Does affective evaluation matter for the success of university-industry collaborations? A sentiment analysis of university-industry collaborative project reports

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HIGHLIGTHS

- Subjective perceptions affect the objective outcomes of university-industry collaborations.
- Collaborations perceived as challenging are seen as less beneficial and less likely to continue.
- Negative affective evaluations reduce the perceived benefits of challenging collaborations.
- Positive affective evaluations can restore perceived benefits despite the perceived challenges.
- Sentiment analysis can be used to “predict” successful university-industry collaborations.

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Abstract:

University-industry collaborations (UICs) play a crucial role in the knowledge-based economy; however, past research has paid surprisingly little attention to the role played by the 'subjective' determinants of collaborations and their influence on 'objective' collaboration outcomes. By performing a sentiment analysis on a dataset of 415 final reports from completed UICs, we find that there is a negative relationship between the collaborators' perceived challenges and benefits of UICs, mediated by negative affective evaluation. Instead, a positive affective evaluation of the UIC is positively correlated with its perceived benefits, which, in turn, are a predictor of an important objective outcome of UICs: the likelihood of future collaboration. A positive affective evaluation also negatively moderates the positive relationship between perceived challenges and negative affective evaluation. Therefore, a positive affective evaluation may increase the likelihood of future collaboration, even in a context in which a UIC is perceived to be challenging. Besides generating theoretical implications, our findings are of significant value for practitioners, as we highlight the need to regulate perception and affective evaluation to achieve successful UICs. We showcase sentiment analysis as a helpful foresight tool to identify those UICs that are more likely to continue over time.

Keywords: ***university-industry collaborations (UICs); perception; affective evaluation; sentiment analysis***

1. Introduction

University-industry collaborations (UICs) have emerged as an important platform upon which to develop higher quality innovations (Laursen, 2012; Huang and Chen, 2017) that are more likely to achieve commercial success (Bhullar et al., 2019). While a substantial body of literature has addressed the objective determinants of UIC success (Mora-Valentin et al., 2004; Bozeman et al., 2013), significant knowledge gaps remain in regard to the effect on of subjective determinants—such as the perceptions and emotional judgements of the collaborating entities—on outcomes (Bstieler et al, 2017; De Silva and Rossi, 2018). This study addresses this knowledge gap by investigating how the collaborators' subjective perceptions of the challenges and benefits of a UIC, and their affective evaluation of the collaboration, influence an important objective outcome of UICs: the likelihood of future collaboration.

Perception referrers to how collaborators perceive/see (Fonti et al., 2017) the challenges and benefits of UIC, and '*affective evaluation'* refers to an evaluative feeling state (Clore and Ortony, 2008) associated with the emotional quality (e.g., goodness or badness) (Forgas, 1991; Delgado-García et al., 2010) that is attributed to a stimulus (Finucane et al., 2000, King and Slovic, 2014), which, in our case, is the UIC. While perceptions take longer to become established, affective evaluations are quick to emerge (Weber and Johnson, 2009; Kahneman 2011). The significance of addressing this research gap is underpinned by the literature, which has argued that the formulation of judgements that drive decision making does not necessarily resemble a rational analysis of benefits and costs, but is a holistic process characterized by numerous psychological biases (Schiebener and Brand 2015; Slovic and Peters, 2006) and by the crucial role of perception, which, in turn, is influenced by affective states (Damasio, 1994; Loewenstein et al., 2001; Slovic et al., 2004). Among the several dimensions of perception that could be relevant to decision making in the UIC context, we

specifically focussed on the collaborators' perceptions of benefits and challenges (Lhuillery and Pfister, 2009; Guzzini and Iacobucci, 2016; Lin, 2017), the latter being often present in UICs due to the inherent differences between collaborators (Lhuillery and Pfister, 2009; Guzzini and Iacobucci, 2016). In particular, we draw upon the literature on the role played by affective evaluations in driving perception (Finucane et al., 2000; Slovic et al., 2004; Slovic and Peters, 2006) and decision making (Lawler, 2001)—which is discussed predominantly in organizational management contexts (Casciaro and Lobo, 2015; Cristofaro, 2020)—to explain how the collaborators' affective evaluations influence the relationship between the perceived challenges and perceived benefits of UICs, and how this may, in turn, influence their decision to engage in further collaborative innovation.

In our research, we used a dataset of 415 narrative reports produced by collaborative teams involved in UICs partly funded by InnovateUK, the UK's innovation agency. The variables relating to the collaborators' affective evaluations and perceptions of challenges and benefits were built through a sentiment analysis of these 415 reports, which describe the process and outcomes of the UICs from the collaborators' perspective. Our findings make three original contributions to the literature on UICs. First, we address the rather inconsistent and broad literature on the determinants and effects of perceived challenges and perceived benefits on decision making processes and behaviours in management (e.g. Delgado-García et al, 2010; Moreno et al., 2002; Kerzner, 2009; de Bakker et al., 2012). We find that the collaborators' perceived challenges of UICs are negatively associated with the perceived benefits that positively influence the likelihood of the collaboration being continued over time, which is considered as an important objective measure of UIC success (Ryu, 2014).

Second, our findings on the influence of affective evaluation on perception reveal that any negative affective evaluations made by collaborators mediate the negative relationship

between perceived challenges and perceived benefits. We also find that any positive affective evaluations of the UIC made by the collaborators are positively correlated with its perceived benefits, and also negatively moderate the positive relationship between perceived challenges and negative affective evaluations. Therefore, even in a context in which a UIC is perceived to be challenging, the likelihood of future collaboration could be increased by a positive affective evaluation, thus revealing how affective evaluations could be used to overcome any negative effects of perceived challenges on the continuation of a UIC. To our knowledge, while previous work has looked into the implications of affective evaluation for decision making (Cristofaro, 2020), suggesting that managers' emotional states and display may impact business outcomes (Daniels 2003; Delgado-García et al., 2010; Khosravi, et. al., 2020), our study is the first to investigate the influence of affective evaluations on the success of UICs.

Third, we also make an important methodological contribution by showcasing the sentiment analysis of textual data as a helpful foresight tool to identify those UICs that are more likely to continue over time. Besides generating theoretical implications, our findings are of significant value for practitioners, as they suggest how perceptions and affective evaluations should be managed to achieve successful UICs. For example, the interim reports prepared by collaborators could be analysed using sentiment analysis tools to identify situations where participants experience negative affective evaluations. In such cases, prompt interventions that aim to alter the overall conditions of a given collaboration that give rise to negative affective evaluations, and to introduce conditions that could generate positive affective evaluations, could result in shifting perceptions of benefits and thereby indirectly affect the likelihood of future collaboration.

The rest of this paper is organized as follows. Section 2 focusses on conceptual development by integrating contributions drawn from diverse but related and relevant fields of literature, including management and psychology, on the effects of affective evaluations on perceptions of challenges and benefits and their impact on decision making. This leads to the development of a conceptual framework linking affective evaluations, perceived challenges and perceived benefits, and the likelihood of future collaborations. Section 3 presents the research context and methodology. The findings are presented in Section 4. Section 5 concludes by outlining this study's theoretical and managerial implications.

2. Conceptual development: affective evaluations, perceived challenges and benefits of UICs

While the factors that underpin the success and failure of UICs have been investigated, researchers in this field usually explore factors that are connected to the pre-existing characteristics of the collaborating individuals or organisations (Walker and Brown, 2004)—including their level of motivation and absorptive capacity (Rajalo and Vadi, 2017; Lin, 2017; Bhullar et al., 2019) and the quality of their human capital (Albats et al., 2020)—or their strategic actions and management practices at the individual, organizational, and project levels (Bjerregaard, 2010; Huang and Chen, 2017). However, little attention has been devoted to the influence of the collaborators' own affective evaluations and perceptions of challenges and benefits on UIC success, and on their likelihood to sustain the collaboration in the future.

Filling this knowledge gap is important because the evidence shows that affective evaluations, both positive and negative, affect managerial behaviours (Gonzalez et al., 2005), including the focus of managerial attention (Hu et al., 2011), decision making (Delgado-García et al, 2010) and problem-solving strategies (Spering et al., 2005). Affective evaluation has also been found to have a broader influence on business outcomes (Lindebaum and

Jordan, 2012), with recent studies suggesting that managers' emotional displays may lead to better performance (Van Kleef et al., 2009) and that emotions influence workers' pursuit of goals (Conroy et al., 2017). Particularly in the context of inter-organizational collaborations, affective bonds have been linked to the development of trust (Ring, 1996), which increases the resilience of such collaborations.

Learning from affective theory (Finucane et al., 2000; Slovic et al., 2004; Slovic and Peters, 2006; Lawler, 2001; Casciaro and Lobo, 2015; Cristofaro, 2020), we aim to enrich our understanding of the relationship between collaborators' affective evaluations of UICs and their perceptions of their challenges and benefits, which then influence their likelihood to engage in further collaborations. Our argument is structured as follows. First, we argue that investigating the correlates of the perceived benefits of UICs matters because, when collaborators perceive higher benefits, they are more likely to engage in further collaborations, which can be considered a measure of actual UIC success. This leads us to investigate the correlates of perceived benefits, wherein we argue that positive affective evaluations are directly and positively associated with perceived benefits (while negative affective evaluations are negatively associated with them), and perceived challenges have a negative relationship with perceived benefits, mediated by negative affective evaluations. Finally, we argue that positive affective evaluations can play an important role in negatively moderating the positive relationship between perceived challenges and negative affective evaluations. Hence, positive affective evaluations should be nurtured to improve the likelihood of UIC success, even or particularly for UICs that are perceived as being more challenging.

2.1. Perceived benefits as a predictor of future collaboration

While the literature on UICs has argued that an individual's experience with past collaborations is likely to influence the likelihood of future ones (Canhoto et al., 2016; D'Este and Patel, 2007), specifically due to their ability to act as boundary spanners (Corsaro et al., 2012; Rosli et al., 2018), we lack an understanding of the effects of the perceived benefits of UICs. Perceived benefits, rather than actual ones, have been found to have consequences on behaviours (Raggio et al., 2013). For example, in marketing studies, the concept of loyalty relies significantly on perceived benefits (Kim et al., 2020); similarly, Hwang and Choi (2020) have shown that, in the gaming industry, perceived rewards play an important role in encouraging more players to sign up. Hence, any changes in perceived benefits may lead to changes in the associated outcomes.

In relation to UICs, there are several reasons to believe that the collaborators' perceptions of their benefits may influence the likelihood of future collaboration. In the management literature, it has been argued that managers' perceptions of success are linked to greater business performance (Reijonen and Komppula, 2010), as past successful performance builds confidence in one's abilities to perform certain activities (Shim and Ryan, 2005). Furthermore, any perceptions of having successfully attained goals are positively associated with both self- and task-satisfaction and establish a platform for embedding expectations that goal attainment will be successfully repeated (Locke and Latham, 2005). The collaborators' perceptions of the potential benefits of inter-organizational collaborations play a significant role in shaping their behaviours throughout such collaborations (Fonti et al., 2017) by increasing their meaningful engagement and commitment (Mir and Pinnington, 2014), which is likely to lead them to continue collaborating over time. Moreover, the confidence instilled by being involved in a collaboration that is perceived to be beneficial can more generally impact the collaborators' innovative work behaviours (Devloo et al., 2016), which increases

their likelihood to engage in further collaborations. Therefore, we put forth the following hypothesis:

H1: The higher the collaborators' perceived benefits of a UIC, the greater their likelihood to engage in subsequent collaborations

If the collaborators' perceived benefits of a UIC influence their likelihood to collaborate in the future, then, any changes in their perceptions can have important practical consequences. Hence, we investigate the correlates of perception, and particularly the role played by affective evaluation, to the extent that this can help us better understand how collaborators' perceptions could be shaped in order to support continued engagement in collaborative innovation.

2.2. The link between affective evaluation and perceived benefits

The behavioural literature distinguishes between cognitive processes and affective processes; the former involve individuals making decisions based on their *perceptions*, whereas the latter involve individuals making decisions based on how they *feel*. While perceptions take longer to become established, feelings are quick to emerge (Weber and Johnson, 2009; Kahneman 2011) and play a crucial role in decision making (Zeelenberg et al., 2008; Kim, 2017), which has often been discussed with respect to managerial decisions (Cristofaro, 2020). It has been suggested that positive and negative feelings (i.e., affective evaluations) may influence perceptions (Finucane et al., 2000; Slovic et al., 2004). Pham et al. (2001) applied a feelings-as-information framework to demonstrate differences in reason-based versus affective evaluations towards advertising. Their findings indicated that affective evaluations are often more immediate, more consistent across individuals, and more predictive of thoughts towards a target than reason-based ones. The effects of affective evaluations on perceptions have been analysed in other contexts, including user perceptions

of the value of technology (King and Slovic, 2014) and consumer perceptions of the value of persuasive messages (DeSteno et al., 2004). In particular, it has been shown that positive and negative affective evaluations may co-exist (Yi and Gong, 2008; Sommer et al., 2016) and may associate differently with the perceived benefits of an event or activity (Vazquez and Hervaz, 2010). Positive affective evaluations are usually associated with greater perceived benefits of an action (Vazquez and Hervaz, 2010), greater perceived instrumental value of relationships (Casciaro and Lobo, 2015), greater citizenship attitude of consumers (Yi and Gong, 2008); while negative affective evaluations are usually associated with lower perceived benefits (Vazquez and Hervaz, 2010) and dysfunctional consumer attitudes (Yi and Gong, 2008). In line with these arguments, in the context of UICs, we expect to find an association between the collaborators' affective evaluations of UICs and their perceived benefits. Hence, we hypothesize that:

H2a: Positive affective evaluation of a UIC is associated with greater perceived benefits thereof

H2b: Negative affective evaluation of a UIC is associated with lower perceived benefits thereof

2.3. Affective evaluation and perceived benefits in the presence of perceived challenges

So far, we have focussed on the perceived benefits of a UIC, without taking into account its perceived challenges. However, inter-organizational collaborations aimed at supporting business innovation, particularly UICs, are often perceived to be challenging (Lhuillery and Pfister, 2009; Guzzini and Iacobucci, 2016; Lin, 2017). The cost and complexity of managing UICs are higher than those associated with the outsourcing of business operations (Narula, 2004, McAdam et al., 2005). Typically, UICs involve the exploration of new knowledge domains and the combination of often distant knowledge bases (Lavie and Drori, 2012;

Mindruta, 2013), and require the management of the inherent differences between universities and businesses in terms of their culture (Lockett and Wright, 2005; Sauermann and Stephan, 2013), motivations (Bruneel et al., 2015), research orientations (Petruzzelli and Rotolo, 2015), approaches to innovation, and speed of delivery (Bartunek and Rynes, 2014).

While these challenges broadly impact any UIC, the literature has reported varied levels of success. Hence, we argue that the collaborators' perceptions of the challenges presented by a UIC may affect their perceptions of its benefits, which in turn influence the objective criteria of success. While very little research has been conducted on the relationship between the perceived challenges and perceived benefits of UICs, there is a broad literature on the effects of perceived challenges on the perceived benefits of general decision making processes and behaviours in businesses; this, however, has approached the issue from different perspectives and yielded apparently inconsistent findings (e.g., Delgado-García et al., 2010; Moreno et al., 2002; Kerzner, 2009; de Bakker et al., 2012).

Several management studies have argued that perceptions of a project being more challenging are associated with greater success, as individuals are likely to scrutinize and evaluate the project and to make decisions after careful deliberation (Delgado-García et al., 2010; Mittal and Ross, 1998; Tseng and Wang, 2016). Hence, this induces them to implement appropriate measures (Das and Teng, 2001; Delerue, 2004; Johnston and Huggins, 2018) that, in turn, increase the likelihood of project success (Kerzner, 2009; de Bakker et al., 2012). Other studies in the management literature have instead argued that perceiving a project as challenging discourages the choice of a course of action (Bullough et al., 2014), institutional investment (Salm, 2017; Bento et al., 2019) and a firm's willingness to engage in innovation (Calantone et al., 2010).

Meanwhile, psychology studies have specifically focussed on the relationship between people's perceptions of the challenges and benefits arising from specific activities or technologies, firmly identifying a negative relationship between them (Alhakami and Slovic, 1994; Schiebener and Brand, 2015). For example, those technologies that are judged to be less challenging are also judged to be highly beneficial (Slovic et al., 2004), while those that are judged to be highly challenging are also judged to be less beneficial, and are thus less likely to be adopted (Tsai et al., 2016). While the challenges and benefits of specific activities or technologies are often dependent on different processes—and would therefore be expected to be judged independently—the psychological evidence suggests that, on the contrary, people judge challenges and benefits as part of the same cognitive process. This is consistent with several established psychological theories that, together, suggest that the process of formulating judgements does not necessarily resemble a rational analysis of benefits and costs, but is a holistic process characterized by numerous psychological biases (Schiebener and Brand 2015; Slovic and Peters, 2006) and by the crucial role of perception (Damasio, 1994; Loewenstein et al., 2001; Slovic et al., 2004).

Given that the psychology literature—which, in line with the focus of this study, specifically relates to the perception of challenges and benefits—reports highly consistent empirical findings on the negative correlation between them (King and Slovic, 2014), we expect to find these effects in our data. Therefore, we formulate the following hypothesis:

H3a: There is a negative correlation between the collaborators' perceived challenges and perceived benefits of a UIC

According to psychological theory, the negative correlation between the perceived challenges and perceived benefits of an activity depends on the mediating role played by negative affective evaluations. This negative correlation is in fact a manifestation of the halo effect

(Alhakami and Slovic, 1994), which occurs when an individual's overall judgement about an object (a person, a thing, or a situation) is based on his or her positive or negative affective evaluation of a single aspect of that object's performance (Nisbett and Wilson 1977). It has been argued that affective evaluations, which are likely to be easier to make and more efficient than a careful analytical assessment of the pros and cons associated with an object, acts as a heuristic for making judgments (Slovic et al., 2007; Västfjäll et al., 2014).

Affective evaluations have been found to influence the judgment of challenges and benefits. In situations that are perceived as highly challenging (possibly because of some pre-existing information), the 'halo effect' tendency to generalise based on an impression of a single aspect (Thorpe et al., 2017) means that people tend to evaluate the overall situation more negatively (Finucane et al., 2000). Perceived challenges, in fact, are associated with feelings of displeasure (Mellers et al., 1999; Loewenstein et al., 2001, Miller and Walker, 2003; Rundmo and Nordfjaern, 2017).

Applying this to the case of UICs, we argue that the impression of a UIC being challenging under one point of view may generate negative emotions towards all its other attributes. This is also aligned with information-processing theories (Carson et al., 2003), which imply that affective evaluations will be influenced by the familiarity with or knowledge of an activity. The less familiar universities and companies are with each other (Bstieler et al., 2017; Lockett and Wright, 2005; Sauermann and Stephan, 2013), the more they will perceive their UICs to be challenging, which will be associated with highly negative affective evaluations, which, in turn, are negatively associated with the perceptions of the benefits of the UICs (Alhakami and Slovic, 1994). As UICs are known to be inherently challenging (Lhuillery and Pfister, 2009; Guzzini and Iacobucci, 2016; Lin, 2017), it may be argued that negative

affective evaluations may mediate the perceptions of challenges and benefits (Finucane et al., 2000) (Figure 1). This, leads to our next hypothesis:

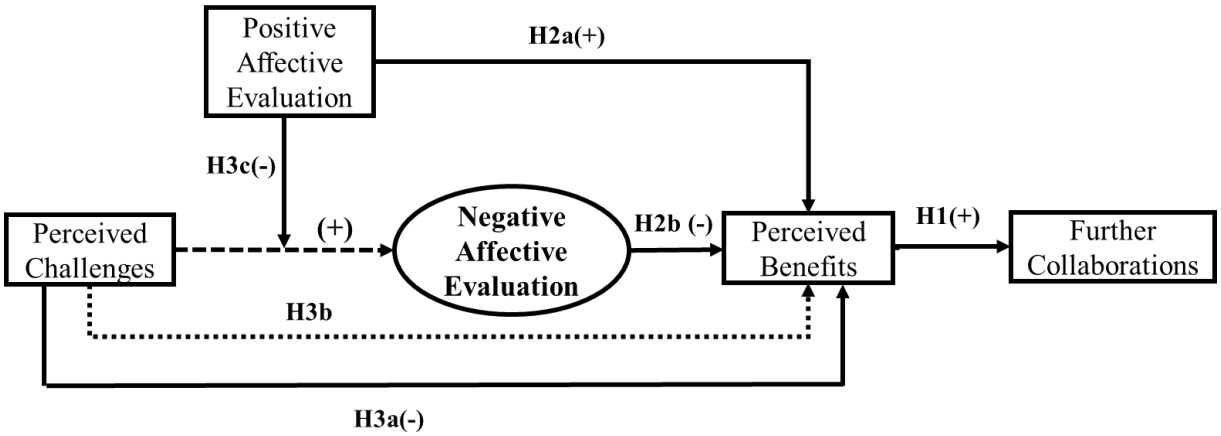
H3b: Negative affective evaluation mediates the relationship between perceived challenges and perceived benefits

While perceptions of UICs as challenging are associated with negative affective evaluations, the presence of positive affective evaluations may mitigate this relationship. To the best of our knowledge, little emphasis has been placed on studying the effect of the interplay between positive and negative affective evaluations on the relationship between perceived challenges and perceived benefits. By drawing on the literature, which has highlighted the positive influences of positive affective evaluations (Van Kleef et al., 2009; Glasø et al., 2017), we argue that, when positive affective evaluations are present, they can negatively moderate the positive relationship between perceived challenges and negative affective evaluations, thus avoiding the lowering of perceived benefits even in situations that are perceived as highly challenging. Additionally, as argued in H2a, as positive affective evaluations are positively correlated with perceived benefits, positive affective evaluations, in addition to the moderation effect discussed in this section, may also directly increase perceived benefits. In examining the relationship between specific kinds of emotional reactions and leadership behaviours, Glasø et al. (2017) found that positive affective evaluations are an equally or even stronger moderator than negative ones, which contradicts the common notion of 'bad is stronger than good' (Baumeister et al., 2001). Hence, we hypothesize that:

H3c: Positive affective evaluation of a UIC negatively moderates the positive relationship between perceived challenges and negative affective evaluation.

We note that, because of the complex nature of the relationship between perceived challenges, perceived benefits, and affective evaluations, hypotheses H2 to H3 do not aim to uncover the fundamental determinants of perceived challenges to and benefit of a UIC, which are numerous and complex both at the individual (Sjöberg, 2000) and organizational levels (Das and Teng, 2001; Delerue, 2004; Kim, 2017), nor do they concern causal effects; rather, they theorise the existence of several complex associations between the variables of interest. As such, our empirical strategy will involve the use of a structural equation model (SEM) aimed at uncovering relationships and their explanations, rather than causality. Yet, as mediation and moderation effects are likely to predict the direction of a relationship, we make use of the management theories that argue for causal direction; however, as mentioned in the limitations section, future studies should look into performing rigorous causal relationship analysis. Figure 1 summarises the proposed conceptual model developed through our hypotheses. The perception of a UIC being more challenging is positively correlated with negative affective evaluations, which then has a negative relationship with perceived benefits. Moreover, if a collaboration is perceived to be more beneficial, the parties are more likely to engage in subsequent ones. Hence, disrupting the negative relationship between perceived challenges and perceived benefits might induce companies and universities to continue to engage in UICs. Using the literature on emotional reactions, we argued that, when a UIC is perceived to be very challenging, the presence of positive affective evaluation may negatively moderate the positive relationship between perceived challenges and negative affective evaluation, as well as being positively associated with perceived benefits.

Figure 1: Conceptual Framework



Note: *the dotted line from Perceived challenges to Perceived benefits is used to represent the mediation effect of Negative affective evaluation (H3b), which implies a positive relationship between Perceived challenges and Negative affective evaluation combined with the negative relationship between Negative affective evaluation and Perceived benefits (as per H2b). The dash line from Perceived challenges to Negative affective evaluation implies the negative moderation effect of positive affective evaluation on the relationship between perceived challenges and Negative affective evaluations.*

3. Data and Methodology

3.1. Study context

The evidence base for this empirical analysis comprises information about 415 projects funded under the Knowledge Transfer Partnership (KTP) scheme in the United Kingdom (UK). Launched in 2003, the KTP programme is funded by 15 UK government organizations led by InnovateUK. Each UIC set up under this scheme is formed between a UK university and a business, which jointly recruit a recent graduate tasked with delivering a project of strategic value to the business. The recruited graduate works under the joint direction of an academic and a business supervisor for a period of 12 to 36 months to the end of producing a final report that details the process and outcomes of the UIC. While the KTP final reports remain confidential, abridged versions of 423 of them were produced, consistently detailing the engagement between the collaborators and the UICs' outcomes. InnovateUK granted us access to these reports, the texts of which we used to develop, through sentiment analysis,

variables proxying the collaborators' positive and negative affective evaluations and perceptions of challenges and benefits.

After removing any duplicates and reports not written in English (two were in Welsh) we were left with 415 usable reports, each of which refers to a different KTP. The reports refer to KTPs that had been completed between 1999 and 2012, with the majority of projects (67%) having been completed between 2005 and 2008; 25% had been completed between 1999 and 2004, and 8% had been completed between 2009 and 2012. Each project lasted on average 2.5 years. These reports, which reflect the collaborators' perceptions of the engagement and outcome of their UICs, formed a base of evidence suited to explore the role played by the affective evaluations of the collaborations in predicting UIC success, taking into account the relationship between the collaborators' perceived challenges and perceived benefits. As the reports had been written in collaboration by the project team—which included the business and the academic partners—after the end of the project in the form of reflection and learning, they could be expected to reflect their honest perceptions and feelings towards their respective projects (Rossi et al., 2017).[1] The condensed reports contain a number of standardized sections that make it possible to perform a certain level of systematic and comparative analysis; yet, the manner in which the information is presented depends subjectively on the compilers' project experience. These documents helped us to understand and make sense of past events occurring during the KTP, and to reflect their narrative content in order to present cohesive and plausible accounts of previous experiences, which made them suitable for sentiment analysis (Wolfe and Shepherd, 2013).

3.2. Variable construction

[1] While the literature suggests that managers may be tempted to underplay any negative outcomes in their reporting of organizational outcomes (Abrahamson and Park, 1994), we had no reason to believe that this issue might affect some reports more than others; i.e., we did not expect that any incentive to under-report negative outcomes would generate a bias in the reporting of the key variables of interest for this study.

In applying sentiment analysis to the reports, we constructed a set of variables using the LIWC software. In particular, we followed the approach proposed by researchers in psycholinguistics (Pennebaker et al., 2003), who assessed the impact of words linked to positive and negative sentiments on behaviours (Berger et al., 2010; Hennig-Thurau et al., 2015; Tirunillai and Tellis, 2012). This approach—which is used extensively in decision making sciences (McHaney et al., 2018), sales and marketing (Singh et al., 2018) and management (Asllani and Long, 2018)—involves the process of automatically distilling sentiments from text (Pang and Lee, 2008). This procedure follows compelling evidence, presented in the literature, that the representation of perceptions and emotions is reflected in the words we use (Weintraub, 1989; Pennebaker et al., 2015). The analysis followed a standard text-mining technique and made use of the dictionaries provided by the LIWC software, 2015 version (Pennebaker et al., 2007), which automatically retrieves expressive words linked to narratives, and the meanings of these words in the contexts in which they are presented. We applied this approach because it supports the conceptual thinking that word choices represent an emergent characteristic that can be captured using sentiment analysis. The LIWC software contains several categories suited to indicate the overall sentiments of the documents, including authenticity, clout and tone. For the purpose of this study, we used the 'risk' (*Perceived Challenges*)[2], 'reward' (*Perceived Benefits*), 'posemo' (*Positive Affective evaluation)* and 'negemo' (*Negative Affective evaluation*) LIWC variables. These were represented in the dictionary by 103 words that represent perceived challenges with 0.68 internal consistency, 120 words that represent perceived benefits with 0.69 internal consistency, 620 words that represent positive affective evaluation with 0.64 internal

[2] The risk variable is constructed by the LIWC software on the basis of a dictionary that contains words relating to uncertainty and doubt (e.g., 'unsafe' and 'unsure') and to difficulties and problems (e.g., 'fail', 'difficulty', 'problem', and 'loss'). In the context of our reports, we interpreted this as a measure of the extent to which the collaborators had indicated that there are challenges to the UIC's ability to deliver outcomes. We preferred the more nuanced word 'challenges' over the word 'risk', which, in the literature, is often used to indicate a measurable degree of certainty around the achievement of an outcome.

consistency, and 744 words that represent negative affective evaluation with 0.55 internal consistency.

Table 1 provides additional information on the LIWC variables used for this analysis. More detailed information about the variable construction process in the LIWC software is provided in Pennebaker et al. (2015).

Table 1. Summary of the key LIWC variables used for the analysis

LIWC variable	Words in category	Internal Consistency (Uncorrected α)	Internal Consistency (Corrected α)	Some examples of words for each variable
Reward	120	0.27	0.69	take, prize, benefit
Risk	103	0.26	0.68	danger, doubt
Posemo	620	0.23	0.64	love, nice, sweet
Negemo	744	0.17	0.55	hurt, ugly, nasty

Several other variables relating to the 415 cases were also drawn from other sources, particularly from InnovateUK's online KTP database. In order to construct the dependent variables for the model developed to test H1, for each KTP, we counted the number of collaborations in which the company and the university had participated, both before and after the one under analysis. Using the data on the subsequent collaborations, we constructed two variables: the number of subsequent collaborations between the same partners (*Number_KTPs Same Partners)* and a binary variable indicating whether the same partners had engaged in at least one subsequent collaboration (*New KTPs Same Partners*). We used data on previous collaborations to construct two binary control variables in the same model: *Previous KTPs Company* (which took value 1 if the company had already participated in KTPs beforehand) and *Previous KTPs Same Partners* (which took value 1 if the same partners in the KTP had already collaborated in the KTP context).

Second, from InnovateUK's online KTP database, we collected information on: the start and end dates of each UIC; the name, business sector, location and size (*SME* – less than 249 employees, or *Large* – 250 or more employees) of the company involved; the name, department, and location of the university involved; the names of the funding bodies; and the amounts granted. The KTP abstracts were used to manually code several variables suited to describe the type of innovation the UIC had been designed to produce (*Product innovation* or otherwise – process, organizational, or service) and the sector in which it had been applied (*Manufacturing* – i.e. agrifood, biomedical, chemical-pharma, construction, electronics, utilities, information and communication technology (ICT), machinery, or healthcare – or *Services* – knowledge intensive business services (KIBS), charity, creative, logistics). From these variables, we constructed some further control ones—namely, *Geographical Proximity* (1 if the management team members had all been in the same UK NUTS1 region, 0 otherwise), *Local Funder* (share of funding from local funding agency) and project *Duration* (in days).

3.3. Empirical strategy

The empirical analysis was executed in two steps. First, to test hypothesis H1, we regressed the *Perceived Benefits* of each UIC on its collaborators' likelihood to engage in subsequent collaborations. This was done by using two alternative dependent variables: the number of subsequent collaborators between the same partners (*Number_KTPs Same Partners,* Model 1) and the binary variable indicating whether the same partners had engaged in at least one subsequent collaboration (*New KTPs Same Partners*, Model 2). Given the nature of the dependent variables, and using the same control variables, we ran a Negative Binomial regression (Model 1) and a Probit regression (Model 2). We controlled for those collaborators that had jointly engaged in previous joint KTPs (*Previous KTPs Same Partners*), which

proxied for the presence of mutual trust between them (which, in turn, would have influenced their likelihood to collaborate again; Lhuillery and Pfister, 2009; Bjerregaard, 2010), and for the previous KTP experience of each company (*Previous KTPs Company*), which proxied for its general openness to collaboration, and would also have influenced its likelihood to engage in further UICs (Cyert and Goodman, 1997; Davenport et al., 1999). Given that partners located closer to each other are more likely to collaborate (D'Este et al., 2012), we controlled for their geographical proximity. We also controlled for company size using the *SME* dummy, which we expect to have a negative effect, as larger companies may be more likely than smaller ones to engage in further UICs simply because they have more resources to do so (Laursen et al., 2011). Given that companies active in certain sectors have been found to be more likely than others to engage in UICs (Cohen et al., 2002), we controlled for the sector in which the innovation produced by the KTP had been applied (distinguishing between *Manufacturing* and *Services*), and for the type of innovation activity (*Product innovation*). Finally, we controlled for the year in which the KTP had ended to account for the possibility that a longer permanence in the KTP database may have been more likely to be associated with repeated collaborations. Table 2 reports some descriptive statistics for those variables.

Table 2: Descriptive statistics of the variables used in Models 1 and 2

Variables	N. obs.	Mean	Standard deviation	Min	Max
Number KTPs Same Partners	415	0.37	0.66	0.00	3.00
New KTPs Same Partners	415	0.28	0.45	0.00	1.00
Perceived Benefits	415	2.80	0.54	1.36	4.75
Previous KTPs Company	415	0.19	.39	0.00	1.00
Previous KTPs Same Partners	415	0.12	.33	0.00	1.00
Geographical proximity	415	0.76	0.42	0.00	1.00
Services	415	0.28	0.45	0.00	1.00
Manufacturing	415	0.68	0.47	0.00	1.00
Product Innovation	415	0.33	0.47	0.00	1.00
SME	415	0.82	0.39	0.00	1.00
Year_end	415	2006	1.20	1999	2012

Second, to test hypotheses H2a, H2b, H3a, H3b and H3c, we applied Structural Equation Modelling (SEM) through the AMOS 26.0 software (maximum likelihood estimation). SEM was appropriate because of the nature of the underlying conceptual model, which was intended to test complex associations between several variables (Nachtigall et al., 2003). The control variables in this model were slightly different from those used in Models 1 and 2, since in Models 1 and 2 we included control variables likely to affect the likelihood of further collaboration between the UIC partners, while in the SEM model we included control variables likely to affect the perceived benefits of the UIC. In line with Kline (2011), in regard to the ratio between sample size and parameters in complex models, we tried to keep to a small number of controls. In particular we included *Geographical Proximity* (1 if all management team members had been in the same UK NUTS1 region, 0 otherwise) and *Local Funder* (share of funding from local funding agency), which measured the 'locality' of the UIC. We did this to control for the fact that geographical closeness can promote trust and facilitate communication, and hence influence the perceived benefits of a UIC (Bonaccorsi and Piccaluga, 1994; Vedovello, 1997). Additionally, we used the control variable *Duration*, to control for the fact that longer-term relationships can promote trust (Humphries and Wilding 2004) and increase the perceived benefits of a UIC, and a set of dummy variables that included *Product innovation*, *SME, Manufacturing* and *Services*, as in Models 1 and 2. In terms of firm size, large firms compared to SMEs are more likely to benefit from interactions with universities, as they have in-built research resources and capabilities (Laursen et al., 2011). With respect to type of innovation, product innovation compared to other types (e.g., service, process, and organizational innovation) has been found to have predominantly differential innovation effects and thus to influence the accrued benefits of UICs (Howells et al., 2012). Finally, in terms of the sector, manufacturing and services have been identified in the literature as having differential collaboration processes that may have differential impacts

on collaboration outcomes and collaborator perceptions (Muscio and Vallanti, 2014). Table 3 provides some descriptive statistics on the variables used in the model (the Z values of the variables). All the variables used in the SEM analysis were standardized around their means.

Table 3: Descriptive statistics of variables used in SEM model

Variables	N. obs.	Mean	Standard deviation	Min	Max
Perceived challenges	415	0.00	1.00	-0.75	9.50
Perceived benefits	415	0.01	0.97	-2.58	3.54
Positive affective evaluation	415	0.01	0.98	-2.18	4.06
Negative affective evaluation	415	0.00	1.00	-0.81	8.12
Geographical proximity	415	0.00	1.00	-2.86	0.35
Services	415	0.00	1.00	-0.62	1.60
Manufacturing	415	0.00	1.00	-0.97	1.03
Duration	415	0.00	1.00	-1.90	5.71
Local funder	415	0.00	1.00	-0.50	3.18
Product innovation	415	0.00	1.00	-0.47	2.13
SME	415	0.00	1.00	-0.50	3.18

4. Analysis and Findings

The regressions run in Step 1 of our empirical analysis (Table 4) revealed that *Perceived Benefits* significantly increased both the likelihood of partners to collaborate again and the number of their future collaborations, thus confirming *H1*. Interestingly, we found that previous company experience with KTPs (*Previous KTPs Company*) had a negative effect on the likelihood of further collaborations (in both regressions, though with lower significance in Model 1, p=0.186)—perhaps suggesting that those companies that had already taken part in many KTPs may have moved on to other types of programmes—whereas previous collaborations between the same partners (*Previous KTPs Same Partners*) were found to have the expected effect on further collaborations. Geographical proximity, as expected, increased the likelihood of further collaborations. We did not find any significant effects of size, year in which the KTP ended, type of innovation and sector of application. Both regressions were found to be significant, and the analysis of the variance inflation factors (VIF) did not highlight any multicollinearity issues, with VIF taking on an average value of 2.74 and a

highest value of 7.08—well below the threshold of 10, which is conventionally considered as a possible indication of multicollinearity problems.

The increased likelihood of further collaborations is an important positive impact of the KTP, and thus, an indication of collaboration success. This suggests that collaborator perceptions of the benefits of the UIC influence an objective success criterion. As perceptions of lower UIC benefits may lead collaborators to withdraw from subsequent ones, thus missing out on important innovation opportunities, it is important to better understand the factors that can improve the perceptions of a UIC's benefits.

Table 4: The relationship between the perceived benefits of a UIC and the likelihood of future collaborations

t	(1) Negative Binomial Regression	(2) Probit Regression
VARIABLES	*Number KTPs Same Partners*	*New KTPs Same Partners*
Perceived Benefits	**0.317***	**0.209***
	(0.164)	(0.128)
Previous KTPs Company	-0.464	-0.513
	(0.439)	(0.313)
Previous KTPs Same Partners	**0.903***	**0.780****
	(0.478)	(0.358)
Geographical proximity	**0.490***	**0.383****
	(0.254)	(0.178)
SME	0.006	-0.252
	(0.257)	(0.189)
Product innovation	0.264	0.182
	(0.187)	(0.148)
Manufacturing	0.001	0.083
	(0.482)	(0.370)
Services	-0.290	-0.054
	(0.510)	(0.386)
Year_end	-0.016	-0.021
	(0.044)	(0.034)
Constant	29.115	41.166
	(88.374)	(67.651)
Observations	415	415
Pseudo R-squared	0.0841	0.0364
LR chi2	41.38	17.32
Prob> chi2	0.0107	0.036

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<=0.1

The SEM performed in Step 2 provided key insights into the relationship between the perceived challenges and perceived benefits of a UIC and how this relationship is influenced by affective evaluations. In order to assess this, we first tested the relationship between perceived benefits and two types of affective evaluations. In relation to hypotheses H2a and H2b, we ran the model with *Perceived Benefits* and *Positive Affective Evaluation, Negative Affective Evaluation* and the set of control variables. This model, presented in Table 5, achieved adequate fit: GFI = 1.000 (>0.95); AGFI = 0.996 (>0.95); CFI = 1.000 (>0.95); NFI = 1.000 (>0.95); RFI = 0.983 (>0.95) (Tabachnick and Fidell, 2007); TLI = 1.103 (>0.95); IFI = 1.002 (>0.95) (Tabachnick and Fidell, 2007); RMSEA = 0.000 (<0.05), p = 0.806 (>0.05) (Byrne, 1998); CMIN/DF = 0.167 (p= 0.683) (<2) (Carmines and McIver, 1981). As posited by H2a, evidence was found for a positive relationship between the *Perceived Benefits* of a project and *Positive Affective Evaluation* (β = 0.460, p = 0.000), and, as suggested by H2b, a negative relationship was found between *Perceived Benefit* of a project and *Negative Affective Evaluation* (β = -0.142, p =0.000) (Table 5).

Table 5: Relationship between perceived benefits and affective evaluations

Variables	Perceived Benefits
Positive Affective Evaluation	**.460 (.043) *** **
Negative Affective Evaluation	**-.142(.041) *** **
Duration	-.072 (.040) *
Manufacturing	.101 (.052) *
Services	.045 (.053)
Product innovation	-.038 (.043)
Local Funder	-.029 (.042)
Geographical Proximity	.017 (.043)
SME	-0.098 (.043) **

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Minimum was achieved: X^2 (1, N = 415) = 0.167, p = 0.683 (>0.05)
Sector -

As it was apparent that a negative affective evaluation negatively influences the perceived benefits of a UIC, it was important to understand whether it mediates the relationship between perceived challenges and perceived benefits, as this would make it possible to investigate how to disrupt the negative loop. The first step in investigating the mediation effect involved running the model with *Perceived Challenges*, *Perceived Benefits*, and all the control variables to test H3a. This model, presented in Table 6, achieved adequate fit: GFI = 1.000 (>0.95); AGFI = 0.999 (>0.95); CFI = 1.000 (>0.95); NFI = 1.000 (>0.95); RFI = 0.995 (>0.95) (Tabachnick and Fidell, 2007); TLI= 1.122 (>0.95); IFI = 1.003 (>0.95) (Tabachnick and Fidell, 2007); RMSEA = 0.000 (<0.05), p = 0.899 (>0.05) (Byrne, 1998); CMIN/DF = .045 (p = 0.832) (<2) (Carmines and McIver, 1981). As expected, we found a negative relationship between the *Perceived Challenges* and *Perceived Benefits* of the UICs, supporting H3a (β = -0.136, p = 0.006) (Table 6).

Table 6: Relationship between perceived challenges and perceived benefits

Variables	Perceived Benefits
Perceived Challenges	**-0.136 (.048)*** **
Duration	-0.081 (0.047)*
Manufacturing	0.104 (0.059) *
Services	0.066 (0.061)
Product innovation	-0.097 (.049) *
Local Funder	.036 (0.047)
Geographical Proximity	.044 (0.048)
SME	-0.037 (.049)

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Minimum was achieved: X^2 (1, N = 415) = 0.045, p = 0.832 (>0.05)

We then tested the role played by negative affective evaluation as a mediator variable by testing the relationship between *Perceived Challenges* and *Negative Affective Evaluation* and between *Negative Affective Evaluation* and *Perceived Benefits* (H3b). First, we calculated

two models presented in Table 7. From the column on the left (SEM model 1), it is evident that, when the negative affective evaluation is added, the direct relationship between perceived challenges and perceived benefits observed previously in H3a, becomes insignificant (β = -.083, p > 0.15), supporting a mediation effect of negative affective evaluation. In order to further validate the mediation effect, we calculated direct, indirect and total effects (Iacobucci et al. 2007; Preacher and Hayes 2008) using bootstrapping (2000 times) method. It was evident that there is a significant indirect relationship between perceived challenges and perceived benefits (β = -.053, p < 0.05), and a significant direct positive relationship between perceived challenges and negative affective evaluations (β = .583, p < 0.01) and a significant negative relationship between negative affective evaluations and perceived benefits (β = -.090, p <0.15), supporting hypothesis H3b (Table 7). We also ran the model excluding the direct relationship between perceived challenges and perceived benefits (presented in the right-hand column, SEM model 2), which further confirms the mediation effect of negative affective evaluation (significant positive relationship between perceived challenges and negative affective evaluation (β = .583, p < 0.01) and a significant negative relationship between negative affective evaluation and perceived benefits (β = -.136, p <0.01). Additionally, the results of Sobel test (-1.835 [SE: 0.028], P= 0.066, <0.1), Aroian test (-1.830 [SE: 0.028], P= 0.067, <0.1), and Goodman test (-1.840 [SE: 0.028], P= 0.065, <0.1) further confirmed that the relationship between perceived challenges and perceived benefits is mediated by negative affective evaluations. Finally, in addition to the SEM model, we also ran an Ordinary Least Squares regression analysis, presented in Appendix A, to further confirm the mediation effect. Perceived challenges were found to have the expected negative effect on perceived benefits (model A1). Perceived challenges were found to have a positive effect on negative affective evaluation, as expected (model A2). When we added negative affective evaluations to the model explaining perceived benefits (model A3), the

significance of perceived challenges was found to be reduced, and the relationship between perceived challenges and perceived benefits was found to become insignificant.

Table 7: Relationship between perceived challenges, perceived benefits and negative affective evaluations

	SEM Model 1		*SEM Model 2*	
VARIABLES	*Negative Affective Evaluation*		*Negative Affective Evaluation*	
Perceived Challenges	**.583**	**(.042)*** **	**.583**	**(.042)*** **
Duration	-.017	(.041)	-.017	(.041)
Manufacturing	.062	(.051)	.062	(.051)
Services	.027	(.053)	.027	(.053)
Product innovation	.057	(.042)	.057	(.042)
SME	-.041	(.042)	-.041	(.042)
Local funder	-.088	(.041) **	-.088	(.041) **
Geographical Proximity	.006	(.041)	.006	(.041)
	Perceived Benefit		*Perceived Benefit*	
Perceived Challenges	**- .083**	**(.058)**		
Indirect effect	***- .053***	***(.036)****		
Negative Affective evaluation	**-.090**	**(.047)** $^{+}$	**-.136**	**(.047)*** **
Duration	-.083	(.047) *	-.082	(.047)*
Manufacturing	.109	(.059) *	.121	(.059)***
Services	.068	(.061)	.081	(.060)
Product innovation	-.092	(.049) *	-.089	(.049)*
SME	-.041	(.049)	-.053	(.048)
Geographical Proximity	.044	(.048)	.045	(.048)
Local Funder	.028	(.047)	.020	(.047)
GFI		1.000	.999	
AGFI		.999	.974	
CFI		1.000	1.000	
NFI		1.000	.996	
RFI		.996	.910	
TLI		1.097	1.002	
IFI		1.002	1.000	
RMSEA, *p*		.000, .899	.000, 669	
CMIN/DF, *p*		.045, .832	.977, .376	

*** p<0.01, ** p<0.05, * p<0.1, $^{+}$ p<0.15
Model 1: Minimum was achieved: X^2 (2, N = 415) = .893, p = .640 (>0.05)
Model 2: Minimum was achieved: X^2 (2, N = 415) = 1.955, p = .376 (>0.05)

Figure 2: The mediating effect of negative affective evaluation

*** p<0.01, ** p<0.05

This leads us to argue that dealing with negative affective evaluations plays an important role in trying to mitigate the lowering of the perceived benefits of a UIC, at the presence of perceived challenges. Once negative affective evaluations arise, which often happens when a UIC is perceived to be highly challenging, the perception of benefits worsens. Therefore, the early mitigation of this negative loop might assist in increasing the success of a UIC.

Hence, we also tested the effect of the presence of *Positive Affective Evaluation* on the relationship between *Perceived Challenges* and *Negative Affective Evaluation*. As illustrated in Figure 3 and Table 8, it was found that *Positive Affective Evaluation* negatively moderates the positive relationship between *Perceived Challenges* and *Negative Affective Evaluation*, supporting H3c. The moderating effect is shown by the negative coefficient (β = -0.229, *p*=0.000) of the moderation variable *Positive Affective Evaluation*Perceived Challenges* on *Negative Affective Evaluation*. This model also achieved adequate fit: GFI = 1.000 (>0.95); AGFI = 0.999 (>0.90); CFI= 1.000 (>0.95); NFI= 1.000 (>0.95); RFI = 0.997 (>0.95) (Tabachnick and Fidell, 2007); TLI= 1.080 (>0.95); IFI = 1.001 (>0.95); (Tabachnick and Fidell, 2007); RMSEA = 0.000 (<0.05), *p*= .899 (>0.05) (Byrne, 1998); CMIN/DF = .045 (*p*= .832) (<2) (Carmines and McIver, 1981). In addition to negatively moderating the positive relationship between perceived challenges and negative affective evaluation: as presented in H2a, *Positive Affective Evaluation* positively correlates with *Perceived Benefits* (Table 5).

Therefore, it could be argued that positive affective evaluation mitigates the negative loop caused by negative affective evaluation due to perceived challenges of UICs.

Table 8: Moderating effect of positive affective evaluation

VARIABLES	*Negative Affective evaluation*	
Perceived Challenges	0.728	(0.049)***
Duration	-0.035	(0.039)
Manufacturing	0.083	(0.050)*
Services	0.051	(0.051)
Product innovation	0.043	(0.041)
SME	-0.023	(0.041)
Local funder	-0.063	(0.041)
Geographical Proximity	0.003	(0.040)
Positive Affective Evaluation*Perceived Challenges	**-0.229**	**(0.027)*** **
Positive Affective Evaluation	**-0.070**	**(0.041)***

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Minimum was achieved: X^2 (1, N = 415) = .045, p = .832

Figure 3: The moderating effect of positive affective evaluation

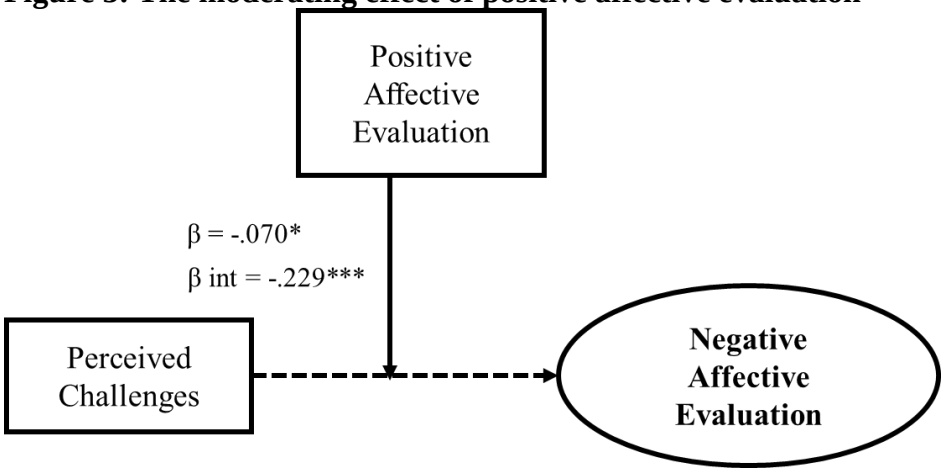
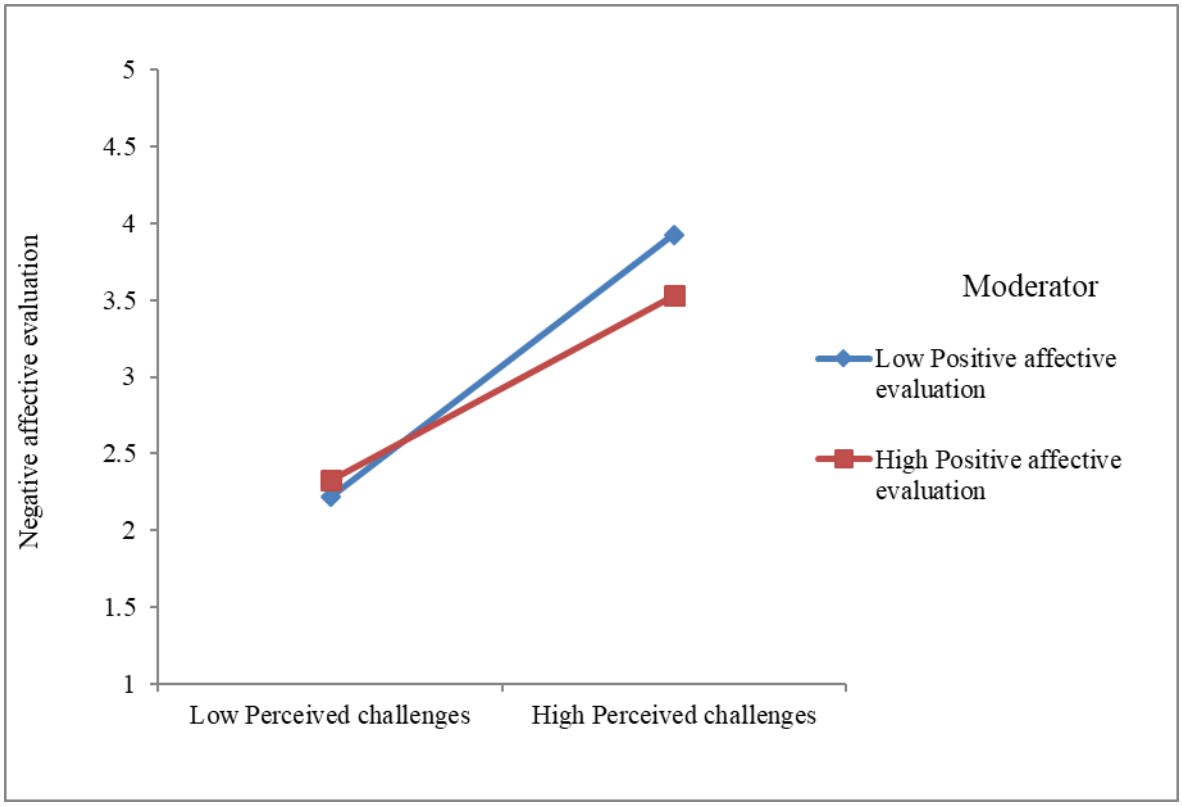


Figure 4 clearly illustrates how high positive affective evaluations weaken the positive relationship between perceived challenges and negative affective evaluations. In this respect, it is clear that those collaborators who make positive affective evaluations are able to lower the negative affective evaluations generated by the perception of the UIC as challenging. This clearly indicates that the presence of positive affective evaluations mitigates the reduction in perceived benefits due to the perception of the UIC as being more challenging. Additionally, we also performed an Ordinary Least Squares regression analysis to further confirm the

moderation effect. As presented in Appendix B, it was found that *Perceived Challenges* has the expected positive effect on *Negative Affective Evaluation* (model B1). The interaction between *Perceived Challenges* and *Positive Affective Evaluation* reduces the positive effect of perceived challenge on negative affective evaluation—i.e., it negatively moderates positive effective evaluation, as expected (model B2).

Figure 4: The moderating effect of positive affective evaluation



To summarise, our results suggest that any increase in the perceived challenges to a UIC is positively associated with an increase in negative affective evaluations, which, in turn, negatively correlates with the perceived benefits of a UIC. In such instances, the presence of positive affective evaluations negatively moderates the positive relationship between

perceived challenges and negative affective evaluations, and improves the perceived benefits of a project. This, in turn, increases the likelihood of future collaboration (Figure 2).

5. Conclusion

Despite the increasing number of companies collaborating with universities (Huang and Chen, 2017), surprisingly little attention has been given by scholars to the investigation of the impacts of subjective determinants such as the collaborators' affective evaluations and perceptions of a project and collaboration outcomes on objective success criteria, such as the decision to engage in future UICs. By filling this knowledge gap of both theoretical and practical significance, we responded to recent calls made to investigate the role played by collaborator perceptions (Bstieler et al., 2017), and affective evaluations (Daniels, 2003; Delgado-García et al., 2010; Johnston and Huggins, 2018; Rajalo and Vadi, 2017) in the decision to engage in future UICs. Furthermore, by extending the previous studies that have shown the influence of perceptions and affective evaluations on managerial decision making in companies (Delgado-García et al., 2010; Wegge et al., 2006; Williams, 2007), our findings add value by highlighting their influence on UICs. We also go beyond the prevailing focus, found in the UIC literature (and in the interorganizational literature in general), on objective measures and determinants of success (Bjerregaard, 2010), looking instead at the influence of subjective determinants on objective success criteria, and highlighting how the former could be managed to improve collaboration success.

In this respect, our contributions are threefold. First, our findings contribute to the UIC literature by highlighting the influence of perceptions, as a subjective determinant, on collaborator likelihood to continue collaboration over time. Ryu (2014) explained that perceived benefits are an important determinant in collaboration success, and our study confirmed this; the greater the perceived benefit, the more likely collaborators are to engage

in future UICs. We added value and extended the research further by investigating the relationship between perceived challenges and perceived benefits. This is particularly relevant because UICs are often perceived to be challenging due to the inherent differences between the partners (Lhuillery and Pfister, 2009; Guzzini and Iacobucci, 2016; Lin, 2017). We found a negative relationship between the perceived challenges and perceived benefits of collaboration, suggesting that challenging UICs are more likely to lead to lower perceived benefits, with negative practical implications. While some literature has argued for a positive relationship between perceived challenges and perceived benefits (Delgado-García et al., 2010; Mittal and Ross, 1998; Tseng and Wang, 2016; Kerzner, 2009; de Bakker et al., 2012; Ghysels et al., 2005), our evidence is aligned with those studies in psychology (King and Slovic, 2014; Schiebener and Brand, 2015; Slovic and Peters, 2006), strategic management (Nickel and Rodriguez, 2002) and finance (Salm, 2017) that have argued for a negative correlation between perceived challenges and perceived benefits. While the differences between universities and businesses are a key reason to promote such interactions (De Silva and Rossi, 2018; Rosli et al., 2018), they can also lead to UICs being perceived as highly challenging, with a negative impact on their perceived benefits.

Second, we found that the interplay between negative and positive affective evaluations enables collaborators to mitigate the negative impacts of perceived challenges on UIC success. On the one hand, the negative relationship between perceived challenges and perceived benefits is mediated by negative affective evaluations. This might be attributed to the halo effect (Thorpe et al., 2017), whereby the perception of a UIC as being highly challenging generates a negative affective evaluation that causes all its aspects to be perceived negatively, resulting in a reduction of its perceived benefits. On the other hand, the presence of positive affective evaluations negatively moderates the positive relationship between perceived challenges and negative affective evaluations, and directly increases the

perceived benefits. When perceived challenges destabilize management by causing disruptions through the introduction of negative sentiments and raised anxiety (King and Slovic, 2014), leading managers to react negatively (Pulk, 2017), it is shown here that any positive affective evaluations made by the collaborating team can at least partly offset this process.

Third, we proved that investigating the relationships between the different psychological constructs through the use of textual data produced jointly by the collaborators, rather than through individual-level data collected through ad-hoc questionnaires, is a feasible approach to the analysis of the subjective determinants of UIC success. This suggests that, in the context of UICs, these evaluative processes also operate at the team level, rather than just at the individual one. Thus, we also make an important methodological contribution to how team level perceptions and affective evaluations could be measured through the sentiment analysis of textual data produced by collaborative teams. These measures could play a role in policies supporting UICs by highlighting the usefulness of sentiment analysis as a foresight tool that can identify which UICs are more likely to continue. This might be helpful for the assessment of policy programmes and for future planning purposes. Through such foresight, companies, and intermediaries like Research and Technology Organisations, Catapult Centres, and Knowledge/Technology Transfer Offices, should be able to better support collaboration teams. This could be helped by more research on collaborative project foresight (Gattringer et al., 2017).

These findings generate important practical implications for those universities, businesses, and policymakers who wish to promote successful UICs. Promptly identifying any UICs in which collaborators experience adverse perceptions and emotions, and intervening to help them develop a more positive view of the collaboration could increase the perceived benefits

of these UICs and, ultimately, their success. The actors involved in supporting UICs—such as intermediaries, university managers, and policymakers—should pay attention to the collaborators' perceptions and affective evaluations of UICs and implement strategies to promptly recover those that are at risk of derailing due to perceived challenges and negative affective evaluations. Collaborators themselves should foster their positive affective evaluations of their UIC, which would disrupt the negative relationship between perceived challenges and negative affective evaluations, and increase the perceived benefits.

This, in turn, begs the question of which factors might foster the collaborators' positive affective evaluations of their UIC. This may depend on several factors, including the characteristics of the collaborating team and the adoption of specific collaboration practices and incentive mechanisms. We thus suggest a stream of future research aimed at examining the factors that promote positive affective evaluations between heterogeneous partners such as universities and businesses. An analysis of the influence of emotion on continuous collaboration practice would benefit by combining the argument considered in our research with the research conducted by Wegge et al. (2006) on why and how specific management strategies used in the design of collaboration features influence organizational attitudes and perceptions towards collaborating with university. Additionally, the use of sentiment analysis could focus on specific emotional constructs to determine how affective evaluations can be better managed. This would enable researchers to unpack the black box of affective evaluations and perceptions in relation to UICs. Moreover, to draw more decisive conclusions, there is a need for more longitudinal studies, particularly on those collaborators who engage in subsequent projects.

Our study has a number of limitations. One is the potential endogeneity between several key variables in the model. We have been careful to present the significant relationships found in

the analysis as evidence of associations, rather than of causal relationships (despite the causal links discussed in the mediation) by attributing them to the relevant literature; however, future research could try to unpick these associations further and try to tease out any causal effects. Second, our operationalisation of the sentiment analysis was built on standard software designed to be applicable to any form of text. The LIWC tool developed by Pennebaker and colleagues enables the quantification of the function word similarity between the project reports in order to better understand the collaborators' positions with regard to collaborations and affective evaluations. This approach offers a tool suited to establish linguistic synchrony by computing the differences between individual- and group-level function word usage. Although our empirical study featured affective content words, it has been established that affective content has a strong impact on behaviour (Delgado-García et al., 2010; Wegge et al., 2006; Daniels, 2003). The dictionaries that are embedded in the LIWC software are, however, partially overlapping, which was liable to introduce some correlations between variables. To minimize this problem, we limited the use of LIWC variables to five, and we ensured their reliability (Schultheiss, 2013; Mehl et al., 2016); additional research could thus involve uncovering other content word categories, perhaps better tailored to the body of text under analysis, to capture key conceptual constructs relating to perceptions and affective evaluations of UICs. Finally, the SEM analysis was performed on key variables drawn from the same source (even though the control variables were drawn from other sources); although this was justified in light of the objectives of the analysis, the robustness of the model should be tested with other datasets that derive similar variables from different sources.

Appendix A. Robustness check of the mediating effect of negative affective evaluation between perceived challenges and perceived benefits

We found confirmation of the mediating effect. Perceived challenges were found to have the expected negative effect on perceived benefits (model A1). Perceived challenges were found to have a positive effect on negative affective evaluations, as expected (model A2). When we added negative affective evaluations to the model explaining perceived benefits (model A3), the significance of perceived challenges was reduced, and the relationship between perceived challenges and perceived benefits became insignificant.

	(A1)	**(A2)**	**(A3)**
	a	**b**	**c**
VARIABLES	**Perceived Benefits**	**Negative Affective Evaluation**	**Perceived Benefits**
Perceived Challenges	**-0.186*** **	**0.452*** **	**-0.114+**
	(0.069)	(0.033)	(0.083)
Negative Affective Evaluation			**-0.159+**
			(0.104)
Duration	**-0.044***	-0.005	**-0.044***
	(0.026)	(0.012)	(0.026)
Services	0.035	0.008	0.037
	(0.034)	(0.016)	(0.034)
Manufacturing	**0.056***	0.019	**0.059***
	(0.033)	(0.016)	(0.033)
Product innovation	**-0.052***	0.017	**-0.050***
	(0.027)	(0.013)	(0.027)
Local_funder	0.019	-0.027**	0.015
	(0.026)	(0.013)	(0.026)
Geographical_Proximity	0.023	0.002	0.024
	(0.027)	(0.013)	(0.027)
SME	-0.020	-0.012	-0.022
	(0.027)	(0.013)	(0.027)
Constant	**2.852*** **	**0.112*** **	**2.869*** **
	(0.033)	(0.016)	(0.035)
Observations	415	415	415
R-squared	0.052	0.331	0.057

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1, +p<0.15

The test on the significance of the mediation effect with bootstrapped errors returns a mediation effect (ACME) that is significant with p=0.064.

Appendix B. Robustness check of the moderating effect of positive affective evaluations on the relationship between perceived challenges and negative affective evaluations

Perceived challenges were found to have the expected positive effect on negative affective evaluations (model B1). The interaction between perceived challenges and positive affective evaluations reduces the positive effect of perceived challenges on negative affective evaluations—i.e., negatively moderates the positive effect, as expected (model B2).

VARIABLES	(B1) a Negative Affective Evaluation	(B2) b Negative Affective Evaluation
Perceived Challenge	**0.452*** **	**0.953*** **
	(0.033)	(0.103)
Perceived Challenge*Positive Affective Evaluation		**-0.100*** **
		(0.020)
Duration	-0.005	-0.010
	(0.012)	(0.012)
Services	0.008	0.016
	(0.016)	(0.016)
Manufacturing	0.019	0.025
	(0.016)	(0.015)
Product innovation	0.017	0.013
	(0.013)	(0.013)
Local_funder	**-0.027** **	-0.019
	(0.013)	(0.012)
Geographical_Proximity	0.002	-0.000
	(0.013)	(0.012)
SME	-0.012	-0.007
	(0.013)	(0.013)
Constant	**0.112*** **	**0.087*** **
	(0.016)	(0.016)
Observations	415	415
R-squared	0.331	0.372

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

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