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## Benefits Management in University-Industry R&D Collaborative Projects: A Review on Benefits and Success Factors

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### Abstract

Benefits Management is a field of growing interest in the universe of University-Industry collaborative partnerships. Therefore, this paper aims to present and discuss a review on benefits and success factors that were previously identified in the literature through two distinct methods of categorization in order to qualify and better understand how each benefit and success factor act and what are their intrinsic properties. Throughout these methods, the next goal is to perform a cause-effect analysis to understand which factors generate which benefits and make some theoretical assumptions based on these correlations. This study will display that there are important underlying conceptual issues in benefits categorization and will suggest, accordingly, an approach to surpass it in order to contribute to further research in benefits management.

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*Keywords:* benefits management; university-industry collaborative projects; success factors

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### 1. Introduction

Benefits Management is described by the Standard of Program Management from [1], as a way of analyzing all available information about management strategies, internal and external factors and the motivations for the project with the purpose of identifying and categorize all of the expected benefits. These potentially benefits should be registered, analyzed, classified and planned in detail. Recent research shows that partnerships established between universities and industries are perceived as an investment from both sides [2]. As thus, with the intention of

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enhancing this investment, project managers involved in R&D collaborative projects have perceived Benefits Management as a tool of growing value [3-5]. This concept leads us to the idea that it is reasonable to employ the concept of return on investment and, therefore, establish relationships between the resources invested and the benefits obtained to be easily measurable [6]. However, benefits management is something more complex and should not be downsized to just economic indicators because, if we want to commit to an appropriate benefits management method, it is crucial to pay attention to all factors, especially to factors that are intangible and therefore are not formally expressed, but are normally implied and recognized by all stakeholders. With the increase of University-Industry partnerships and its importance to promote the strategic development of national and mainly local economies [3, 6], it is critical to develop new methodologies to face the challenges that this type of partnerships encounter, since the knowledge in this field, accordingly to the state of art, is quite limited. One of the biggest challenges of University-Industry partnerships is performing an appropriate management of all the benefits that arise from this symbiosis and its respective economic impact. Therefore, this paper consists of a compilation of all success factors that can lead to benefits and an extensive analysis of the benefits encountered.

This paper will be divided into distinct parts. After the introduction, a literature review of the benefits and success factors is done. Then the research methodology used will be explained. After that, a cause-effect analysis between factors and the related benefits will be shown, ending with some final considerations about the research.

## 2. Literature Review

### 2.1 Benefits review

According to the literature, a benefit is a measurable improvement that derives from the results obtained [7]. It is a result of a perceived change that is seen as an improvement through the eyes of a stakeholder [8]. In conclusion, a benefit is a result whose nature and value can assume innumerable forms and, ultimately, be something that brings advantages to an organization. Although we already know the primary definition of a benefit, and since we are aware of all the range of interpretations that the concept of benefit can have, it is necessary to, not only identify the benefits, but categorize them so we can have a better understanding of their purposes. As thus, related to each identified benefit there will be a categorization concerning his type, nature, incidence, perpetuity, agent and scope (Table 1). When it comes to the type of benefits, based on literature review [9-13], they will be divided into four typologies:

- Strategic – These benefits are correlated with business opportunities that promote growth and development [9]. They are mainly benefits related to institutional aspects that, in some way, contribute to make decisions about their resources to accomplish the objectives aimed by the organization (having in mind the environmental factors of the organization and the stakeholders' expectations).
- Operational – These are benefits related to changes in critical activities of the organizations [9]. They intervene in the daily life of an organization affecting it towards the efficiency of products/processes/services.
- Economic – These type of benefits act on the regulation of goods and resources of the organization and all of financial related issues.
- Social – These are benefits that promote the knowledge transfer into the society [10]. They sponsor the adoption of attitudes, behaviors and actions that promote the general welfare and solidarity.

To what concerns the nature of benefits they will be divided into two types: tangible and intangible. Tangible benefits can be measured in an objective, quantitative, and even financial way (note that these characteristics are not mutually exclusive). Nonetheless, intangible benefits can only be assessed through a more subjective way and using qualitative measures since they cannot be evaluated by financial performance but behavioral value [9].

Benefits can also be categorized to what concerns their incidence in the project [5]. They can have direct incidence when the benefit focuses clearly and immediately on the project, or indirect incidence when the opposite occurs. In the second case, the benefits do not take a clear action and repercussion in the project itself but act like a mean to a bigger purpose that transcends the project itself.

Known the benefits incidence, it is also important to recognize their perpetuity to be able to understand better what their impact on the project is and how much their impact lasts. Having this concept in mind, a benefit can have a short term or long term impact. Short term benefits cause repercussions on the project immediately and you can

clearly see what actions they set off (short-term benefits often have direct incidence). On the other hand, long-term benefits have their outcomes shown only when the lifecycle of the project is over its initial phase (normally these type of benefits have also indirect incidence). To better understand in what type of agents the benefits act, it is crucial to distinguish them into benefits that affect only industries, universities or both simultaneously. Benefits should be categorized as well in scope so we can comprehend what is the field of action of each benefit/success factor. During this study there were found seven areas of interest:

- Value creation – benefits that belong to this scope contribute to optimize the return on investment [14]. More specifically, value creation is reliant on the relative quantity of value that is, subjectively, attributed by its target user (which is the focus of this value creation, either being an individual entity, university or industry) and its ability to transform this perception into an exchange under the form of monetary value [15].
- Strategy – benefits that take part of a process or plan of action to achieve certain goals that are seen as crucial to the organizations growth by the stakeholders' eyes.
- Resources – benefits that are related to all of the available assets that are used in a project. This resources can be material (e.g. equipments) or human (e.g. hiring researchers/project coworkers).
- Quality/Performance – benefits that fit in this scope contribute to achieve the level of excellence of something or correspond to the totality of its intrinsic characteristics that satisfy all the requisites in order to stimulate continuous improvement.
- Employability – benefits that lead to the establishment or preservation of work places.
- Knowledge – benefits whose field of action is to take part in knowledge transfer and are related to the know-how of organizations and the project itself.
- Inter-relational – benefits that trigger reactions into inter and intrapersonal relationships between the agents involved.

Table 1. Benefits categorization method.

| Benefit type | Benefit nature | Benefit incidence | Benefit perpetuity | Benefit agent        | Benefit scope       |
|--------------|----------------|-------------------|--------------------|----------------------|---------------------|
| Strategic    | Tangible       | Direct            | Long-term          | University           | Value Creation      |
| Operational  | Intangible     | Indirect          | Short-term         | Industry             | Strategy            |
| Economic     |                |                   |                    | University/ Industry | Resources           |
| Social       |                |                   |                    |                      | Quality/Performance |
|              |                |                   |                    |                      | Employability       |
|              |                |                   |                    |                      | Knowledge           |
|              |                |                   |                    |                      | Inter-relational    |

## 2.2 Success factors review

The concept of success factors is usually credited to Daniel [16] who introduced it in relation to the 'management information crisis'. This approach has many proponents. A success factor can be defined as an element that interferes during the course of an action triggering certain type of answers. Ultimately, a factor is perceived as the cause of an effect. In this study, we aimed to categorize factors that lead to certain benefits and to understand their timeframe of action, type of agent from where they arise and field of action (scope). The factors that can lead to benefits are divided into five types:

- Inter-relational – this type of factors lead to repercussions in the relationships established between the university and the industry and can be divided into three extents: inter-relational factors for communication, inter-relational factors for peer to peer relation and inter-relational factors for cooperation.
- Economic – these are financial nature factors and, therefore, are related to the performance of the organization when it comes to resource optimization.
- Technical and Scientific factors – these are success factors that trigger operational type benefits and, as thus, are factors with more technical features that stimulate improvements in processes that are performed within the organizations.
- Strategic – express all the necessary conditions that allow a strategic benefit to be generated. Hence, these factors are the direct result from the conclusions that are possible to make out of the organizations pre-established vision, mission and goals.
- Cultural – this form of factors emerges from the society where the organizations are integrated and also from the

viewpoint and norms that the members of the organization share between them.

It is also crucial to identify either in which lifecycle moment of the project the different types of factors take action. The lifecycle of a project consists in the sequences of phases that a project goes through since its planning until it ends. The lifecycle is also determined and shaped by all the unique aspects of each organization, market or technology employed [17]. For purposes of this study, during this process of categorization, it was not specified any ranges of project phases, hence, the timeframe of action will be distributed among all the factors that intervene before the project starts, during the project, after it ends or during the project whole lifecycle.

As well as the benefits are categorized by the type of agent, the factors are also categorized by this criteria, in order to understand from where the factors are provided since they can arise from universities, industries or from both simultaneously. Also like in the benefits categorization method, factors will be, as well, object of a categorization relative to scope with categories similar to the ones used before as referred above. This principle will be assumed since the factors scope should be able to trigger the same field of action in benefits and, therefore, facilitate the possibility of cause-effect connections. Therefore, factors will also be divided to what concerns their scope into ‘strategy’, ‘resources’, ‘quality/performance’, ‘knowledge’ and ‘inter-relational’. Additionally, there was the necessity to add one more category named ‘organizational’ because, all factors that are implied from specific behaviours in the organizations context will fit in this scope.

Table 2. Success factors categorization method.

| Factor type              | Factor timeframe of action         | Factor agent        | Factor scope        |
|--------------------------|------------------------------------|---------------------|---------------------|
| Inter-relational         | Before the project start           | University          | Strategy            |
| Economic                 | During the project                 | Industry            | Resources           |
| Technical and Scientific | After the end of the project       | University/Industry | Organizational      |
| Strategic                | During the whole project lifecycle |                     | Quality/Performance |
| Cultural                 |                                    |                     | Employability       |
|                          |                                    |                     | Knowledge           |
|                          |                                    |                     | Inter-relational    |

### 3. Research Methodology

The research methodology in this paper was supported mainly by theoretical analysis and elementary quantitative analysis. Initially, it was conducted a literature review of papers published between 1998 and 2015 in order to analyze the state-of-art and to select and gather all the benefits and success factors that might generate any impact in R&D funded projects between University and Industry [18-26] . After this analysis, it was possible to collect 34 benefits and 71 success factors (not listed in the paper because of space limitations) that were later allocated to each other through deductive reasoning in order to recognize which factors contributed to which benefits. With this information, it was performed a brief quantitative study using statistical analysis to identify patterns and common behaviors between benefits and the allocated factors. Since this is an ongoing study, future work will gather a focus group of experts to validate this categorization method and from there, the aim is to develop an approach to improve and optimize benefits management in University-Industry R&D Collaborative Projects.

### 4. Benefits and Success Factors: Cause-effect Analysis

Of all the 34 benefits identified in the literature, 19% were categorized as ‘economic’ benefits, 25% were ‘strategic’, the same percentage, 25% were ‘operational’ and 31%, the most common type, were categorized as ‘social’ benefits.

Table 3 shows that the ‘economic’ benefits known are entirely ‘tangible’ in nature, 83% of them had ‘direct’ incidence in the project and 67% acted in ‘short-term’ period and have more impact in industries, i.e. ‘industry’ agent. As expected, the scope of ‘economic’ benefits is most linked to ‘resources’ (50%), 33% are categorized as ‘strategic’, and 17% as ‘value creation’.

‘Strategic’ benefits are all (100%) ‘intangible’ in nature, have ‘indirect’ incidence and generate effects in the ‘long-term’. These benefits are perceived mostly by the ‘industry’ (62.5%) or by both ‘university/ industry’ (25%). The scope of action of ‘strategic’ benefits is ‘strategy’ (50%), ‘value creation’ (37.5%) and ‘knowledge’ (12.5%).

‘Operational’ benefits are divided among ‘tangible’ (44%) and ‘intangible’ (56%) in nature. They set off mainly ‘direct’ effects on the project itself (78%), as ‘operational’ benefits interact, usually, in daily processes of the organizations in an attempt to optimize them, and, 78% of them have a ‘short-term’ impact. These benefits are also perceived mostly by the ‘industry’ (89%). The scope of action of ‘operational’ benefits is mostly ‘quality/performance’ (44.5%) and ‘knowledge’ (33.3%), but also ‘resources’ and ‘value creation’ (11.1% each).

‘Social’ benefits are perceived mostly as ‘intangible’ (62.5%) and with a ‘long-term’ impact (62.5%), 75% had an ‘indirect’ effect, and 50% had covered both ‘industries/ universities’. Most of the scope of action of ‘social’ benefits is ‘knowledge’ (62.5%), since one of the goals of these benefits is to transfer information into society, this result was expected, just like the equal distribution ratio of scope between ‘value creation’, ‘employability’ and ‘inter-relational’ (12.5%).

Since the categorization of benefits it is already known, the natural step is to try to understand which factors lead to the development of each benefit so, in future research, we could develop from here a model that would tell the stakeholders in which factors they should invest/improve to obtain certain expected benefits. Based on literature review and on researchers’ expert judgment, assumptions were made to what concerns the relations between certain factors and specific benefits. In other words, due to previous-knowledge, factors were allocated to benefits through logical deductions. Therefore, the type of factors that contribute to the manifestation of ‘economic’ benefits come from both ‘universities and industries’ (81%) and are, typically, ‘technical and scientific’ factors (29%), ‘economic’, ‘strategic’ and ‘cultural’ factors (19%) and ‘inter-relational’ factors (16%). These factors have impact ‘before the project start’ and ‘during the whole project lifecycle’ (31%), which means that ‘economic’ benefits are highly sensitive to their success factors impact.

Very similar to the factors that contribute to ‘economic’ benefits, ‘strategic’ benefits formation occurs due to factors with the same ‘timeframe of action’ and ‘agent’. However, the type of factors that contribute to ‘strategic’ benefits are, fundamentally, ‘inter-relational’ factors (29%) and ‘strategic’ and ‘cultural’ factors (25%). On the other side, the factors that set in motion ‘operational’ benefits are ‘technical and scientific’ factors, ‘strategic’ and ‘inter-relational’ factors, predominantly. ‘Operational’ factors have also impact ‘during the whole project lifecycle’ and come from actions of both ‘universities and industries’ that arise from improvements in (scope) ‘strategy’ (24%), ‘inter-relational’ (21%) ‘quality/performance’ (18%), ‘knowledge’ and ‘resources’ (13%) and ‘Organizational’ (11%). Factors that trigger ‘social’ benefits are substantially ‘inter-relational’ (37%), ‘cultural’ (29%) and ‘strategic’ (22%) and 44% of them take action ‘before the project start’. Once again, either ‘inter-relational’ and ‘cultural’ factors come from both ‘universities and industries’ (71%) and their scope is the widest, varying between ‘inter-relational’ (37%), ‘strategy’ (20%), ‘organizational’ (17%), ‘resources’ and ‘knowledge’ (10%) and ‘quality/performance’ (7%).

## 5. Conclusions

This study presents two categorization methods to classify and better understand what a benefit and a success factor is in University-Industry R&D collaborations. After applying both methods, it was discovered that benefits could be divided into ‘economic’, ‘strategic’, ‘operational’ and ‘social’ and that factors could assume five different forms: ‘inter-relational’, ‘strategic’, ‘economic’, ‘technical and scientific’ and ‘cultural’. Once they were categorized, there were made assumptions and established correlations between which factors lead to which benefits and it was found out that ‘inter-relational’, ‘technical and scientific’ and ‘strategic’ factors were the most common ones to contribute to the formation of benefits. The same happened with the timeframe of action and, although a few factors have impact in specific moments of the project life, most of them have influence on benefits during the whole lifecycle of the project. With a lot of similarities between factors and benefits, factors scope had a lot of resemblances with the benefits type, which makes sense in a theoretical point of view, since the field of action should be the same between both of them in order to exist coherence. Therefore, we could perceive that ‘strategic’, ‘cultural’ and ‘inter-relational’ factors are the ones that can trigger off the most type of benefits and should deserve special attention from all stakeholders in order to optimize University-Industry Partnerships Although the size of the

data sample of factors and benefits were reduced, it was possible to identify a few patterns and behaviors that can facilitate future research in this field. Since this study is still in progress, the practical contribution of it is to use these lists as support in the identification of the benefits that the stakeholders want to see as a result of University-Industry collaborations, when performing benefits management. Once the benefits are identified, the next step is to evaluate which success factors are associated with them in order to perform an appropriated selection of actions that will trigger those specific success factors and therefore the expected benefits by the stakeholders.

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