Bridging Management Control Systems and Innovation: the evolution of the research and possible research directions

Rúben Silva Barros, Ana Maria Dias Simões da Costa Ferreira
Instituto Universitário de Lisboa (ISCTE-IUL), Business Research Unit (BRU-IUL), Lisboa, Portugal

Abstract

Purpose: The purpose of this study is to present the evolution of thinking on the role of management control systems (MCS) in innovation, according to the development of control practices, and to provide a reflection on the achievements of the more recent literature.

Design/Methodology/Approach: This paper assesses articles, books, and book chapters that have explored MCS in innovation, together with seminal works on management accounting and control.

Findings: Moving from the traditional phase where MCS were seen as detrimental to innovation, the literature has now reached a new consensus that attributes a positive role to control. In this recent phase, it arises from the literature that: MCS in the realm of innovation should embrace a multiplicity of controls; MCS depend on the magnitude and innovation mode of a company; MCS evolve over time; and that synergies and tensions are expected to arise. Adding these factors to the inherent complexity of innovation, the assertion is that qualitative approaches should be undertaken to infuse the field with more fine-grained evidence. It is also proposed that this methodological approach be used to address the following points: (1) The use of multiple controls; (2) Synergies and tensions, and (3) behavioural aspects of controls in relation with innovation.

Originality/value: The paper is of value for researchers who have an interest in studying the use of MCS in innovation and in qualitative research and proposes some areas of research that could be explored.

Keywords: Management Control Systems, Innovation, Control, Creativity;

Paper Type: Literature Review

1. Introduction

Innovation could be seen as a result of processes that organisations are able to manage, rather than random events that some of them happen to experience at some point in their existence (Davila, 2005; Bisbe and Malagueño, 2015). With innovation being regarded as a critical source of competitive advantage (Crossan and Apaydin, 2010), and as a driver of value creation (Bisbe and Malagueño, 2015), managers are constantly looking for solutions or tools that are not only able to trigger an innovative response in organisations (Chenhall and Moers, 2015), but can also manage the processes associated with that. This just goes to show the importance that MCS can have in relation to innovation.

In recent years, the role that Management Control Systems (MCS) can play in innovation has been given a lot of attention by accounting and management journals with a fairly substantial increase in published works (e.g.: Curtis and Sweeney, 2017; Gurd and Helliar, 2017; Speklé *et al*., 2017; Aaltola, 2018; Christensen *et al*., 2018; Guo *et al.*, 2018; Li and Sandino, 2018). For quite some time, accounting and management control systems were perceived as a hindrance to innovation. Traditionally, control has been seen as a constraint on the freedom, creativity, experimentation, and flexibility of the developers and, therefore, detrimental to innovation (Davila *et al*., 2009a; Christner and Strömsen, 2015). MCS were seen as a way to have unenthusiastic and compliant employees (Ouchi, 1979), which ran contrary to what was needed for innovation (Davila *et al.,* 2009a, b). Indeed, traditional formulations of control were designed to guarantee efficiency, so innovation, perceived as an inefficiency due to the high probability of failure, had to be eliminated (Davila *et al*., 2009a).

In contrast to the more traditional belief that MCS (or accounting) constrained or, at least, were detrimental to innovation, the consensus nowadays is that these systems can play an important role in it (Bedford, 2015; Major *et al.,* 2018). Now, the literature has established bridges between innovation and MCS (e.g.: Henri, 2006; Bedford, 2015), and recognised that MCS could help decision-making through the innovation process (Pfister, 2014). Some authors point out that MCS encourage creativity (Merchant and Van der Stede,

2012), facilitate flows of information (Lopez-Valeiras *et al*., 2016), or orient managers to opportunity seeking behaviours (Simons, 1995a).

Despite the increase in published works and the clear paradigm change, both the use of MCS and the vagaries of innovation are complex realities that make studying the combination of the two a hard and complex task. Therefore, the purpose of this paper is twofold. The first is to analyse the evolution of research on MCS and the perceptions about its role in innovation. This will take into consideration the typologies in use of the techniques that were in place in organisations to try to explain and understand the shift from a traditional point of view to a more contemporary one. The base point here is that it is not possible to dissociate the conclusions and the analysis that research provides without considering the evolution of management control practices and the overall environmental context that determined these practices. Second, having perceived the movements that have occurred, this paper provides a reflection on the achievements reported in the literature and provides arguments as to why it would be important to adopt a qualitative research design in future studies.

Prior reviews of the literature have been conducted (Chenhall and Moers, 2015; Moll, 2015; Fried, 2017; Lövstål and Jontoft, 2017). However, they have very concrete sub-points and do not include the most recent developments that have been published. Fried (2017) concentrates her review on the terminological distinctions of control, while Lövstål and Jontoft (2017) mainly review tension-related terms and their interpretation. Chenhall and Moers (2015) examine the role of innovation as an element of context and as a key variable in the evolution of MCS from simple closed systems to complex calculative practices. Moll (2015) writes an editorial for a special issue in Management Accounting Research, where some studies that focus mainly on new product developments are discussed.

Therefore, the present study builds on the previous literature reviews, while differentiating from them in three aspects that represented contributions to the literature as well. First, analysing the control techniques and mechanisms used, helps to highlight the evolution, and explain the differences between the two moments in this body of research. These two moments represent the different perceptions about the role of MCS in innovation mentioned earlier. The first moment comprehends the traditional view, and the second is a more recent moment hereinafter called contemporary.

Second, it provides a reflection of what could been perceived from the various studies developed under the more contemporary moment that make it important, and highlights the potentialities of using qualitative approaches. Given the multiple controls that would be expected in relation to innovation - its evolutionary perspective, the impacts of the characteristics of innovation to set controls, the synergies and tensions expected to appear and the inherent complexity of innovation - it is argued that qualitative approaches would be helpful in furthering the debate. The reason for this relates to the potentiality of analysing the realities through a fine-grained understanding and to capture data more holistically in order to infuse the debate.

And, lastly, it provides researchers with specific paths for qualitative research that could be explored in further studies. Concretely, there are three areas identified for further research, each with some specific points within them that could be addressed: (1) The use of multiple controls; (2) Synergies and tensions, and (3) behavioural aspects of controls.

In this way, the present paper merges two bodies of research. First, it builds on the evolution and the characteristics of MCS with some fundamental and seminal works on management accounting and control. Second, it resorts to the literature on MCS and innovation. This later body of research include both empirical and theoretical works presented in articles, books, and book chapters that explored any aspect of the role of MCS in innovation, or provided important arguments. When looking for these articles, the focus was on journals related to management and accounting. In accordance with our definition of MCS, the search was for works that specifically analysed formal controls. In relation to innovation, no specific criteria were established, which led to using some works that also explored creativity, for example. Some works appeared through the snowball effect in that, when works reported important aspects perceived to be relevant for the main understanding of the role of MCS in innovation, they were analysed and entered the reference list. Also, some other works were found by a screening of the main journals of accounting carried out by the authors on a regular basis. The searches stopped at the end of 2018.

The remainder of this paper is structured as follows. The next section explains the key terminology used herein. The third section portrays the evolution of the role of MCS in innovation, starting with the traditional view and its contextualisation. Within the same section, the alterations that led to the more contemporary phase are explained, and there is a reflection on what has been achieved so far in the fourth section. The fifth section

presents qualitative research as a design approach to consider, and some directions for future research are proposed, before concluding in the final section.

2. Conceptual underpinnings

Before reviewing the literature, it is necessary to clarify the underlying theoretical concepts. This section presents those concepts, starting with the definition that will be applied to MCS and then moving on to innovation.

2.1. Management control systems definition

Since there is little agreement in the literature, focusing on a single definition of MCS is not an easy task. Therefore, for the purposes of this study, it was decided to adopt a comprehensive definition of their scope that could, like the approach followed by Franco-Santos *et al.* (2012), focus on the necessary and sufficient conditions that comprise MCS. Accordingly, based on the definitions provided by Simons (1995a) and Chenhall and Moers (2015), it is considered that MCS are the formal information routines and procedures used by managers to maintain or modify patterns to achieve organisational goals. This definition, therefore, puts an important emphasis on the connection between these systems and strategy, ensuring the operationalisation and attainment of the organisational strategic goals. Furthermore, it will allow us to develop the analysis following the various time periods and the evolution of the perception of the role of MCS in innovation.

This definition assumes that MCS represent processes of information, that could be more or less complex, with more or fewer controls involved. This opens the door to the inclusion of ideas such as: a combination of systems that work together (Malmi and Brown, 2008; Sandelin, 2008; Ferreira and Otley, 2009; Grabner and Moers, 2013); the levers of control framework (Simons, 1995a); performance measurement systems like Balanced Scorecard (Kaplan and Norton, 1992, 1996); budgets, and other systems that can fulfil the principles of operationalisation of the strategic goals from the definition mentioned.

2.2. Defining Innovation

Innovation is a broad concept with multiple definitions depending on the author and the research tradition, which makes it difficult to define in few words. Baregheh *et al.* (2009) found 60 different definitions of innovation in their search through journals from various disciplines. The first definition of innovation is attributed to Schumpeter in 1934 (Crossan and Apaydin, 2010). Known as the prophet of innovation, Schumpeter (1934) argues that economic development is driven by innovation, and it can come in the form of a new product, a new production method, a new organisational structure, a new source of supply, or the exploitation of new markets (Schumpeter, 1934; Fagerberg, 2005; Crossan and Apaydin, 2010). After Schumpeter's theories, several other authors and institutions defined innovation (e.g.: Damanpour, 1991; OECD, 2005; Crossan and Apaydin, 2010).

From the body of research examined in this study, various authors adopt interpretations of innovation closer to the idea that innovation is a process by which the implementation of new ideas happens (e.g.: Davila, 2000; Davila *et al*., 2009a; Bisbe and Malagueño, 2015; Chenhall and Moers, 2015). This approach highlights the relevance of MCS, in which innovation is treated not as a random event but as a result of organisational processes able to be managed (Davila, 2005; Davila *et al.,* 2009a; Bisbe and Malagueño, 2015). Following this thought, Davila (2000) mentions that as new product development processes gained more importance in company strategies so, too, did the role of MCS in coordinating and controlling them. Along the same lines, Davila (2005) stated that the MCS control systems can be flexible enough to deal with the unpredictability of innovation and, at the same time, stable enough to frame action, thus reinforcing the idea that innovation is an organisational process able to be managed. The author further adds that the organisational processes that could be related to innovation, at both the strategic and organisational level, include the internal powers that make it possible to "*identify, nurture, and translate the seed of an idea into value*" (Davila, 2005: 42). Consequently, this interpretation leads to the distinction between the concept of creativity and innovation, although these two concepts are closely linked to each other (Chenhall and Moers, 2015). Chenhall and Moers (2015), for example, see creativity as the production of a novel idea that can, therefore, be considered the starting point for innovation. Adler and Chen (2011), also studying creativity, define it as the generation of novel ideas. However, innovation is then seen by the lens of Chenhall and Moers (2015) as the creation

and successful implementation of these creative ideas that could be related to new processes, new products, or new services that improve outcomes for companies.

3. The evolution of thinking regarding the role of MCS in innovation

The evolution of thought and the techniques associated with MCS are organised here at two moments. From the works reviewed, there is a perceived shift from a point at which some authors provided arguments and evidence to show how detrimental MCS were for innovation, to a second moment where there is a change to a different perspective. These phases elapsed like "historical" phases which, for the purposes of this study, are named traditional and contemporary phases. The naming of these phases followed the nomenclature and ideas already presented in the literature.

3.1. Traditional thinking about MCS and Innovation

In their book about management accounting change, Wickramasinghe and Alawattage (2007) give a good account of the historical context of what the authors call a mechanistic approach to management accounting and control. Two important facts are pointed out by the authors to justify the practices developed and used in this period (Wickramasinghe and Alawattage, 2007). First, the shift from craft production to mass production. With the industrial revolution and the economies of scale that could be gained as a consequence, large amounts of money were invested in the production processes (Johnson and Kaplan, 1987). Managerial movements, like Taylorism and Fordism, led to job and process fragmentation, standardisation, and rationalisation of production systems that de-skilled the workforce and resulted in more productivity (Wickramasinghe and Alawattage, 2007). Furthermore, industrialised countries were able to sell their products easily with low competition either in price or quality (Ashton *et al*., 1995), which allowed companies to focus on the efficiency of production processes (Loft, 1995).

Second, the shift that occurred in the production process also led to the emergence of bureaucratic forms of organisation (Wickramasinghe and Alawattage, 2007). Johnson and Kaplan (1987) also mention that following the industrial revolution, a hierarchical form of organisation appeared that created a new demand for accounting information in order

to maximize the efficiency of the capital invested. These hierarchical organisations continued to grow, with advances in transportation, communication, and economies of scale creating more opportunities to gain from this form of organisation (Johnson and Kaplan, 1987).

In this way, the traditional formulations of control were established to act in accordance with the principles of standardisation, in bureaucratic environments, and with rigid rules (Davila, 2005; Wickramasinghe and Alawattage, 2007). In other words, this meant that management accounting was centred on principles such as the mechanisation of production and production-orientation in management. Management accounting and control provisioned the managers with tools to monitor behaviour and minimised the need for direct supervision (Wickramasinghe and Alawattage, 2007). Indeed, the focus of these traditional MCS was to make sure that processes delivered the value they were projected to generate, promoting the execution of the same routines in companies with little or no change (Davila, 2005; Davila *et al.*, 2009b; Ylinen and Gulkvist, 2014). Efficiency of the internal processes was the motive for having controls at this period (Johnson and Kaplan, 1987). Example of that, is the definition of management control provided by Robert Anthony, in which he defines management control as "*the process by which managers assure that resources are obtained and used effectively and efficiently in the accomplishment of the organisation's objectives*" (Anthony, 1965: 2). Focusing on planning, monitoring and measuring, this conceptualisation is very representative of the way these systems were initially perceived.

These systems were mainly reactive, identifying courses of action only after deviations from the plans were detected (Ashton *et al*., 1995). The use of cost accounting, variance analysis to production activities, budgeting control, and financially oriented decision analysis as modes of delegation and control predominated (Ittner and Larcker, 2001; Wickramasinghe and Alawattage, 2007). MCS focused on internal concerns and were financially-oriented (Chenhall and Langfield-Smith, 1998). What is more, they were intended to reduce uncertainty and emphasised problem solving (Langfield-Smith, 1997), specifying concrete objectives for managers to accomplish (Wickramasinghe and Alawattage, 2007). Simons (1995b) noted that managers in this era exercised control by telling employees how to do their jobs and monitored them with constant surveillance to guard against any surprise.

Regarding innovation, these systems emphasised execution and not exploration (Davila *et al.,* 2009a, b), leading to employee dissatisfaction and stifling their creativity (Cardinal, 2001). As Davila *et al*. (2009a) point out, control tools were a way of delivering pre-determined objectives and, therefore, eliminated the possibility of innovation because this was seen as inefficient due to the high risk of failure. The processes associated with innovation were identified as uncertain: they lacked routine and their outputs were usually hard to evaluate (Abernethy and Brownell, 1997; Davila *et al*., 2009b). Additionally, their features were not within the pillars of uniformity and predictability required by traditional systems (Davila, 2005). In short, MCS were understood to hold back the development of innovation (Davila, 2000; Ditillo, 2004; Davila, 2005; Mouritsen *et al*., 2009; Davila *et al*., 2009a; Haustein *et al*., 2014; Christner and Strömsen, 2015; Lopez-Valeiras *et al.,* 2015; Chenhall and Moers, 2015).

To support this view, the early literature that linked MCS and innovation debated the dysfunctional effects of these systems in research and development (Van der Meer-Kooistra and Scapens, 2015). Overall, early studies found that organic forms of control were more suitable for organisations that try to pursue innovation (Chenhall and Moers, 2015). Or, as Grabner and Speckbacher (2016) state, for organisations highly dependent on creativity it was believed that they could gain from establishing a low level of formal controls. Quinn (1978) states that formal planning practices in organisations institutionalise innovation as an incrementalism. Ouchi (1979) resorts to some examples to show that control systems which depend on explicit monitoring, evaluation, and correcting lead to unenthusiastic and compliant employees. Ouchi (1979) goes further and states that, in innovation settings, no "rational" forms of control can be applied. Based on Ouchi's framework (1979), Rockness and Shields (1984) seek to understand which control systems are appropriate for research and development, yet achieve results that do not allow them to verify many of the planned associations. Reaching a similar conclusion, Abernethy and Brownell (1997) report that in research and development organisations, where uncertainty is high, reliance on more personal forms of control are preferable to accounting or behavioural control systems. The authors dissociated formal MCS from entrepreneurship and innovation (Davila *et al*., 2009b).

The same idea is shared in the literature on innovation. Damanpour's (1991) meta-analysis of the relationship between innovation and its potential determinants sees control as detrimental to innovation effort, and reports the negative effect of formalisation. The

above arguments are all examples of the traditional view that control should be avoided when innovation is sought.

Since then, a new approach to control is now in place. At the end of the 1980s, Johnson and Kaplan (1987) argued that the approaches to management accounting and control had lost their relevance. Following this, various techniques have been developed to provide an answer to an environment with new challenges. With it, the perspectives on the role of MCS in innovation have also evolved, and more recent empirical studies have portrayed a new way of thinking about control in innovation contexts.

3.2. From traditional thinking to a new paradigm

During the 1980s, Johnson and Kaplan (1987) posited that the MCS of most companies were of little help to them, and that a loss of relevance occurred regarding management accounting. The social-political and economic context changed, ushering in an historical transformation (Wickramasinghe and Alawattage, 2007). The global competition of the 1980s, associated with a revolution triggered by the new practices introduced by the Japanese manufacturers and the development of technology, put companies under pressure (Johnson and Kaplan, 1987; Wickramasinghe and Alawattage, 2007).

More specifically, the context in which companies found themselves evolved from local to global (Wickramasinghe and Alawattage, 2007), with a decline of protected markets (Ashton *et al*., 1995), and a considerable increase in global competition (Ashton *et al*., 1995; Chenhall and Langfield-Smith, 1998). In parallel, a set of technological and political changes had occurred, such as the development of information technologies, telecommunications, and transport, along with an appreciation of knowledge-intensive activities (Johnson and Kaplan, 1987; Wickramasinghe and Alawattage, 2007). Also, Japan was becoming one of the world leaders (Ashton *et al*., 1995), motivated by the models developed in the 1970s which had made the Japanese companies a competitive threat that could not be taken lightly (Wickramasinghe and Alawattage, 2007). Markets had become volatile and managers started to turn their attention to the market positioning of the company and customer satisfaction (Wickramasinghe and Alawattage, 2007). New entrants and substitutes now represented a potential threat, which made managers think more strategically and less financially (Wickramasinghe and Alawattage, 2007).

Following this line, the ideals about manufacturing also changed, and at that moment, instead of mass production, the organisations tended to adopt more flexible regimes of production (Wickramasinghe and Alawattage, 2007). Products now become rapidly obsolete, and flexibility to adapt to customer preferences is needed (Johnson and Kaplan, 1987). Also, companies are required to adopt structures and management styles that are more flexible and responsive (Ashton *et al*., 1995). Against this background, Wickramasinghe and Alawattage (2007) argue that from the mid-1980s a mechanistic form of organisation gave way to a post-mechanistic approach. This transformation also has implications for management accounting and control practices, which now have a completely different role (Wickramasinghe and Alawattage, 2007).

Before, the standardisation and control of production activities were the main roles of management accounting. Now, these systems contribute mainly to flexibility and autonomy (Wickramasinghe and Alawattage, 2007). This is in line with Johnson and Kaplan (1987), who posit that the challenge is to develop flexible approaches to performance measurement systems and management control. Indeed, the scope of management control has increased and entered the field of strategy, with emphasis being placed on value creation, employee empowerment, and formulating competitive benchmarks (Langfield-Smith, 1997; Ittner and Larcker, 2001). The recognition of the need for value creation called for the identification, measurement, and management of value drivers that guarantee customer satisfaction, investor return, and organisational innovation (Ittner and Larcker, 2001). Furthermore, the new emphasis put on the strategic focus has brought to the discipline of management accounting a wide array of possibilities (Langfield-Smith, 2008).

New tools and techniques have been developed that allow management accounting and control to integrate with operations at both the management level and the strategic level (Wickramasinghe and Alawattage, 2007). Examples of such techniques are Activity-Based Costing (ABC), Enterprise Resource Planning (ERP), and Balanced Scorecard (BSC) (Ittner and Larker, 2001; Wickramasinghe and Alawattage, 2007; Chenhall and Moers, 2015). In general, besides regularly measuring a variety of financial indicators, these systems also focus on non-financial indicators based on the company strategy. As Langfield-Smith (1997) highlights, management control should involve the use of non-financial measures to determine the performance of short-term indicators linked to the attainment of long-term strategic goals. Therefore, MCS have developed in such a way

that they are now able to back innovation, providing rationales around which innovation issues can be debated (Chenhall and Moers, 2015).

And, more recently, an emerging stream of literature has questioned traditional thinking and stressed the positive role of MCS with regard to innovation (e.g.: Mouritsen *et al*., 2009; Adler and Chen, 2011; Chenhall *et al*., 2011; Ylinen and Gulkvist, 2014; Bedford, 2015; Bisbe and Malagueño, 2015). The current understanding is that MCS support organisational efforts to respond and adapt to the environment (Davila, 2005); allowing organisations to create unique capabilities (Mundy, 2010) and promote dialogue and ideas creation (Davila *et al*., 2009b). Lopez-Valeiras *et al*. (2015), study how MCS facilitate the appropriations of the benefits of sustainable innovations and conclude that MCS can enhance the impact of innovations on organisational performance when used in accordance with the more recent notions of control. They give the example of the Balanced Scorecard[1], which is oriented to the external environment and is able to offer a comprehensive approach to controlling the internal processes within the strategy.

In general terms, as Davila (2005) points out, MCS can be flexible and dynamic enough to deal with innovation processes, and should not be treated as random exogenous events, but rather as manageable organisational processes. Also, MCS can be significant not only in the initial phase but also for the implementation and commercialisation of new ideas (Guo *et al.*, 2018), or even to provide a "guide rail" to innovation activities giving them meaning beyond their roles (Healy *et al*., 2018), and guiding strategizing efforts (Jørgensen and Messner, 2010). Amabile (1998) reports that creativity can be enhanced only when people are granted freedom to achieve the goals, and further adds, that these goals need to be clear and stable over a long period of time. Nixon (1998) conducted a case study that highlights the important role played by accounting and by the financial controller in planning and controlling new product development processes. Davila (2000) shows that Performance Measurement Systems (PMS) are relevant in product development processes, and a necessary tool to reduce uncertainty.

However, this new view, does not necessarily mean that the traditional techniques stop being used. These techniques now co-exist with the newer ones and assist to form,

[1] The applicability of the BSC approach to innovation activities and research and development (R&D) is also addressed by a few authors, mainly in the innovation literature (e.g.: Kerssen-Van Drongelen and Cook, 1997; Sandström and Toivanen, 2002; Bremser and Barksy, 2004; Yawson *et al*., 2006; Chiesa *et al*., 2009b). These authors base their studies upon the managers' need to measure the performance and contribution of R&D activities against value (Lazzarotti *et al.*, 2011).

articulate, legitimise and make visible the role of innovation within the organisation (Chenhall and Moers, 2015).

4. Some themes about the role of MCS in innovation

In this more contemporary period of thinking on the role of MCS in innovation, some themes have emerged from the works reviewed. A summary of the main findings here presented are expressed in Appendix A[2].

4.1. The use of multiple controls regarding innovation

Chenhall and Moers (2015), in their review, mention that more complex forms of control have made management accounting evolve into a calculative practice in order to help managers develop innovation[3]. Revellino and Mouritsen (2015), referring to the innovation Telepass, argue that calculative practices are engines that catalyse both the development of innovation and insights into its effect[4].

Nonetheless, Chenhall and Moers (2015), further add that more complex notions of control include a combination of the more traditional and the newer practices that have emerged over recent years. These notions are, also, more connected to behavioural and organisational concerns (Chenhall and Moers, 2015).

Indeed, what is argued today in the control literature is the use of multiple controls (e.g.: Malmi and Brown, 2008; Grabner and Moers, 2013), being important to understand how these controls are used and act in combination. For example, Smets *et al.* (2016) mention that no single form of control can simultaneously enhance coordination and cooperation behaviours. Nonetheless, the use of multiple controls, specifically with regard to innovation, is further reinforced by the inherent characteristics of innovation. Innovation

[2] This list does not claim to exhaustively present all the insights provided by the paper, but instead comprehensively clarifies for the reader the principal conclusions that are deemed important for this body of research.

[3] In line with Chenhall and Moers (2015), other authors also endorse this vision of accounting as a calculative practice to help develop innovation. Like, for example, Revellino and Mouritsen (2015) and Major *et al*. (2018).

[4] The insights into the effects of Telepass were obtained by accumulating knowledge about the behaviour of drivers on motorways.

is not considered a simple process, and involves many processes at different organisational levels (Lövstål and Jontoft, 2017).

Looking at the question from another angle, the general management control literature presents various conceptualisations that help us, in a broader sense, to understand the use of controls. Simons' Levers of Control (LOC) framework, is one of the taxonomies that recognises the use of multiple controls and styles in their use (Chenhall and Moers, 2015; Curtis and Sweeny, 2017). Therefore, it has been an influential framework in this new approach on MCS and innovation, and was the subject of much reflection in the literature (see Appendix A). Indeed, Davila *et al*. (2009a) consider Simons' levers of control framework to be a paradigm shift in the traditional way of thinking, as it clearly identifies interactive systems as tools to ensure that organisations explore strategic uncertainties. Highlighting the importance of this framework, Moll (2015) reports that Simons' seminal work seems to have served as an inspiration for researchers to rethink accounting's compatibility with the development of new products. Chenhall and Moers (2015) note that the most significant and remarkable advances linking innovation and PMS came from studying the use of control mechanisms according to the LOC framework. In fact, the framework describes an efficient way in which managers can balance innovation and control while implementing the intended strategy (Simons, 2000).

With recourse to the LOC framework, authors have prompted the debate with insights that help us to better understand the role of the MCS, according to the different levers, in the outputs of innovation. Globally, the wide array of studies help us to perceive the individual roles of the four systems presented in this framework and how they are able to contribute to innovation.

From these studies, interactive use of control systems is said to favour innovation by providing guidance for searching, legitimacy for autonomous initiatives, and stimulus for initiatives in firms with low innovation (Bisbe and Otley, 2004). Also, Lopez-Valeiras *et al*. (2016) conclude that the interactive use of MCS is a key determinant for process innovation since it facilitates the necessary internal and external information flows. Moreover, the authors state that interactive use of MCS acts as a moderator in the relationship between process innovation and financial performance. Dunk (2011) concludes that the use of budgets as a planning mechanism, consistent with Simons' interactive system, facilitates the positive impact of product innovation on a company's financial performance. However, when budgets are used essentially as a control

mechanism, innovation does not foster performance. Also, interactive use of PMS were found to impact positively on creativity through psychological empowerment (Moulang, 2015), and to increase the effectiveness of innovation processes rather than the propensity for companies to engage with new products and technologies (Bedford, 2015).

Diagnostic use of control systems, a use more closely linked to the one that was characteristic of the traditional period (Davila *et al*., 2009a), has achieved some dubious findings. While there are studies reporting their constraining effect (e.g.: Henri, 2006; Bisbe and Malagueño, 2015), others have reported a positive contribution for the deployment of innovation (e.g: Koufteros *et al.,* 2014; Bedford, 2015). Henri (2006) found that when using the PMS for diagnostic purposes, it contributes negatively to the deployment of the capability of innovativeness. The results achieved by Bisbe and Malagueño (2015) suggest that the diagnostic control system plays a minor role in each of the various phases of the innovation process. Aaltola (2018) reports that financial information was used to monitor costs and investments, but since there was no tracking against pre-established goals, diagnostic control was absent. On the other hand, for example, Koufteros *et al*.'s (2014) study provides evidence that the diagnostic use of PMS contributes positively to the development of organisational capabilities. Indeed, the authors note that, statistically, the effect of diagnostic use is the strongest. Healy *et al.* (2018) report the use of controls in a diagnostic way to monitor behaviours and drives that behaviour to achieve the company's strategic objectives.

Belief and boundary systems are less explored. Bisbe and Malagueño (2015) conclude that the value system (a group that includes Simons' belief and boundary systems), and the interactive use of control systems as well, have significant effects on each phase of the innovation process. Curtis and Sweeney (2017) also report that value systems create an infrastructure for innovation, and show how interactive and diagnostic use of feedback and measurement systems protect innovation. Aaltola (2018) reports that a strategic story, which has both elements of belief and boundary systems, is a motivational framework to which innovation should be aligned. Maier and Branzei (2014), highlighted that belief systems acted as reminders that creative inputs had to be timed, and that the team was a part of the larger organisation. Also, the authors posit visual controls as a kind of boundary system. Christensen *et al.* (2018), although not using the LOC framework, reveal the importance of voluntarily implemented new values in influencing behaviour

and in setting a new direction Icelandic banks took in the aftermath of the 2008' financial crisis.

Another way that authors have looked for control in this field of research is by relying on Merchant and Van der Stede's (2012) object of control framework. Based on this framework, Haustein *et al*. (2014) hypothesise that results' control is not suitable for companies with a high innovative capability as employees tend to adopt risk-averse behaviour. The authors even hypothesise that results and action control are negatively associated with innovation capability in innovative companies. Haustein *et al*. (2014) also hypothesise that cultural control should be positively associated with innovation capability. According to the authors, cultural control stems from a strong culture and will serve as a repository of knowledge and should stimulate collective action and tolerance for divergent ideas. Pesämaa's (2017) results suggest that follow-up action and personnel controls make it possible to seize the effects of innovativeness. Faßauer (2018) also relies on Merchant and Van der Stede's framework to show that management control can create the necessary conditions for innovative behaviours.

Additionally, there are a couple of studies using a distinction between input, behavioural and output controls[5], the same trichotomy that was used earlier by Rockness and Shields (1984). This is the case of Cardinal's (2001) study. Cardinal (2001) defends the importance of control for both incremental and radical innovation. In her view, input, behaviour, and output forms of control are good for innovation as they enable scientists to conduct their work. While behavioural and input control are the most appropriate in the case of radical innovation, input and output control are more fitting for incremental innovation. Also, Guo *et al.* (2018) perceive that input control is important to process innovation in both low and high tech companies. Behaviour controls are beneficial for both types of innovation in high-tech, but in the case of low-tech this form of control is more beneficial for process innovation than product innovation. Finally, the authors find output controls positive for both types of innovation. Akyord and Maguire (2011), also use this terminology, and show that MCS reduce uncertainty during the development process and encourage goal congruence at the decision moments (gates) of a stage-gate approach.

[5] Following the explanations of Cardinal (2001), input control may be perceived as a form of resource allocation; control behaviour as the monitoring of activities and behaviours, and control output with the evaluation of results. As Davila *et al*. (2009b) explains, input control is more informal and the other two are more formal controls.

In short, the main points that could be extracted from the prior analysis is that the use of control systems in relation to innovation comprehends a set of controls used in different ways, with different results being expected. Depending on the way they are used, controls produce different results and can provide different routines that impact innovation either by supporting or constraining it.

4.2. Distinctions on the use of controls regarding innovation

Research has also acknowledged that the use of controls differs depending on the magnitude of innovation carried out, modes of innovation (e.g.: Bedford, 2015) or even the strategy followed. Following this line, Chenhall *et al*. (2011) contribute to the debate in the literature by examining how MCS are involved in the relationship between strategies of product differentiation and innovation, and Guo *et al*. (2018) differentiated between high-tech and low-tech sectors.

Regarding the differentiation of incremental and radical innovation, it is argued, for example, that differences should exist in management control (Davila *et al.,* 2009a). Ylinen and Gulkvist (2014) found support for the importance of organic control in both incremental and radical innovation projects. On the one hand, they found that organic control had an indirect effect through innovativeness in radical innovation projects' performance. On the other hand, there was no evidence of this in the case of mechanistic control.

Bedford (2015) analysed the use of controls by exploring the differences in organisations that pursue different modes of innovation. The author concludes that the interactive use of control systems is found to be associated with performance in companies more focused on exploratory innovation. However, companies looking to refine first-order skills tend to benefit more from focusing on diagnostic use and the boundary system. McCarthy and Gordon (2011) predicted and confirmed that the diagnostic system and the boundaries system contribute to exploitation while the interactive and belief systems contribute to exploration.

The same line of thinking is done by Bisbe and Malagueño (2009), who found that the specific choice of an individual MCS for interactive use is related to the company's type of innovation mode. The authors found evidence that companies dedicated to simple and isolated forms of innovation, and companies looking to create a rich portfolio of

innovations usually tend to select BSC for interactive use. Bisbe and Malagueño (2015) argue that the influence of MCS in innovation processes depends on the entrepreneurial orientation of the firm that is reflected in its values and in its strategic uncertainties. Their findings reveal that the interactive use of MCS stimulates creativity in conservative and entrepreneurial companies. The interactive use of control systems in entrepreneurial companies is not only positively associated with the filtering stage, but its use also activates this stage. Emphasis on the value system is also positively associated with the filtering phase in conservative companies, while the interactive use of control systems is positively associated with creativity.

Furthermore, it is also possible to learn that each stage of the development of new products requires different controls and different ways of using them, as well as different projects require different controls. The case study of Ditillo (2004) provides a clear example of how different projects used patterns of controls differently within the same company. Ditillo (2004) is able to determine that each project team requires different control mechanisms depending on the complexity of knowledge inherent to each project. Likewise, Revellino and Mouritsen (2009) assert that controls are mobilised differently, and at some points they show great power but after their work is completed they can stop being used. Furthermore, the authors state that "*controls are not durable, coherent and consistent*" (Revellino and Mouritsen, 2009: 360). They assume that innovation must go through several phases requiring different controls. The authors substantiate this thesis by following the development of Telepass[6], an innovative product developed by an Italian company. In short, they try to understand how MCS interferes in and shapes the development of innovation activities and argue that a mixture of various control elements will be changed and adapted as the innovation process itself evolves. Reinforcing this idea, Artto *et al*. (2011) argue that a natural path exists from a first emphasis on the use of diagnostic and control systems and, later, interactive and belief systems. Chiesa *et al.* (2009a) observe that MCS adopted in a project evolve as the information needs vary. Additionally, Chiesa *et al.* (2009a) report that the use of interactive and boundary control systems is more appropriate in the early stages of innovative processes, given the higher level of uncertainty, but that the diagnostic control system is generally adopted in the final stages. This is not only because it is easier to implement at this point, but information

[6] Telepass is an electronic toll for payments used on motorways in Italy (Revellino and Mouritsen, 2009; 2015)

processing requirements are incompatible with its use in the initial stages. Bisbe and Malagueño (2015) acknowledge the importance of using MCS according to interactive, belief, and boundary systems in each phase of innovation projects and attribute only a minor role to diagnostic control.

In summary, as Fried *et al.* (2017) highlight, the management of innovation and control is strongly challenged by the inherent specificities of innovation. And, the variety of approaches and analysis followed are an indication of that. The use of multiple controls is dependent of the characteristics of the company and/or the projects. Different times, stages, magnitudes of innovation require different controls and different forms of their use. Also, in a broad sense, the conclusions of Revellino and Mouritsen (2009) show that controls evolved which make it hard to perceive the best approaches to use. Moreover, it is also possible to acknowledge that the correct use of MCS in new development projects depends on the phase of that project (e.g.: Chiesa *et al.*, 2009a; Artto *et al*., 2011), and that these controls are not durable (Revellino and Mouritsen, 2009).

4.3. Synergies, dichotomies and tensions on control use

So far, we have shown how the use of MCS has evolved from being seen as a hindrance to innovation to the general consensus that these systems, depending on how they are used, can enable innovation. As a result, and using the words of Van der Meer-Kooistra and Scapens (2015: 88), "*we must recognise that management accounting, and management controls more generally, can both constrain and encourage creativity/innovation at the same time*". In fact, the debate regarding both constraining effects and enabling effects seems to lead to the point that the use of controls in the context of innovation keeps the presence of both forces simultaneously. This generates a dichotomy between these forces. Pfister (2014), however, reports that control can be directing, enabling, and supportive and, with these characteristics, open the door to innovation and creativity rather than coercively constraining them.

Grabner and Speckbacher (2016) also posit a dilemma faced by organisations that can share some points with this dichotomy. For the authors, organisations that rely on creativity face the dilemma that while the nature of creativity production may demand formal control, that control could weaken creativity. Marginson (2002) proposes the use of administrative controls to manage the tension concerning creative innovation and goal-

related activity. Davila *et al.* (2009b) states that one of the reasons for adopting MCS is the legitimisation of the process by external parties. Meanwhile, Knardal and Petterson (2015) argue that in their case study, by using budgets interactively it was possible to achieve a balance between creativity and control, and Speklé *et al.* (2017) reported that creativity and control can coexist. Gurd and Helliar (2017) revealed the power of institutional leaders in balancing risk management and management controls and innovation.

The LOC framework, also, shows its concern with balance by simultaneously predicting the constraining of employee behaviour while facilitating creativity (Mundy, 2010). Undeniably, the LOC framework is built on the idea of balance between positive and negative forces that constrain and enable behaviours (Simons, 1995; Mundy, 2010). Moreover, in the management control and management accounting literature, by considering a combination of controls instead of single controls, it is clear that dichotomies appear through the distinct forces that the different uses of these controls exert. The result is the appearance of tensions. Tensions, as advanced by Lövstål and Jontoft (2017) appear through the existence of competing demands. In this sense, the LOC framework incorporates complementarities and tensions caused by the different types of use of the four systems (e.g.: Simons, 1995a). Envisioned to have the four levers of control working simultaneously, tensions would be expected from the use of all four levers. These are the so called dynamic tensions (Simons, 1995a; Mundy, 2010). In other taxonomies of controls, there is also present the idea of dichotomies that do, indeed, have some parallels between them. Chenhall and Moers (2015) mention that the dichotomy presented by the diagnostic/interactive use of controls has a parallel with more complex control characteristics like the mechanistic and organic controls, tight or loose controls or, even coercive and enabling controls. Therefore, in studying the relationship between MCS and innovation, these dichotomies and the inherent tensions have to be accounted for. Reinforcing this idea, Maier and Branzei (2014) report that the enabling and constraining aspects of controls can produce productive tension when creativity is required.

The created tensions are expected to affect innovation, as well. Mouritsen *et al.* (2009) report that tensions between calculations can bend innovation to considerations like growth, profitability or even productivity and, in this way, connect the innovation to a firm's wider concerns. Ylinen and Gulkvist (2014) state that the interaction effect of

organic control and mechanistic control enhances performance in both incremental and radical innovation projects. In this regard, Henri (2006) concludes that the balanced use of interactive and diagnostic control systems generates a dynamic tension that will also contribute positively to developing innovativeness in uncertain environmental contexts. In the second phase of their study, Koufteros *et al*. (2014) conducted retrospective interviews that allowed them to further conclude that the combination of an interactive and diagnostic use of PMS, in a concurrent logic, proves quite beneficial for companies. Bedford (2015) also reports that in the case of companies looking to achieve simultaneous exploration and exploitation, it is the dynamic tension created by the diagnostic and interactive use that permits a higher performance. Adler and Chen (2011), in turn, indicate that an optimal mix of the use of diagnostic and interactive systems is expected to have a positive effect on motivation. Marginson (2002) proposes that top management's use of PMS originates tension and trade-offs during the development of new ideas and initiatives.

Using a different terminology, which in essence expresses similar ideas, Van der Meer-Kooistra and Scapens (2015) show in their case study how minimal structures provide firmness and flexibility for co-developing new products. Some other authors also argue or show that MCS should accommodate some degree of flexibility (Jørgensen and Messner, 2009; Chiesa *et al*., 2009a; Kapsali, 2011; Maier and Branzei, 2014). Jørgensen and Messner (2009) show through a case study focusing on new product development how different control mechanisms have permitted the organisation to strike a balance between it and efficiency. Kapsali (2011) found that operational flexibility and boundary management are more significant to successful practice than formalisation or control mechanisms. Maier and Branzei (2014) highlight that control systems need to be flexible in order for project managers to respond to the uncertainties of the projects.

Curtis and Sweeney (2017), meanwhile, have provided a different perspective. They report on the case study of a highly innovative company in which the mutually reinforcing combinations of MCS are analysed according to the LOC framework, and taking into consideration the tension created between different types of innovation (customer oriented innovation and technology oriented innovation). In this case, the authors conclude that although MCS trigger a push for consistency, they end up excluding one of the types of innovation rather than creating a dynamic tension between the two. The study also underlines the protective role of MCS in managing innovation. Feedback and

management systems are said by the authors to command management attention, stimulate action, and drive accountability on innovation projects.

But it is not only tensions between controls and their type of use that appear. Research, as expected, shows that the use of multiple controls, ends up creating synergetic effects along with tensions. The study of Rijsdijk and van den Ende (2011) concludes exactly this, and the authors mention that synergies and conflicts arise from the use of multiple controls. Consistent with this line of thinking, Cardinal (2001) also mentions that the different combination of controls can originate both synergies and tensions.

In short, the line of the debate would appear to indicate that MCS both constrain and enable behaviours. These aspects generate tensions between the controls used and between competing organisational demands that end up having an impact on the outputs of innovation. The impact could also generate synergies between these controls.

4.4. Multiple levels of analysis

It would appear also, from the literature, that authors employ different levels of analysis. Some derive their results from the analysis of development projects (e.g.: Maier and Branzei, 2014; Rezania *et al.*, 2016; Smets *et al.*, 2016) and others from the overall organisation (e.g.: Henri, 2006; Bedford, 2015).

Indeed, it is important to acknowledge that innovation, nowadays, can stem from innovation projects within an organisation but also, from external projects that link various organisations. It has become common organisations to partnered with other organisations, to leverage expertise and overcoming financing problems posit in research and development projects (Moll, 2105). Smets *et al.* (2016), for instance, based their research work on development projects formed by teams from competing companies. Thus, innovation projects involve a complex set of activities that should be treated as independent organisations, from which a certain level of performance and a final output can be expected (Rezania *et al*., 2016). Managers are, therefore, faced with the challenge of establishing control mechanisms to orient projects in the right strategic direction and monitor their progress (Bonner *et al*., 2002). Akroyd and Maguire (2011) attribute to MCS a role in promoting the alignment at each decision phase of the stage-gate model. Akroyd *et al.* (2016) report that managers at the company in their case study use MCS to

enable the alignment between new product development projects and multiple conflicting strategies.

Van der Meer-Koistra and Scapens (2015) address a development project with multiple parties that evolved and developed in temporary organisations comprising staff from non-temporary organisations, with the authors looking at the governance mechanisms of these organisations.

This would indicate that we should acknowledge the existence of various levels of possibly analysing innovation which may include organisations, projects within the organisations, or inter-organisational temporary organisations. These levels would require different uses of controls and they would need to ensure alignment with other controls and strategies.

5. The need for more qualitative approaches and possible directions

The section presented above, give an indication of the arguments that will underpin our suggestions for further research. First, it has become clear that research in this field is still in its infancy. In fact, claims and calls for further research to explore how control practices can contribute and relate to innovation have been made by various authors (e.g: Chenhall and Moers, 2015; Moll, 2015; Major *et al.*, 2018). These calls are endorsed in this study by the perceptions obtained from the studies reviewed. A growing body of knowledge has begun to be accumulated but a more in-depth analysis is required. This leads us to a second point. Namely, that analysis so far undertaken has also revealed that control and innovation are a complex and challenging realities to analyse, there being many aspects that affect this relationship, and that many impacts can be expected.

Indeed, by its very nature, innovation is imbued with complexity and uncertainty and progresses along uncharted paths (Fried, 2017; Fried *et al*., 2017; see also what Jørgensen and Messner (2010) refer about new product development). Innovation is not monolithic, it involves various processes, with each demanding different controls (Davila *et al*., 2009a). In turn, as considered in the management control literature, MCS do not exist in isolation (e.g. Malmi and Brown, 2008; Sandelin, 2008; Ferreira and Otley, 2009; Grabner and Moers, 2013), and analysing isolated forms of control has limited practical validity (Rijsdijk and Van den Ende, 2011). This means that one single practice cannot be explored without considering other controls (Chenhall and Moers, 2015).

Therefore, these points sustain our argument regarding the need for more qualitative approaches to study the role of MCS in innovation. Qualitative research is able to bring to the debate the complexity of control, innovation and the two realities combined. As Moll *et al*. (2006) mentions, the multifaceted nature of accounting practices can only be analysed by qualitative methods. Quantitative empirical work provides a narrow view of a reality where organisations are coherent units and individuals behave in rational ways (Moll *et al*., 2006, Vaivio, 2007), which does not permit the apprehension of interesting dynamics in the way that qualitative research does. Also, as noted by Parker (2014: 15), qualitative research "*opens up the possibility of asking and interrogating questions no-one has previously bothered to ask, and better understanding and reconstituting what we thought we already knew*".

It would be important to have more case-based research built on rich empirical data collected through a diversity of sources in the contexts examined. Case studies, as expressed by Feeney and Pierce (2018) assist a more detailed exploration of human actions and interactions regarding the use of accounting information. Perhaps, multiple case studies could be carried out both in innovative and non-innovative settings (Fried, 2017). Qualitative research with longitudinal contact in the field to study the processes in their natural settings deeply embedded in the perceptions, realities, and behaviours of the actors would bring richer and broader evidence to the debate (Ahrens and Dent, 1998; Vaivio, 2008; Parker, 2014).

Qualitative studies on this realm, have recently begun to emerge in the literature (e.g.: Van der Meer-Kooistra and Scapens, 2015; Gurd and Helliar, 2017; Aaltola, 2018; Christensen *et al.*, 2018; Feeney and Pierce, 2018; Healy *et al.*, 2018). These studies provide us with more in-depth insights, but there are still so many issues to explore that there is much scope left to pursue this path.

Considering this methodological positioning, and the building blocks presented in the earlier section, there are some research paths and dynamics that are worth exploring and which could inspire researchers.

Studying management control and innovation through multiple controls

As expounded earlier, it can be expected that multiple controls will be used. However, their use will vary from company to company, from project to project, and will be

dependent of the inherent characteristics of the innovation sought, for example. These aspects will determine the design features and use of MCS. Although, this could be perceived from the body of research analysed and in the literature on management control, it is still an area for scholars to explore.

The use of case studies could provide fine-grained data on the "messy" range of controls that companies put in place and what their impacts are. The use and consequences of using multiple controls are difficult to determine, so case studies could also be helpful to analyse how "packages" of control (Malmi and Brown, 2008) or systems (Grabner and Moers, 2013) are used in the case of innovation. Additionally, the control mechanisms work as complements or substitutes in their influence, and neglecting the interdependencies could lead to inadequate insights into how to manage innovation (Rijsdik and van den Ende, 2011). These are all aspects that could benefit from more insights with specific evidence provided by real situations closer to the practice that could help us, step by step, to close gaps. As Moll (2015) mentions, there is scant literature in this area, and the current understanding of how accounting can be made practicable and effective in the context of innovation is limited as well. The same applies to MCS, where the simultaneous use of different techniques with different purposes is still to be fully explored.

The evolutionary aspect of controls in the different phases of projects, as demonstrated by Revellino and Mouritsen (2009), should also be analysed to provide more insight into how that evolution impacts innovation. Extrapolating to the organisation as a unit, we might also expect some evolution of controls in guiding the company towards more innovative behaviours, which is a further aspect that could be analysed. Questions that could be raised are: How do MCS evolve in contexts demarcated by the need for creativity and innovation? What are the links between controls over time and their impacts on innovation?

Also, with the acknowledgement of the various types of use of controls, there are also paths to explore considering the LOC framework. The role that belief and boundary systems play in promoting innovation would benefit from richer insights. The insights provided by the qualitative cases of Aaltola (2018) and Christensen *et al.* (2018) provide good indications about the importance of belief and, to some extent, boundary systems. Derives from the findings of Aaltola (2018) that innovation should be aligned with a strategic story to make use of the motivational framework that it provides. From the

multiple case study of Christensen *et al.* (2018) we learn that values, an element of the belief systems, are able to influence behaviour. Also, Van der Meer-Kooistra and Scapens (2015) show how accounting information could be used to set boundaries. Therefore, an extended analysis on how belief and boundary systems act regarding innovation could be explored. How do belief systems specifically affect behaviours and the development of new products? Or, how could boundaries be established without restricting creativity and blocking the experimentation needed for innovation? How does the use of belief and boundary systems relate to, influence and impact the use of other types of controls?

The role of the diagnostic use of systems (or the more traditional forms of controls) in the development of new products is another area of interest. Going beyond the debate about constraining or enabling, at some points the use of diagnostic systems can be required or worthwhile. In their analysis of radical innovation projects, Chiesa *et al*. (2009a) conclude that diagnostic control is used more at the commercial stage or in the final stages of development. Researchers may, therefore, investigate how and when MCS are used both diagnostically and in accordance with other systems.

Synergies and tensions

With the use of multiple controls and the way that managers use them, the creation of some tensions and synergies can also be expected. As we have seen, although some insights into this subject have been achieved, there is still much to be known. By relying on the interpretation of MCS working as a package of systems, it is possible to analyse the tensions mentioned earlier. When various systems are in place, how do tensions appear and disappear from their combined use (Moll, 2015)? How do these tensions impact the success of new product development? How do the tensions that appear change the development processes and the practices of control over time? The different frameworks for analysing the types of use of MCS also comprehend these ideas. For example, a research stream in the literature on the LOC framework has highlighted the mutually reinforcing aspect of the four levers of control (e.g.: Widener, 2007; Mundy, 2010; Kruis *et al.*, 2016; Curtis and Sweeney, 2017; Speklé *et al*., 2017). The whole model is based not only on the complementarity of the levers but also on the dynamic tensions generated by their combined use. Only by having all these systems working together, as Chenhall and Moers (2015) report, is it possible to ensure the effective management of both innovation and efficiency. However, the literature has merely

addressed the tension between the diagnostic and interactive systems in this regard (Henri, 2006; Koufteros *et al*., 2014; Bedford, 2015; Chenhall and Moers, 2015). Further research is, therefore, needed to understand how the dynamic tension between Simons' four control systems can be managed and balanced to promote innovation from an organisational perspective.

In addition, researchers may investigate other types of tension, following Curtis and Sweeney (2017) who analysed the tension between the coexistence of two forms of innovation in a company rather than the tension between the various levers. Tervala *et al.* (2017) also identify tension in the fact that project managers are under and in control of their projects. Lövstål and Jontoft (2017) make a literature review about tensions, and argue for more research around this idea as well. Thus, the role of the LOC framework in the internal management of tensions created from aspects related to innovation is an interesting avenue for research, and is one in which the case field advocated could provide various insights.

Behavioural aspects in management control and innovation

Another interesting line that researchers could follow is the exploration of some aspects related to the behaviour of the individual. Amabile (1998) identifies expertise, creative thinking and motivation as components of creativity. Although the studies reviewed provide some insights into how the control could impact on innovation, further research could explain how control impacts these aspects. For example, despite the underlying idea of some studies being that the various components of MCS could have a positive or negative influence on the attitude of employees toward innovation, a link has not yet been established between the LOC framework and an individual's motivation to be creative (Chenhall and Moers, 2015). Nor has this aspect been specifically explored in the literature reviewed. Interviews or case-based research could provide exploratory analyses to clarify these aspects.

Considering the realm of change, it would be worthwhile to explore how MCS change the internal views of innovation, or how the development of new products change MCS over time. Depending on the conditions of the field of study, it would also be interesting to study how variations of MCS affect the internal ideals and processes of innovation, or

even how the control practices of new developments are coupled or decoupled from the overall control practices of the organisation.

Additionally, the literature so far has not explored how and why MCS influence or determine the sense-making of actors and their decision-making processes regarding innovation. Here, introducing theories more connected to organisational behaviour could strengthen the analysis. For example, Faßauer (2018) asking how management control can contribute to innovative behaviours used Merton's anomie theory to explore the effects that objects of control framework had on it. Institutional theory could, also, be helpful. The role of actors that is portrayed in every stream of institutional theory could provide a theoretical background in these matters.

Further research could, also, explore relations of power and the distribution of responsibility. How do the relations of power existing within organisations affect innovation? How do MCS distribute responsibility and manage it? As Fried (2017) mentions, a better understanding of the effect of material forces could provide a basis for the development of MCS. How the environmental demands for innovation affect the use of MCS and change the control practices related to innovation processes, or how the regulatory mechanisms for innovation change affect the practices of control in relation to innovation. How can funding and grants for new developments affect MCS and change them?

6. Concluding Remarks

Building on the relevance of innovation as a key to organisational success, and the recent importance given in the literature to the role of MCS in innovation, this study has first presented a broad overview of the evolution of the research, and the most recent understandings that have been achieved.

As stated at the very beginning of this work, this evolution should first be perceived in the light of the practices that were in place at the time and the contextual factors that determined them. This led to the analysis being divided into two moments. The first moment is associated with a more traditional view of management control, determined by practices for mass production (Wickramasinghe and Alawattage, 2007), in which internal efficiency was the main goal. At that moment, innovation was perceived as an inefficiency and, therefore, MCS acted to constrain innovation. Research in this period

discussed the dysfunctional effects control had on innovation (Van der Meer-Kooistra and Scapens, 2015). Following that moment, a transition is perceived with the changes in practices and the rise of new techniques that focused more on strategy and less on the return and efficiency. In this period, the contemporary one, research starts to present a new paradigm, where MCS are not viewed as a hindrance to innovation (Davila *et al.* 2009a). At this recent point, authors have perceived that innovation requires the simultaneous use of multiple controls that evolve over time, have specific moments to be used and should vary according to the type of innovation. Also, tensions and synergies by the type of uses emerged and must be accounted for. Given this background and these points, this study argues for the use of more qualitative approaches to analyse, as a starting point, these considerations in a holistically way and to provide fine-grained evidence. With this approach, researchers could explore certain dynamics beyond a functional and practical view of MCS, and thus infuse the debate.

Further research could continue to uncover evidence on how multiple controls are being mobilised by managers, in what moments they are being used and how their effects disappear or change. Also, researchers could explore how tensions and synergies appear and what their impacts in innovation are. The role of MCS in managing them is a possible way to develop research. Further analysis of the role of belief and boundary systems in connection with other controls could be another. In fact, these are just a few ideas that researchers could use, but the main point here is that there is still much to discover about the connections of these two realities. And qualitative approaches, in particular, would help to explore and give rise to new issues.

As with any other research work, it is also necessary to acknowledge some limitations. Given the rise in the number of papers published on management and accounting, and the literature around these matters, it is hard to keep track of all the works and the insights that they provide to the field. Although, this paper tries to provide the most comprehensive view of the field with a considerable amount references, it is still possible that there are some missing works. Moreover, the goal of this paper was to perceive how qualitative researches could contribute to this line of debate. Therefore, the arguments put forward were intended to highlight the paths that researchers could follow, and to use the potentialities of this methodology to go beyond the more practical and bring to the debate a rich understanding more able to fuel it and, possibly, take it in different directions. This does not necessarily mean, however, that there are no other possible research directions

like quantitative approaches, for example, that would be worthwhile exploring, but that was not the goal of this paper.

Appendix A

Table 1 around here

References

Aaltola, P. (2018), "Investing in strategic development: Management control of business model and managerial innovations" *Qualitative Research in Accounting & Management,* Vol. 15 No. 2, pp. 206-230.

Abernethy, M. A. and Brownell. P. (1997), "Management control systems in research and development organizations: the role of accounting, behavior and personnel controls", *Accounting, Organizations and Society,* Vol. 22 No. 3/4, pp. 233-248.

Adler, P. S. and Chen, C. X. (2011), "Combining creativity and control: Understanding individual motivation in large-scale collaborative creativity", *Accounting, Organizations and Society,* Vol. 36 No. 2, pp. 63-85.

Ahrens, T. and Dent, J. F. (1998), "Accounting and Organizations: realizing the richness of field research", *Journal of Management Accounting Research*, Vol. 10 No., pp. 1-39.

Anthony, R. (1965), *Planning and Control Systems: A Framework for Analysis*, Division of Research, Harvard Business School, Boston, MA.

Amabile, T. M. (1998), "How to kill creativity". *Harvard Business Review*, Vol. 75 No.5, pp. 76–87.

Akroyd, C. and Maguire, W. (2011), "The roles of management control in a product development setting", *Qualitative Research in Accounting and Management*, Vol. 8 No. 3, pp. 212-237.

Akroyd, C., Biswas, S. S. N., and Chuang, S. (2016), "How management control practices enable strategic alignment during the product development process", *Advances in Management Accounting*, Vol. 26, pp. 99-138.

Artto, K., Kulvik, I., Poskela, J., and Turkulainen, V. (2011), "The integrative role of the project management office in the front end of innovation", *International Journal of Project Management*, Vol. 29 No. 4, pp. 408-421.

Ashton, D., Hopper, T., and Scapens, R. W. (1995), "The changing nature of Issues in Management Accounting", in Ashton, D., Hopper, T. and Scapens, R. W. (Eds.), *Issues in Management Accounting*, Second Edition, Prentice Hall, Essex, England, pp. 1-20.

Baregheh, A., Rowley, J., and Sambrook, S. (2009), "Towards a multidisciplinary definition of innovation", *Management Decision*, Vol. 47 No. 8, pp. 1323-1339.

Bedford, D. S. (2015), "Management control systems across different modes of innovation: Implications for firm performance", *Management Accounting Research*, Vol. 28, pp. 12- 30.

Bisbe, J. and Malagueño, R. (2009), "The choice of interactive control systems under different innovation management modes", *European Accounting Review*, Vol. 18 No. 2, pp. 371–405.

Bisbe, J. and Malagueño, R. (2015), "How control systems influence product innovation processes: examining the role of entrepreneurial orientation", *Accounting and Business Research,* Vol. 45 No. 3, pp. 356-386.

Bisbe, J. and Otley, D. (2004), "The effects of the interactive use of management control systems on product innovation", *Accounting, Organizations and Society*, Vol. 29 No. 8, pp. 709–737.

Bonner, J. M., Ruekert, R. W., and Walker, O. C. (2002), "Upper management control of new product development projects and project performance", *The journal of Product Innovation Management*, Vol. 19 No. 3, pp. 230-245.

Bremser, W. G., and Barsky, N. P. (2004), "Utilizing the balanced scorecard for R&D performance measurement". *R&D Management*, Vol. 34 No. 3, pp. 229-238.

Cardinal, L. B. (2001), "Technological innovation in the pharmaceutical industry: the use of organizational control in managing research and development", *Organization Science*, Vol. 12, pp. 19–36.

Chenhall, R. H., and Langfield-Smith, K. (1998), "Adoption and benefits of management accounting practices: an Australian study", *Management Accounting Research*, Vol. 9, pp. 1–9.

Chenhall, R. H., Kallunki, J. P., and Silvola, H. (2011), "Exploring the relationship between strategy, innovation, and management control systems: the roles of social networking, organic innovative culture, and formal controls", *Journal of Management Accounting Research*, Vol. 23, pp. 99-128.

Chenhall, R. H. and Moers, F. (2015), "The role of innovation in the evolution of management accounting and its integration into management control", *Accounting, Organizations and Society*, Vol. 47, pp. 1–13.

Chiesa, V., Frattini, F., Lamberti, L., and Noci, G. (2009a), "Exploring management control in radical projects", *European Journal of Innovation Management,* Vol. 12 No. 4, pp. 416-442.

Chiesa, V., Frattini, F., Lazzarotti, V., and Manzini, R. (2009b), "An exploratory study on R&D performance measurement practices: a survey in Italian R&D intensive firms", *International Journal of Innovation Management, Vol.* 13 No. 01, pp. 65-104.

Christensen, L., Rikhardsson, P., Rohde, C. and Batt, C. E. (2018) "Changes to administrative controls in banks after the financial crisis", *Qualitative Research in Accounting & Management,* Vol. 15 No. 2, pp.161-180.

Christner, C. H. and Strömsten, T. (2015), "Scientists, venture capitalists and the stock exchange: The mediating role of accounting in product innovation", *Management Accounting Research*, Vol. 28, pp. 50–67.

Crossan, M. M. and Apaydin, M. (2010), "A Multi-Dimensional Framework of Organizational Innovation: A Systematic Review of the Literature", *Journal of Management Studies,* Vol. 47 No. 6, pp. 1154-1191.

Curtis, E. and Sweeney, B. (2017), "Managing different types of innovation: mutually reinforcing management control systems and the generation of dynamic tension", *Accounting and Business Research*, Vol. 47 No. 3, pp. 313-343.

Damanpour, F. (1991), "Organizational innovation: a meta-analysis of effects of determinants and moderators", *Academy of Management Journal,* Vol. 34 No. 3, pp. 555-590.

Davila, A. (2000), "An empirical study on the drivers of management control systems design in new product development", *Accounting, Organizations and Society*, Vol. 25 No. 4–5, pp. 383–409.

Davila, A. (2005), "The promise of management control systems for innovation and strategic change", in Chapman, C.S. (Ed.) *Controlling Strategy: Management, Accounting, and performance measurement*, Oxford University Press, Oxford, pp. 37-61.

Davila, A., Foster, G., and Oyon, D. (2009a), "Accounting and control, entrepreneurship and innovation: venturing into new research opportunities", *European Accounting Review*, Vol. 18 No. 2, pp. 281–311.

Davila, A., Foster, G., and Li, M. (2009b), "Reasons for management control systems adoption: Insights from product development systems choice by early-stage entrepreneurial companies", *Accounting, Organizations and Society*, Vol. 34 No. 3-4, pp. 322-347.

Ditillo, A. (2004), "Dealing with uncertainty in knowledge-intensive firms: the role of management control systems as knowledge integration mechanisms", *Accounting, Organizations and Society*, Vol. 29, pp. 401-421.

Dunk, A. S. (2011), "Product innovation, budgetary control, and the financial performance of firms", *British Accounting Review,* Vol. 43, pp. 102–111.

Faßauer, G. (2018), "Linking deviation with innovation: behavioral effects of management control through the lens of a theory of deviance" *Journal of Management Control*, Vol. 19 No. 3-4, pp. 275-293.

Fagerberg, F., (2005), "Innovation: a guide to the literature". In Fagerberg, J., Mowery, D. C. and Nelson, R. R. (Ed.) *The Oxford Handbook of Innovation*, Oxford University Press, Oxford, pp. 1-26.

Feeney, O. and Pierce, B. (2018) "Accounting and new product development: The importance of interactions within social and technical structures", *Qualitative Research in Management and Accounting,* Vol. 15 No.2, pp. 251-279.

Ferreira, A. and Otley, D. (2009), "The design and use of performance management systems: An extended framework for analysis", *Management Accounting Research*, Vol. 20 No. 4, pp. 263-282.

Franco-Santos, M., Lucianetti, L., and Bourne, M. (2012), "Contemporary performance measurement systems: a review of their consequences and a framework for research", *Management Accounting Research*, Vol. 23 No. 2, pp. 79–119.

Fried, A. (2017), "Terminological distinctions of 'control': a review of the implication for management control research in the context of innovation", *Journal of management control*, Vol. 28 No. 41, pp. 5-40.

Fried, A., Götze, U., Möller, K. and Pecas, P. (2017), "Innovation and management control", *Journal of management control*, Vol. 28 No. 41, pp. 1-4.

Grabner, I. and Moers, F. (2013), "Management control as a system or a package? Conceptual and empirical issues", *Accounting, Organizations and Society*, Vol. 38 No. 6-7, pp. 407-419.

Grabner, I. and Speckbacher, G. (2016), "The cost of creativity: A control perspective", *Accounting, Organizations and Society*, Vol. 48, pp. 31-42.

Guo, B., Paraskevopoulo, E. and Sánchez, L. S. (2018), "Disentangling the Role of Management Control Systems for Product and Process Innovation in Different Contexts", *European Accounting Review*.

Gurd, B. and Helliar, C. (2017), "Looking for leaders: 'Balancing' innovation, risk and management control systems", The British Accounting Review, Vol. 49, pp. 91-102.

Haustein, E., Luther, R., and Schuster, P. (2014), "Management control systems in innovation companies: a literature based framework", *Journal of management control*, Vol. 24 No. 4, pp. 343-382.

Healy, M., Cleary, P. and Walsh, E. (2018), "Innovativeness and accounting practices: an empirical investigation", *Qualitative Research in Management and Accounting,* Vol. 15 No.2, pp. 231-250.

Henri, J. (2006), "Management control systems and strategy: a resource-based perspective", *Accounting, Organizations and Society*, Vol. 31 No. 6, pp. 529–558.

Ittner, C. D. and Larcker, D. F. (2001), "Assessing empirical research in managerial accounting: a value-based management perspective", *Journal of Accounting and Economics*, Vol. 32, pp. 349-410.

Johnson, H. T. and Kaplan, R. S. (1987), *Relevance lost – the rise and fall of management accounting*, Harvard Business School Press, Harvard.

Jørgensen, B. and Messner, M. (2009), "Management Control in New Product Development: The Dynamics of Managing Flexibility and Efficiency", *Journal of Management Accounting Research*, Vol. 21 No. 1, pp. 99-124.

Jørgensen, B. and Messner, M. (2010), "Accounting and strategizing: A case study from new product development", *Accounting, Organizations and Society*, Vol. 35 No. 2, pp. 184–204.

Kaplan, R. S. and Norton, D. P. (1992), "The balanced scorecard – measures that drive performance", *Harvard Business Review*, Vol. Jan-Feb, pp. 71-79.

Kaplan, R. S. and Norton, D. P., (1996), *Translating Strategy into Action. The Balanced Scorecard*, Harvard Business School Press, Harvard.

Kapsali, M. (2011), "Systems thinking in innovation project management: A match that works", *International Journal of Project Management*, Vol. 29 No. 4, pp. 396-407.

Kerssens-van Drongelen, I. C. and Cook, A. (1997), "Design principles for the development of measurement systems for research and development processes", *R&D Management*, Vol. 27 No. 4, pp. 345-357.

Knardal, P. S. and Pettersen, I. J. (2015), "Creativity and management control – the diversity of festival budgets", *International Journal of Projects in Business*, Vol. 8 No. 4, pp. 679 – 695.

Koufteros, X., Verghese, A. J., and Lucianetti, L. (2014), "The effect of performance measurement systems on firm performance: a cross-sectional and a longitudinal study", *Journal of Operations Management*, Vol. 32 No. 6, pp. 313-336.

Kruis, A. M., Speklé, R. F., and Widener, S. K. (2016), "The Levers of Control Framework: An exploratory analysis of balance", *Management Accounting Research*, Vol. 23, pp. 27-44.

Langfield-Smith, K. (1997), "Management control systems and strategy: a critical review", *Accounting, Organizations and Society*, Vol. 22 No. 2, pp. 207-232.

Langfield-Smith, K. (2008), "Strategic management accounting: how far have we come in 25 years?", *Accounting, Auditing and Accountability Journal*, Vol. 21 No. 2, pp. 204-228.

Lazzarotti, V., Manzini, R, and Mari, L. (2011), "A model for R&D performance measurement", *International Journal of Production Economics*, Vol. 134, pp. 212-223.

Li, S. X. and Sandino, T. (2018), "Effects of an Information Sharing System on Employee Creativity, Engagement, and Performance", *Journal of Accounting Research*, Vol. 56 No. 2, pp. 713-747.

Loft, A. (1995), "The history of management accounting: relevance found", in Ashton, D., Hopper, T. and Scapens, R. W. (Eds.), *Issues in Management Accounting*, Second Edition, Prentice Hall, Essex, England, pp. 21-44.

Lopez-Valeiras, E., Gonzalez-Sanchez, M. B., and Gomez-Conde, J. (2016), "The effects of the interactive use of management control systems on process and organizational innovation*", Review of Managerial Science*, Vol. 10 No. 3, pp.487-510.

Lopez-Valeiras, E., Gonzalez-Sanchez, M. B., and Naranjo-Gil, D. (2015), "Sustainable Innovation, Management Accounting and Control Systems, and International Performance", *Sustainability*, Vol. 7 No. 3, pp. 3479-3492.

Lövstål, E. and Jontoft, A. M. (2017), "Tensions at the intersection of management control and innovation: a literature review", *Journal of management control,* Vol. 28 No. 1, pp. 41-79.

Major, M., Suomala, P. and Laine, T. (2018), "Guest Editorial", *Qualitative Research in Accounting & Management,* Vol. 15 No. 2, pp.154-160.

Maier, E. R. and Branzei, O. (2014), " 'On time and on budget': Harnessing creativity in large scale projects", *International Journal of project Management*, Vol. 32 No. 7, 1123-1133.

Malmi, T. and Brown, D. A. (2008), "Management control systems as a package – Opportunities, challenges and research directions", *Management Accounting Research*, Vol. 19 No. 4, pp. 287-300.

Marginson, D. E. W. (2002), "Management control systems and their effects on strategy formation at middle-management levels: evidence from a U.K. organization", *Strategic Management Journal*, Vol. 23 No. 11, pp. 1019–1031.

McCarthy, I. P. and Gordon, B. R. (2011), "Achieving contextual ambidexterity in R&D organizations: a management control system approach", *R&D Management*, Vol. 41 No. 3, pp. 240-258.

Merchant, K. A. and Van de Stede, W. A. (2012), *Management Control Systems, performance measurement, evaluation and incentives, third edition*. Prentice-Hall, London.

Moll, J., Major, M., and Hoque, Z. (2006), "The qualitative research tradition" in Hoque, Z. (Ed.), *Methodological Issues in Accounting Research: Theories and Methods*, Spiramus Press, London, England, pp. 375-398.

Moll, J. (2015), "Editorial: Special issue on innovation and product development", *Management Accounting Research*, Vol. 28, pp. 2-11.

Moulang, C. (2015), "Performance Measurement systems use in generating psychological empowerment and individual creativity", *Accounting & Finance*, Vol. 55 No. 2, pp. 519 -544.

Mouritsen, J., Hansen, A., and Hansen, C. O. (2009), "Short and long translations: Management accounting calculations and innovation management", *Accounting, Organizations and Society*, Vol. 34 No. 6-7, pp. 738-754.

Mundy, J. (2010), "Creating tensions through a balanced use of management control systems", *Accounting, Organizations and Society*, Vol. 35 No.5, pp. 499-523.

Nixon, B. (1998), "Research and development performance measurement: a case study", *Management Accounting Research*, Vol. 9 No. 3, pp. 329-355.

OECD (2005), *The Measurement of Scientific and Technological Activities: Guidelines for Collecting and Interpreting Innovation Data. Oslo Manual. 3rd ed.* OECD, Paris.

Ouchi, W. G. (1979), "A conceptual framework for design of organizational control mechanisms", *Management Science*, Vol. 25 No. 9, pp. 833-848.

Parker, L. (2014), "Qualitative perspectives: through a methodological lens", *Qualitative Research in Accounting and Management*, Vol. 11 No. 1, pp. 13-28.

Pesämaa, O (2017), "Personnel- and action control in gazelle companies in Sweden", *Journal of Management Control*, Vol. 28 No. 1, 107-132.

Pfister, J. (2014), "Controlling creativity and innovation: Paradox or necessity?" in Otley, D. and Soin, K. (Eds), *Managing through uncertainty*, Palgrave Macmillan, London, England, pp. 134-148.

Quinn, J. B. (1978), "Strategic change: 'Logical incrementalism'", *Sloan Management Review*, Vol. 20 No. 1, pp. 7–21.

Revellino, S. and Mouritsen, J. (2009), "The multiplicity of controls and the making of innovation", *European Accounting Review*, Vol. 18 No. 2, pp. 341–369.

Revellino, S. and Mouritsen, J. (2015), "Accounting as an engine: The performativity of calculative practices and the dynamics of innovation", *Management Accounting Research*, Vol. 28, pp. 31-49.

Rezania, D., Baker, R., and Burga, R. (2016), "Project control: and exploratory study of levers of control in the context of managing projects", *Journal of Accounting and Organizational Change*, Vol. 12 No. 4, pp. 614-635.

Rijsdijk, S. A. and van den Ende, J. (2011), "Control Combinations in New Product Development Projects", *Journal of Product Innovation Management*, Vol. 28, pp. 868-880.

Rockness, H. O. and Shields, M. D. (1984), "Organizational control systems in research and development", *Accounting, Organizations and Society,* Vol. 9 No. 2, pp. 165-177.

Sandelin, M. (2008), "Operation of management control practices as a package—A case study on control system variety in a growth firm context", *Management Accounting Research*, Vol. 19, pp. 324–343.

Sandström, J. and Toivanen, J. (2002), "The problem of managing product development engineers: Can the balanced scorecard be an answer?", *International Journal of Production Economics*, Vol. 78 No. 1, pp. 79-90.

Schumpeter, J. A. (1934), *The Theory of Economic Development*. Harvard University Press, Cambridge Mass.

Simons, R. (1995a), *Levers of Control. How managers use innovative control systems to drive strategic renewal.* Harvard Business School Press.

Simons, R. (1995b), "Control in an age of empowerment", *Harvard Business Review,* Vol. Mar-Apr., pp. 80-88.

Simons, R. (2000), *Performance measurement and Control Systems for Implementing Strategy*, Prentice-Hall, London.

Smets, L. P. M., Langerak, F. and Tatikonda, M. V. (2016), "Collaboration between competitors' NPD teams: in search of effective modes of management control", *R&D Management*, Vol. 46, pp. 244-260.

Speklé, R., Van Elten, H. J., and Widener, S. K. (2017), "Creativity and Control: A paradox. Evidence from the levers of control", Behavioral Research in Accounting, Vol. 29, No. 2, pp. 73-96.

Tervala, E., Laine, T., Korhonen, T., and Suomala, P. (2017), "The role of financial control in new product development: empirical insights into project managers' experiences", *Journal of Management Control*, Vol. 28 No. 1, 81-106.

Vaivio, J. (2007), "Qualitative research on management accounting: achievements and potential" in Hopper, T., Northcott, D., and Scapens, R. (Eds.), *Issues in Management accounting, third Edition*, Prentice Hall, Essex, England, pp. 425-444.

Vaivio, J. (2008), "Qualitative management accounting research: rationale, pitfalls and potential", *Qualitative Research in Accounting and Management*, Vol. 5 No. 1, pp. 64-86.

Van der Meer-Kooistra, J. and Scapens, R.W. (2015), "Governing product co-development projects: The role of minimal structures*", Management Accounting Research*, Vol. 28, pp. 68-91.

Wickramasinghe, D. and Alawattage, C. (2007), *Management accounting change: approaches and perspectives*, Routledge, New York.

Widener, S. K. (2007), "An empirical analysis of the levers of control framework", *Accounting, Organizations and Society,* Vol. 32, pp. 757-788.

Yawson, R. M., Amoa-Awua, W. K., Sutherland, A. J., Smith, D. R., and Noamesi, S. K. (2006), "Developing a performance measurement framework to enhance the impact orientation of the food research institute Ghana". *R&D Management*, Vol. 36 No.2, pp.161-172.

Ylinen, M. and Gullkvist, B. (2014), "The effects of organic and mechanistic control in exploratory and exploitative innovations*", Management Accounting Research*, Vol. 25 No. 1, pp. 93-112.

Study	Methodological Approach	Distinctions of Control	Main Conclusions
Nixon (1998)	Case study	-	Accounting has a proactive role as a supporter for new product development. Accounting is regarded as a channel of communication for projects participants, supporting coordination of activities as well, along the duration of the project.
Davila (2000)		-	The relevance of MCS are reinforced. MCS are used to obtain information that helps to reduce uncertainty. Project managers rely on non-financial information more than on financial. Cost, and design information relates positively to performance, but time information blocks performance.
Cardinal (2001)	Survey	Input, behaviour and output controls	Input, behaviour and output are important to enhance radical innovation, and input and output controls are important to enhance incremental innovation. However, incremental and radical innovation does need to be managed differently. Synergies and tensions could be generated by combinations of controls.
Bonner *et al*. (2002)	Survey	-	Formal controls have detrimental effects on the performance of the project. Early and active participation of the team has no association with project performance, and management intervention has a negative relation with project performance. Creativity of teams is fully realised when they have flexibility.

Marginson (2002)	Case study	LOC framework	Belief systems are reported to affect the company's strategic climate which, in turn, represents a filter influencing which ideas are supported and which are not. Also, administrative systems are said to be used to manage the tension between creative innovation and goal-related activity. And, key performance indicators's included in the PMS can originate tensions and trade-offs
Bisbe and Otley (2004)	Survey	LOC framework	Interactive use of system fosters innovation only in the case of low innovative firms by providing guidance for search, triggering initiatives, and providing legitimacy to these initiatives. The opposite effect appears in high innovative firms, due to the filtering of initiatives from the exposure of ideas.
Ditillo (2004)	Case study	-	It is reported that the projects use different patterns of controls since their use depends on the complexity of knowledge.
Henri (2006)	Survey	LOC framework	Interactive use of PMS is positive for the development of innovativeness. But a negative effect is expected from the use of PMS in a diagnostic manner. Furthermore, support is found that a balanced use of the two types of use benefits the development of innovativeness.
Bisbe and Malagueño (2009)	Survey	LOC framework	The choice of which controls are used interactively depends on the company's innovation mode. Interactive use of BSC tends to be used by companies dedicated to simple forms of innovation and to companies that look for rich portfolios of innovation.

Chiesa *et al.* (2009a)	Case study	LOC framework	Reliance on interactive systems in the early stages of radical projects. There is a broader use of interactive and boundary systems in response to higher uncertainty. Diagnostic control is used more in the commercialisation phase.
Chiesa *et al.* (2009b)	Survey	-	The study concludes with a significant diffusion of PMS in R&D Italian companies and shows how their design and use support their management activities.
Davila *et al.* (2009a)	Theoretical work	-	The earlier literature (empirical and theoretical) is reviewed to drive some research opportunities and design a framework to examine MCS in innovative settings. This framework creates categories depending on the type of innovation (Incremental or Radical), and the source of innovation (Top management or the rest of the organisation).
Davila *et al.* (2009b)	Survey and Interviews	-	By looking at different systems in early-stage entrepreneurial companies it is clear that managers adopt these systems by the need to contract and legitimise the process externally and, the internal reasons for adoption are related to learning, focus, as a reaction to problems and the managers' background.
Jorgensen and Messner (2009)	Case study	Enabling and coercive bureaucracy	Since the organisation under study was committed to an enabling form of control, it has been able to balance the challenge of efficiency and flexibility through the use of a harmonious control architecture.

Mouritsen *et al.* (2009)	Case study	-	Accounting calculations give perspective to innovation and act as a mediator between innovation activities and firm-wide concerns. This happens through short and long translations. Short translations extend or reduce innovation through a single calculation. Long translations are where more than one calculation to problematize the role of innovation is used.
Revellino and Mouritsen (2009)	Case study	-	The case of Telepass illustrates how innovation goes through various phases that need different controls. The multiplicity of controls used have changed and adapted as the innovation followed its path. Controls are not durable, coherent and consistent along the innovation process
Jorgensen and Messner (2010)	Field study	-	Accounting information can represent specific rules coming from the top management that can be enacted by them in key moments, and can represent a general understanding to help actors meet competing and conflicting demands. As a general understanding, accounting information guides actors. Accounting is powerful enough to help managers navigate despite high levels of uncertainty and complexity.
Adler and Chen (2011)	Theoretical work	LOC framework	I tis proposed that interactive and beliefs systems are expected to be positively associated with innovation. Diagnostic and boundary systems when used in an enabling way could be positive for innovation, but when used coercively are negative. A mixture of diagnostic and interactive systems should have a positive effect on motivation.

Akroyd and Maguire (2011)	Case study	Input, process and output control	The importance of goal-congruence and uncertainty reduction provided by management control is pointed out. While promotion of goal congruence was present at the decision gates, it was management controls that acted in reducing uncertainty during the stages.
Artto *et al.* (2011)	Case study	LOC framework	It is perceived that the company relies more on diagnostic and boundary systems than interactive and belief systems, which are mostly absent in the majority of companies studied. A natural path may exist from a first emphasis on diagnostic and boundary systems to an intensive emphasis on interactive and belief systems. Organic and embedded matrix structures are desirable.
Chenhall *et al.* (2011)	Survey	-	Studying the MCS dimensions of social networking, organic innovative culture and formal controls, the author found indirect and direct effects of them on innovation. Social networking presented an indirect effect on innovation through organic innovative culture. Formal controls and organic innovative culture, in turn, presented a direct effect. Innovation is enhanced by the three dimensions.
Dunk (2011)	Survey	-	The presented findings suggest that through an emphasis on budgets as a planning mechanism (consistent with interactive use of MCS), product innovation is able to impact positively on financial performance. When it is used as a control mechanism, innovation does not favour performance.

McCarthy and Gordon (2011)	Theoretical work	LOC framework	Interactive and belief systems contribute to exploration, while diagnostic and boundary systems contribute to exploitation.
Rijsdijk and Van den Ende (2011)	Survey	Outcome controls, process control and Clan control	Synergies and conflicts between the combination of different controls affects project outcomes; Outcome and clan controls act synergistically in increasing process performance. Process controls block clan controls in positively affecting process performance. Outcome and process control interact negatively in financial performance.
Moulang (2013)	Survey	LOC framework	The relevance of interactive control in the generation of creativity is stressed. Psychological empowerment helps explain the relationship.
Haustein *et al.* (2014)	Theoretical work	Object of Control framework	A theoretical model of the impact of contingency factors on the MCS of companies that engage in innovation is proposed. The hypothesis presented indicated potential interactions of the four MCS categories (Results, action, personnel and cultural control). Following the hypothesis proposed, innovation capability should be positively influenced by cultural control, and negatively by results and action control.
Koufteros *et al.* (2014)	Survey	LOC framework	Interactive and diagnostic use of PMS contributes positively to the development of organizational capabilities.

Maier and Branzei (2014)	Case study	LOC framework	Using a dramatic television series as the unit of analysis, three practices were found that allow a balance between creativity and the parameters of the project.
Pfister (2014)	Case study	-	The is concluded that control can be directing, enabling and supportive and does not necessarily coercively constrain innovation.
Ylinen and Gullkvist (2014)	Survey	Organic and mechanistic control	The importance of organic control as the main form of control both to exploratory and exploitative innovation is highlighted. In exploratory innovation projects, organic control enhanced performance through innovativeness. In exploitative innovation, it enhances project performance. Mechanistic control does not seem to drive innovativeness. The combination of organic and mechanistic control also enhances performance of both innovation projects.
Bedford (2015)	Survey	LOC framework	Interactive use of controls is found to be associated with performance in exploratory innovation, and exploitative innovation firms tend to benefit from diagnostic and boundary use of controls. Diagnostic use is found to be important for firms that focus on the refinement of first-order skills.
Bisbe and Malagueño (2015)	Survey	LOC framework	The influence of MCS on innovation depends on the entrepreneurial orientation of the firm. Value systems and interactive systems have significant effects on the phases of innovation processes. Diagnostic use of MCS plays only a minor role in each phase.

Knardal and Pettersen (2015)	Case study	LOC framework	By using budgets in a diagnostic and interactive way, the managers of festivals were able to enhance organisational learning and perceive how to cope with unpredictability. Budgets were used interactively throughout the planning period, but as planning progresses and freedom decreases the diagnostic use of budgets starts to be increased.
Lopez-Valeiras *et al.* (2015)	Survey	-	Dividing the MCS into either traditional or contemporary revealed contemporary to have the stronger moderating effect.
Revellino and Mouritsen (2015)	Case study	-	In the case of Telepass, calculative practices and innovation were combined in a performative process that affects the trajectory of innovation by a set of drifts brought to the table by the transformation of accounting. Calculative practices represent a force that pushed actors to do new things.
Van der Meer-Koistra and Scapens (2015)	Case study	-	Economic and technical structures may be set up at the beginning, but the existence of context and temporal embeddedness mean that an institutional structure comes prior to the existence of the project. A social structure may emerge alongside the project. Accounting and financial information end up setting boundaries.
Akroyd *et al.* (2016)	Case study	-	Since sales growth and profit growth strategies were in place at the case company, tensions were expected. Management controls were used at the gates of decision. The two strategies were separated and responsibility attributed to different departments.

Lopez-Valeiras *et al.* (2016)	Survey	LOC framework	Interactive use of MCS is a key element to process innovation and there is a positive relation of this type of use and organisational innovation. Interactive use of MCS is a moderator between process innovation and financial performance.
Grabner and Speckbacher (2016)	Survey	-	High reliance on employee creativity leads to 2 costs: 1) dysfunctional behaviour; and this reliance leads to 2) organisations not using effective control.
Rezania *et al.* (2016)	Survey	LOC framework	The levers are positively associated with project performance and the authors stress the importance of the combined work of the four. Diagnostic, interactive and boundary systems are positively related to project performance. Belief systems do not have a strong effect on their performance.
Smets et al (2016)	Experimental	Input, process and output control	Acknowledging that controls used to stimulate coordination may impede cooperative behaviour, the results show that no single control enhances both coordination and cooperative behaviour at the same time.
Curtis and Sweeney (2017)	Case study	LOC framework	The relationship is studied between mutual reinforcement of MCS and the generation of tensions in two types of innovation. Value systems provide an infrastructure for innovation to flourish. The positive role of diagnostic and interactive is emphasised by evidence on how feedback and measurement systems can protect innovation.

Gurd and Helliar (2017)	Case study	-	Institutional leaders can balance risk management and innovation. Through one of the companies studied, it is revealed that the lack of a leader of innovation has provoked the lost value in the rhetoric and framing discourse.
Pesamma (2017)	Survey	-	The model developed, suggests that follow-up action and personnel controls make it able to capture the effects of innovativeness;
Speklé *et al.* (2017)	Survey	LOC framework	The results indicate that control and creativity can coexist. Intensity of use of LOC systems having a direct effect on creativity.
Tervala *et al.* (2017)	Interview study	-	Based on the principle that the opinions of project managers are of relevance since they influence project performance, financial information is highlighted as a supporter of managers' work, and their desire to play an active role in financial information is revealed.
Aaltola (2018)	Case study	LOC framework	A strategic story is posited as a motivational frame and innovation should be aligned with it. Strategic story has elements of both belief and boundary systems. Financial information was used to monitor cost and investments, but was not tracked against pre-established standards. Therefore, diagnostic control is absent.
Christensen *et al.* (2018)	Case study	-	The new values implemented voluntarily (albeit driven by external pressure) were supported by the "tone at the top" and were fundamental in influencing behaviour and in setting a new direction.

Feeney and Pierce (2018)	Case study	-	The findings show different degrees of formality regarding the nature, preparation and use of accounting information.
Guo *et al.* (2018)	Survey	Input, behavior and output controls	Input controls are positively associated with process innovation in both a low and high-tech context. Behaviour controls are beneficial for product and process innovation in high-tech, and output control is positively associated with product and process innovation in both settings.
Healy *et al.* (2018)	Case study	LOC framework	PMS used diagnostically monitors behaviour and drives it to achieve the company objectives. Used interactively, the metrics foster learning and create opportunities for innovation and problem solving, with the involvement of top management.
Li and Sandino (2018)	Experimental	-	On average, the findings do not allow us to say that the information sharing system recording employees creative work changes the quality of creative work, but it does improve it in stores that consulted it more frequency, in stores with fewer nearby stores of the same company, and also in divergent markets.

Table 1: Contemporary studies on the role of MCS in innovation and their main conclusions