The expected benefits are even pre-established during the 'program preparation' phase, where the primary benefits identified were included in the *Funding Application*, and later in the *Funding Contract*, and the fund to receive from the government was constrained to the realisation of the contracted benefits. Therefore, in UIC programs context the 'right' ownership of benefits realisation is even more critical as the final funding is conditioned to the benefits realisation.

Finally, another challenge observed was related to the complexity of the program's governance model adopted, given the nature of inter-organisational collaborative programs and the reliance on cross-boundary collaboration (Hesselmann and Kunal, 2014; Fernandes, Pinto, Araújo, & Machado, 2020a). Governance in programs and projects is widely recognised as a critical factor for successful benefits realisation (Musawir et al., 2020) and one of the main barriers to UIC (Nsanzumuhire and Groot, 2020). That being said, the existing supportive PgPMO structure played an essential role in promoting and supporting the engagement of stakeholders and the inter-relationships between stakeholders, essential for the BM process (Jenner, 2014; Zwikael and Meredith, 2019), by helping namely the Program and Project Managers to define the expected benefits and respective KPI's to measure them. This was accomplished by giving examples of KPIs from other projects within the program, as well as by reporting to the Program Managers all the circumstances that might put in risk not only the program scope, time, cost, and quality, but especially the program benefits. Additionally, the PgPMO had a critical role in the effective communication and integration of the benefits at the program and project level (PMI, 2017), and in the embedding process of the BM activities into the program and the projects. This insight led to the final proposition:

Proposition 4: A Project Management Office or similar structure plays a central role in embedding the BM practices and tools and supporting stakeholders in each step of the BM process.

6. Conclusions

The research reported in this paper has both theoretical and practical contributions. Through an ethnographic approach, this research builds knowledge in the area of BM, by adopting a practical process view for developing a holistic and structured framework focussed on inter-organisational collaboration programs, in the form of university-

industry consortia, which brings together unique challenges such as different organisation cultures and often competing expected benefits.

Based on well-recognised BM frameworks (Ward et al., 1996; Axelos, 2011; PMI, 2017; Jenner, 2014), the BM.UIC framework summarises the management of benefits in four main iterative activities: 'Identify expected benefits'; 'Plan benefits realisation'; 'Pursue benefits realisation'; and 'Transfer and sustain benefits', that build upon current theoretical approaches. The adoption of the PDCA perspective (Deming and Edwards, 1982) emphasises the recursive and interdependent nature of BM activities, particularly crucial in inter-organisational consortium between university and industry, subject to high uncertainty and risks and significant pressure in terms of creativity and innovativeness that commonly leads to stakeholders expected benefits changes. Additionally, given the governance complexity of these types of inter-organisational programs, the BM.UIC framework identifies a systematic set of key activities that should be performed, with a clear set of controls, inputs, outputs and resources that need to be managed.

Therefore, to answer the research question: *How can organisations effectively manage the benefits of major university-industry collaborations?* Much of the developed framework has focussed on so-called 'technical' elements, and although most of the activities and tools are already identified in literature (Axelos, 2011; Jenner, 2014; PMI, 2017; Ward et al., 1996; Zwikael and Meredith, 2019), a few different tools emerged, such as the benefit breakdown structure to identify benefits and the benefit critical factors to pursue benefits realisation. Nevertheless, it has also introduced some 'social' elements and in particular the importance of governance, namely the transition of responsibility of the Benefits Owner role from Program Managers to Line Managers of each organisation, during program closure phase, and the supporting role of Program and Project Management Offices during the BM process.

The study has revealed that inter-organisational BM has several challenges during their implementation and that although the BM.UIC framework was developed to support inter-organisational UIC programs, most of the proposed BM activities and tools are generic and may be relevant in other typologies of programs and projects.

The BM.UIC framework is also linked to a program and project management approach shown in a RUP-like diagram. This linkage allows one to view some BM activities as familiar to the whole program management approach rather than being exclusive to BM (Badewi, 2016). Further work might be conducted to identify the adequate level of effort put into the different activities of the BM.UIC framework throughout a program management lifecycle. The level of effort that has been presented in this paper is based only on the experience of the focus groups' participants—however, the curves in the RUP-like diagram of the BM.UIC framework should be accurately obtained, resulting from a time-sheet registration of the active hours spent on BM activities, ideally from several UIC programs.

Moreover, this paper also brings an important contribution to practice by emphasising the need to move beyond the *triple constraints* of time, cost and quality into more strategic measures that for industry might mean access to new knowledge and for universities might mean access to 'real-life' environments. This implies the development of a formal and unique BM process for each particular UIC context, for which the developed BM.UIC framework might be used as a starting point, emphasising as well as the importance of taking into account both technical and social aspects on BM practice. Additionally, the case study revealed that in its context, during the program management lifecycle, the Program/ Project Owner and the Benefits Owner were the same. This has important practical implications, which raises an interesting question for future research: Should organisations distinguish between the roles of Program/ Project Owner and Benefits Owner?

We acknowledge the drawbacks of the research study, which mainly result from the decisions we made concerning the methodological approach. First, our findings were based on one case study of a major UIC. Hence, they cannot be generalised for all UIC contexts, neither to other industry contexts. In this regard, future studies can induce multiple case

studies and cross-check the conclusions among them, thereby increasing the generalisability of the results. Second, as common among in-depth longitudinal case studies, a large amount of related primary data was collected and challenging to report in a single research paper. This data around topics such as quality assurance and societal impacts, may be the subject of future work.

Declaration of Competing Interest

There is no conflict of interest.

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Gabriela Fernandes is an Assistant Professor at University of Coimbra (Portugal) on Project Management (PM) and Innovation Management. She spent 10 years in the coordination and management of projects in different industries. Throughout her career, she served as an executive director of some companies. She was responsible for various communications and author of several publications in the PM area. She developed and taught several PM training courses and as a consultant, coordinated the implementation of PM systems, as well as the implementation of PM office structures. She was director of the PMI Portugal Chapter, and is PMP® credential holder.

David O'Sullivan is Professor of Industrial Engineering at the School of Computer Science in the National University of Ireland Galway. He is a graduate of the Dublin Institute of Technology, Trinity College Dublin and University College Dublin. His research interests include innovation management with particular relevance to established industrial and public organizations. He is author of a large number of peer reviewed articles and including the books *Applying Innovation* (Sage); *Manufacturing Systems Redesign* (Prentice-Hall); *Reengineering the Enterprise* (Chapman & Hall) and; *The Handbook of IS Management* (Auerbach). He is also author and presenter of large MOOC on *Applying Innovation*.