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Beyond the system vs. package dualism in Performance Management Systems design: A loose coupling approach

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ABSTRACT

A Performance Management System (PMS) can be conceived as either a package or a system, with the latter generally being seen as preferable to the former. This paper tries to go beyond this dualism by adopting an approach which understands the integration of the mechanismswithin an overall PMS as being a continuum that ranges from a complete lack of integration to a totally integrated system. Loose coupling theory is used to investigate the type of relationships occurring in a PMS, with no and tight coupling being the extreme ends of a spectrum, with loose coupling representing a range of intermediate solutions providing both a desired level of coordination and also a degree of flexibility for local control needs. To ascertain whether one type of PMS coupling delivers superior performance, in terms of both organizational effectiveness and process innovation, this paper conceptually develops a PMS coupling index and validates this using a sample of 140 managers operating in a variety of sectors. The empirical findings show that the coupling approach demonstrates the effect of different PMS coupling states on both outcomes. Despite differing results from prior studies, intermediate levels of coupling appear to give the best outcomes for both effectiveness and innovation. Although further empirical work is necessary, this study contributes to enriching both the PMS design and the innovation management literature. Practitioners can also benefit from this research by using it to help design or redesign the relationships in a PMS in order to effectively match local and overall control needs.

1. Introduction

The reductionist approach in management control studies has been criticized because performance management techniques which are analyzed in isolation provide only partial and problematic insights into the comprehensive functioning of an overall Performance Management System [PMS] (Hopwood, 2009; Ittner & Larcker, 2001; Malmi & Brown, 2008). However, the literature on the design of overall PMSs has made limited progress and has tended to split into a dichotomous approach. Grabner and Moers (2013) identified a PMS as a package when it *"represents the complete set of control practices in place, regardless of whether the MC practices are interdependent and/or the design choices take interdependencies into account"*. The contrasting perspective, which defines the PMS as a system, assumes that PMSs are designed according to a rational, maximizing goal, where different elements are *"interdependent and the design choices take these interdependencies into account."* (Grabner & Moers, 2013, p. 408). This latter situation appears to be seen as preferable as it is believed to lead to better outcomes.

These definitions have been seen as polar opposites, whereas we believe that a more realistic view treats them as defining a spectrum of possible coupling states. The extreme systems view assumes that an overall PMS takes the form of a tightly integrated set of mechanisms which have been designed and implemented in a coherent manner and which (perhaps given a little time to settle down) forms an optimal system from a contingency perspective. The package view includes all other possibilities. We favor a more continuous perspective whereby an overall PMS can be seen as occupying intermediate positions on this spectrum, being neither totally uncoordinated nor perfectly integrated. This follows Ferreira and Otley (2009, p. 276) who state that:

> *"… it should be noted that it is not assumed that an extant PMS will be coherent.* Otley (1980) *discussed control 'packages' rather than*

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control 'systems' because he had found that they tended to be composed of loosely coupled elements. These were often designed and implemented by different people, in different parts of an organization, at different times."

This view was further elaborated by Otley and Franco-Santos (2019) who write:

"Hence, it appears to be more sensible to assume that individual controls are in continuous transformation in order to better meet the demands being placed upon them. In such a context, it seems unlikely that equilibrium is a useful concept as the overall control system is likely to be dynamic and in a constant state of flux. It may also be more reasonable to assume that control systems are the result of both rational choice (i.e., human deliberate intention and design) and 'natural' evolution (i.e., path dependent or spontaneously grown) because past organizational contingencies and the responses of people to these contingencies create a context which limits the available choices for purposeful designs."

We will adopt this view and treat the degree of control system integration as an empirical issue rather than making prior assumptions. Such a perspective clearly identifies that the degree of integration of control mechanisms[1] is an important aspect of PMS design, development, implementation and adaptation, and is worthy of more detailed study. A similar approach was taken by Bedford and Malmi (2015), where they aim

"to empirically examine how accounting and other control mechanisms combine as a package, and the associations these configurations have with contextual circumstances." (p.2)

But whereas they develop a taxonomy of control configurations, we focus on the links between different control mechanisms, and how the type and degree of their interactions combine to produce various organizational outcomes. A parallel can be drawn between the spectrum of systems integration (package to system) and ideas of coupling (from no coupling through loose to tight) drawn from organization theory. Research in organization theory has shown that tight relationships can be conducive to superior efficiency in well-understood and predictable circumstances (Anthony, 1965), but that less tight linkages may be needed in the context of uncertainty, flexibility and delegated supervision (Modell, 2003, 2009; Newton, Ewing, & Collier, 2014; Nor-Aziah & Scapens, 2007; Orton & Weick, 1990). To develop this argument from a conceptual and an empirical perspective, we draw on loose coupling theory, which argues that loose coupling systems are able to foster both efficiency by means of responsive behavior and innovation through autonomous and distinctive responses to contextual stimuli.

In particular, we argue that the degree of coupling in a PMS emerges from both its fundamental determinants, namely responsiveness and distinctiveness (Orton & Weick, 1990). While responsiveness addresses organizational control and efficiency, distinctiveness enables autonomy and fosters innovation. A PMS shows loose coupling between its mechanisms when they are both responsive and distinctive. Since a PMS comprises a set of *"evolving formal and informal mechanisms, processes, systems, and networks used by organizations for conveying the key objectives and goals elicited by management, for assisting the strategic process and ongoing management through analysis, planning, measurement, control, rewarding, and broadly managing performance, and for supporting and facilitating organizational learning and change"* (Ferreira & Otley, 2009, p. 264), PMS coupling can involve interactions between all kinds of control practices, including planning, administrative and cultural controls. Empirical findings from this study show that the level of coupling affects both perceived effectiveness and innovation. This study thus contributes to the literature on PMS design and innovation, by introducing the idea of loose coupling as an additional dimension of PMS design, and one which helps enable ambidexterity.

In this paper, we first review the concept of coupling and how it can be measured by reference to the organizational theory literature (Beekun & Glick, 2001; Orton & Weick, 1990; Weick, 1976, 2001), use it to develop an empirical measure of the degree of coupling exhibited by a set of control mechanisms, and empirically test its effect on both perceived system effectiveness and process innovation.

2. Background

2.1. What is a loose coupling PMS?

Organizations need PMSs that serve both efficiency and innovation objectives (Simons, 1995). Loose coupling theory seems to embed both of these contrasting objectives since it allows the "simultaneous existence of rationality and indeterminacy which can occur at any organizational level, suggesting that "any location in an organization (top, middle, or bottom) contains interdependent elements that vary in the number and strength of their interdependencies" (Orton & Weick, 1990, p. 204). Research in this tradition has used loose coupling ideas to examine organizational tensions and contradictions using different units of analysis: individuals, sub-units, organizations and hierarchical levels, ideas, activities, intentions and actions (Liguori & Steccolini, 2011; Modell, 2003, 2009; Newton et al., 2014; Nor-Aziah & Scapens, 2007). We will adopt an individual PMS mechanism as our unit of analysis to investigate the nature of the relationships within a PMS. Hence, an overall PMS might be designed according to some performance maximizing function in some parts of an organization at a given time, in a systemic fashion (Grabner & Moers, 2013), but then be adapted and revised due to changing organizational and environmental conditions, following a package approach (Otley, 2016; Otley & Franco-Santos, 2019).

Since the loose coupling approach in the PMSs field looks at the *nature* of the dynamic interdependencies between PMS mechanisms, it goes beyond prior dichotomies of control. In order to effectively manage the tension between different control needs associated with competing objectives such as efficiency and innovation, a loose coupling PMS may be composed of mechanisms that are both interactive and diagnostic (Simons, 1994), formal and informal (Tiwana, 2010), organic and mechanistic (Chenhall, 2003), professional and bureaucratic (Abernethy & Stoelwinder, 1995) as well as coercive and enabling (Ahrens & Chapman, 2004).

According to loose coupling theory, a loose coupling structure shows organizational elements that can be linked to each other in such a way that they are "responsive, but retain evidence of separateness and identity" (Weick, 1976, p. 3). Thus, a loose coupling PMS can exhibit internal consistency with regard to some relationships in some locations of the system (Drazin & Van de Ven, 1985), but it also allows less internal consistency between other mechanisms in the overall system to better cope with local PMS needs (Modell, 2003; Newton et al., 2014). Hence, tighter "coupling produces stability", i.e. control and efficiency, whereas "looseness

[1] To avoid confusion in terminology, we will use the term 'mechanism' to represent a sub-system of an overall PMS. In many studies, such mechanisms are often referred to as 'systems' (as in a budgetary control system), but we will restrict the use of the term 'system' to the overall set of control mechanisms used in an organization. The term 'component' has also been used in some studies.

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produces flexibility", such as adaptability and innovation (Orton & Weick, 1990, p. 205). Thus a loose coupling PMS addresses ambidexterity, since it can simultaneously lead to *a variety of organizational outcomes* by coupling more tightly in those parts of the organization requiring more efficiency, while decoupling some mechanisms from the core PMS in other areas to allow more flexibility and creativity (Speklé, van Elten, & Widener, 2017).

Moreover, prior research on the interdependencies of PMS mechanisms has investigated the relationship between only two mechanisms at a time (Bedford, Malmi, & Sandelin, 2016; Grabner & Moers, 2013). However, there is a need to move beyond the analysis of parts of the PMS to understand the operation of the overall PMS (Malmi & Brown, 2008; Moll, 2015; Otley, 2016). In this respect, the loose coupling theory allows both the existence of *one-to-many relationships* between organizational elements and the configuration of *different structural relationships* in different organizational locations (i.e., branches, departments, hierarchical levels, projects, control mechanisms, and so forth), in terms of both structure (i.e., number of linkages between different elements, and similar vs. different elements involved in a relationship in different locations) and strength. According to this perspective, the same control mechanism (e.g., a budget) can be tightly linked to other mechanisms (e.g., strategic planning and performance evaluation) in some locations (e.g., production departments) while being loosely coupled in other areas (e.g., R&D departments).

To assess the degree of strength in a relationship and to explain what coupling means, Orton and Weick (1990) oppose the view of using coupling as a unidimensional variable with loose and tight as endpoints of a single scale, although this perspective has been largely adopted in the literature on loose coupling, and in the management control literature (Sandelin, 2008). They instead conceive loose coupling as an emergent behavior of systems showing simultaneously *distinctiveness* and *responsiveness* features, which are considered two pivotal characteristics of loose coupling systems (Orton & Weick, 1990, p. 205):

> *"If there is neither responsiveness nor distinctiveness, the system is not really a system, and it can be defined as a noncoupled system. If there is responsiveness without distinctiveness, the system is tightly coupled. If there is distinctiveness without responsiveness, the system is decoupled. If there is both distinctiveness and responsiveness, the system is loosely coupled."*

We follow this view in our subsequent discussion, with a loose coupling PMS being seen as a dynamic set of control mechanisms that are linked to each other (at an overall level) by relationships that are responsive to both internal and external changes but at the same time they provide a distinctive control response adapted to local control needs. This study aims at conceptualizing the meaning of loose coupling in the PMS field by providing both a conceptual and an operational specification of the two features that characterize such a system, namely responsiveness and distinctiveness.[2]

(a) Responsiveness

Although not explicitly defined by Weick (1976) and Orton and Weick (1990), responsiveness can be conceptualized as the feature of a PMS (or some of its mechanisms) to react to internal or external changes. According to the definition by Orton and Weick (1990), all systems showing any degree of coupling are expected to show a high degree of responsiveness. Hence, when either an external or an internal change occurs, some mechanisms of the PMS should quickly adapt to respond to this variation. Prior research demonstrates that loose coupling PMS can exhibit a high responsiveness in the use of budgets at different organizational levels (*vertical coupling*) (Covaleski & Dirsmith, 1983). Further, van Hengel et al. (2004) put forward the view that results orientation and the development of performance indicators were highly responsive (*horizontal coupling*) in Dutch municipalities after the introduction of governmental reforms. Similarly, the development of performance indicators was found to be responsive to governmental targets in the Swedish university sector (Modell, 2003).

Research in the PMS field analyzing the distinctiveness feature of loose coupling systems is related to the study by Brown, Malmi, and Booth (2009, pp. 1–19), and its extensions by Moilanen (2012) and by Van der Kolk and Schokker (2016). These authors conceptualized the feature of responsiveness by relying on the study by Beekun and Glick (2001) and included three of Beekun and Gleek's coupling dimensions, that is *strength*, *directness* and *dependence* as dimensions of responsiveness (omitting *consistency*). However, in order to avoid issues of conceptual misspecification (Bisbe, Batista-Foguet, & Chenhall, 2007), this study will consider all four dimensions put forward by Beekun and Glick (2001). We define each of these sub-dimensions, and indicate how they have been used in prior PMS research.

Strength is captured by the degree of influence of one PMS mechanism to the others in terms of frequency, intensity, probability and importance of change in the emphasis on one (or more) PMS mechanism(s) (Weick, 1982, Table 1, item A.1.). A stronger influence between two PMS mechanisms is associated to a higher degree of responsiveness, since covariations provide more coordination and coherence to the overall PMS (Ferreira & Otley, 2009). Accordingly, Abernethy and Chua reported that a change in the emphasis on budget limits addressed a change in the cultural control, thereby witnessing a strong influence between the two mechanisms, which resulted in a successful organizational change program (Abernethy & Chua, 1996). Similarly, Widener found that the interactive control system influences the diagnostic and boundary systems, whereas the beliefs system influences the diagnostic, the interactive and the boundary systems, which leads to higher attention and learning and eventually to higher performance (Widener, 2007). Moreover, literature on PMS as a system has investigated this dimension by estimating the demand function of one PMS mechanism with regard to other control mechanisms dependent upon contextual variables to maximize performance (Grabner & Moers, 2013). Further, Grabner provided evidence that a performance appraisal system based on subjective evaluations and a rewarding mechanism based on monetary incentives influence each other, and jointly affect organizational outcomes, in creativity-dependent firms (Grabner, 2014).

Directness is the extent to which two PMS mechanisms directly affect each other's targets (adapted from Beekun & Glick, 2001, Table 1, item A.2.). A more direct effect on the target of the related PMS mechanisms results in more responsive systems. This dimension is expected to ensure more internal consistency to the PMS, since a change in the targets attached to some PMS mechanism has to be addressed by a change in another related PMS mechanism to enhance the effectiveness of the overall PMS. This argument is rooted in that part of the literature stressing that when targets in different PMS mechanisms are loosely connected to each other, the effectiveness of (one part of) the PMS is put at risk (Ferreira & Otley, 2009; Otley, 1999). Hence, if a change in the targets of non-financial performance measurement mechanism is not linked to a change in the targets included into the rewarding mechanism, then the impact of the former mechanism will be likely

[2] Although we begin by having a single category for loose coupling, we extend this in our discussion to allow for a variety of intensities of loose coupling, using a simple linear scale.

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Table 1
Items included into the dimensions of the PMS coupling index and their scale.

Dimension - Item	Question in the questionnaire	Scale						
		1	2	3	4	5	6	7
A. Responsiveness								
A.1. Strength	How would you rate the degree of coupling within your unit with regards to the Strength of influence (i.e. when a change affects one mechanism, the other mechanism experiences a similar change)?	Not at all coupled		Loosely coupled			Tightly coupled	
A.2. Directness	How would you rate the degree of coupling within your unit with regards to the Directness of target setting influence (i.e. target setting of one mechanism is directly affected by the target setting of the other mechanism)?	Not at all coupled		Loosely coupled			Tightly Coupled	
A.3. Consistency	How would you rate the degree of coupling within your unit with regards to the Consistency of the relationship (i.e. effects of changes in the external environment usually are very similar in the two PMS mechanisms)?	Not at all coupled		Loosely coupled			Tightly Coupled	
A.4. Dependence	How would you rate the degree of coupling within your unit with regards to Sharing of performance measures?	Not at all coupled		Loosely coupled			Tightly Coupled	
B. Distinctiveness								
B.1. Emphasis on control	Within your unit, the emphasis on control in the following performance management system mechanisms is …	… Ex-ante (i.e., planned behaviours/actions to address environmental dynamics) Planning		… An even mix of ex-ante and ex-post			… Ex-post (i.e., respond to deviations between actual and planned behaviours/actions) Control	
B.2. Use (strategic uncertainty)	How would you rate the use of the following performance management system mechanisms in detecting strategic uncertainties within your unit?	Extremely unsatisfactory		Neither satisfactory nor unsatisfactory			Extremely satisfactory	
B.3. Use (superior-subordinate involvement)	How would you rate the satisfaction with the collaboration between superiors and subordinates in regularly reviewing the assumptions and scenarios embedded in the following performance management system mechanisms within your unit?	Extremely unsatisfactory		Neither satisfactory nor unsatisfactory			Extremely satisfactory	
B.4. Use (face-to-face)	How would you rate your satisfaction with the use of the following performance management system mechanisms in facilitating the sharing of top management's and their subordinates' objectives within your unit?	Extremely unsatisfactory		Neither satisfactory nor unsatisfactory			Extremely satisfactory	
B.5. Discretion	Within your unit, the information provided by the following performance management system mechanisms is …	…Based entirely on subjective performance measures		… Based on an even mix of subjective and objective performance measures			… Based entirely on objective performance measures	

to be lower than expected (Otley, 1999; Speckbacher, Bischof, & Pfeiffer, 2003). Similarly, in his analysis of the Swedish university sector, Modell found that universities responded responsively to the changes in the governmental targets by adapting their targets, after the introduction of a national reform (Modell, 2003).

Consistency defines the extent to which the effects of changes in the external environment are similar in two PMS mechanisms (Orton & Weick, 1990; Beekun & Glick, 2001, Table 1, item A.3.). Fragmented external environments, i.e. "dispersed stimuli or incompatible expectations", are one of the causes of the lack of consistency (Orton & Weick, 1990, p. 207). Therefore, when different mechanisms of the PMS are able to sense and adapt to external changes, the PMS will show higher degrees of responsiveness to environmental variations. This dimension is consistent with the PMS as a system approach which takes into account the effect of external changes on two interacting PMS mechanisms (Grabner & Moers, 2013).

Dependence represents the extent to which the PMS mechanisms share the same performance measures (adapted from Beekun & Glick, 2001, Table 1, item A.4.). According to Beekun and Glick (2001) dependence identifies "the relative magnitude of an exchange *and* the lack of substitutes for the exchange" (p. 232). In Glassman's words when "two systems either have few variables in common or if the common variables are weak compared to other variables which influence the system, they are independent of each other. It is convenient to speak of such a situation as one of loose coupling" (Glassman, 1973, p. 84). From a conceptual standpoint, dependence applies to relationships involving any PMS mechanism. For instance, the number of measures included into both the budget and the group rewards, as a mechanism to perform cultural

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control (Merchant & van der Stede, 2007) can capture the dependence between cybernetic and cultural controls. Similarly, following Kaplan and Norton's reasoning, the indicators in the four perspectives of the balanced scorecard (BSC) should be tightly linked to the indicators in the budget in order to "ensure that their budgets support their strategies" (Kaplan & Norton, 1996, p. 8). More specifically

> *"Scorecard users select measures of progress from all four scorecard perspectives and set targets for each of them. Then they determine which actions will drive them toward their targets, identify the measures they will apply to those drivers from the four perspectives, and establish the short-term milestones that will mark their progress along the strategic paths they have selected."*
>
> (Kaplan & Norton, 1996, p. 8).

(b) Distinctiveness

As in the case of responsiveness, the loose coupling literature lacks an agreed upon definition of distinctiveness (Orton & Weick, 1990; Weick, 1976). Consistent with prior research, distinctiveness can be conceptualized as the feature of some mechanism(s) of a PMS to show autonomous behavior from the rest of the PMS (Lingard, McDougall, Levstik, Spafford, & Schryer, 2014; Orton & Weick, 1990). Following Weick, we can argue that distinctiveness provides the PMS with looseness and "looseness contributes to successful change" (Weick, 1982, p. 378). Hence, distinctiveness counterbalances the effect of responsiveness in a loose coupling PMS, by providing an *ad hoc*, and more flexible response to local control needs. Also, it grants the PMS with the feature of *modularity* (Brusoni, Prencipe, & Pavitt, 2001; Teece, 2018), that is the possibility to vary the composition of the mechanisms forming the control package, provided that they all share a high degree of responsiveness, consistent with the notion of equifinality (Doty, Glick, & Huber, 1993; Gresov & Drazin, 1997). Prior studies put forward that loose coupling effectively supports middle managers to adopt distinctive budgetary control styles when either communicating with the top management or with subordinates (Covaleski & Dirsmith, 1983). Similarly, van Hengel et al. (2004) suggested that even when results orientation and the development of performance indicators exhibit tight *formal* relationships, they can also show distinctive behaviors *in practice*.

Hence, to capture the degree of distinctiveness between PMS mechanisms, we reviewed the literature on loose coupling and included the dimensions already investigated in prior PMS studies. Research in the PMS field analyzing the distinctiveness feature of loose coupling systems is related to the study by Brown et al. (2009, pp. 1–19), further extended by Moilanen (2012) and Van der Kolk and Schokker (2016). These studies adopted three dimensions to measure the distinctiveness in the relationship between PMS mechanisms, that is focus, use, and components. *Focus* aims at measuring the "control problem that the MC element addresses" (Van der Kolk & Schokker, 2016, p. 133), which can be categorized into five sub-foci according to Malmi and Brown's framework (2008), namely planning, cybernetic, administrative, socio-ideological, and reward and compensation. The dimension of *use* relates to the timing being ex-ante or ex-post in which the PMS mechanism is supposed to be used. *Components* refer to

> *"the information the MC elements are built upon […]. When two MC elements contain, for instance, individual productivity measures, but are used in different ways, their 'building blocks' are similar, even though their focus may be different. Whenever the components of two elements are the same, we speak of a relatively lower distinctiveness of those elements. When the elements contain different sources of information, the distinctiveness of the two elements is relatively higher"*
>
> (Van der Kolk & Schokker, 2016, p. 134).

In this study we will introduce some adjustments to the prior conceptualization of distinctiveness. First, we will provide an alternative and more operationalizable definition of focus, in order to be able to apply it to any PMS framework, that we call *emphasis on control*. Second, since interactive use of PMS is a commonly debated item in the PMS design literature to capture the "tension" in the interdependence between PMS mechanisms (Ferreira & Otley, 2009; Henri, 2006; Mundy, 2010; Simons, 1995; Widener, 2007), the definition of *use* will be based on Simons' interactive vs. diagnostic PMS conceptualization (Bisbe & Otley, 2004; Simons, 1994; Widener, 2007). Third, since the dimension of components shows low degrees of operationalizability and, consistent with prior research calling for the assessment of discretion in a variety of PMS mechanisms (Bol, Kramer, & Maas, 2016), we replace the dimension of components with that of *discretion*. Hence, differences in emphasis on control, use, and discretion between PMS mechanisms will show higher degrees of PMS distinctiveness.

Emphasis on control is related to the prevalent approach, either planning or controlling, of the PMS mechanisms (Table 1, item B.1.; Grafton, Lillis, & Widener, 2010; Malmi & Brown, 2008). Starting from the work by Anthony (1965), different emphases on control attached to different PMS mechanisms enable the accomplishment of the twofold objective of PMS, that is steering and monitoring. Control in innovative firms is used to curb the excess of innovation (Chenhall & Moers, 2015; Davila, Foster, & Li, 2009), whereas planning can be adopted to select promising innovative projects (Berry, 1994; Hayward, Caldwell, Steen, Gow, & Liesch, 2017). Hence, larger differences in emphasis on control in two PMS mechanisms are associated to higher levels of distinctiveness in their coupling.

Use identifies the extent to which the PMS mechanisms are used interactively. Following Simons (1995), interactive use is assessed by three dimensions, namely *strategic uncertainty* (Table 1, item B.2.), *superior and subordinates' involvement* in the use of the PMS mechanism (Table 1, item B.3.), and *face-to-face challenges and debates* of the underlying assumptions to the PMS (Table 1, item B.4.; Bisbe et al., 2007; Simons, 1995). PMS mechanisms can be used more interactively to foster experimentation and "to stimulate opportunity-seeking and encourage the emergence of new initiatives" (Simons, 1995, p. 93). However, organizations also need to attain efficiency, then some PMS mechanisms have to be used diagnostically at the same time, within the same PMS (Simons, 1995). Also, different organizational contingencies may affect the relationship between diagnostic vs. interactive control use and organizational outcomes (Bedford et al., 2016; Bisbe & Otley, 2004). Thus, differences in use of two PMS mechanisms will result in higher distinctiveness of the interactive PMS mechanism with respect to the other ones.

Discretion is the extent to which the measurement of the performance in the PMS mechanisms is primarily related to either subjective or objective information (Table 1, item B.5.). Discretion further specifies the distinctiveness characteristics by investigating the different role of personal judgement in different PMS mechanisms. For instance, higher degrees of discretion in the performance appraisal mechanism compared to the non-financial performance measurement mechanism allows senior managers to incorporate factors other than performance indicators listed in the BSC in the performance evaluation (Ittner, Larcker, & Meyer, 2003). A stream of literature addressed too much discretion as a potential

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decoupling between the non-financial performance measurement mechanism and the implementation of strategy (Ittner et al., 2003; Kaplan & Norton, 1996). In the public sector van Hengel, Budding, and Groot (2014) found that loose coupling patterns in the PMS are consistent with subjective and objective performance measures in different PMS mechanisms. Similarly, in the Swedish university sector, quality audits show a high degree of discretion whilst being strongly linked to more objective quality control programs, which enabled universities to adapt to governmental reforms more flexibly (Modell, 2003). Different degrees of discretion in different PMS mechanisms are also likely to support innovation initiatives, since subjective evaluation of non-task related performance and more objective rewarding schemes are suitable in creativity-dependent firms (Grabner, 2014). Thus, it is expected that differences in the degree of discretion in two PMS mechanisms will show higher distinctiveness.

3. Development of the PMS coupling index

Based on the above conceptual development of the dimensions included within the two main features of coupling, the following operationalization process is used to develop an overall PMS coupling measure, which we call the PMS coupling index (PMSCI). This section sets out the operationalization of each dimension of responsiveness and distinctiveness in order to measure each of the two features of a coupling PMS, and then to aggregate these two features into an overall PMSCI.

3.1. Measurement of the dimensions of responsiveness and distinctiveness

According to the theoretical development of the PMSCI, *responsiveness* is defined by four underlying dimensions: strength, directness, consistency and dependence.

These dimensions are measured using 7-point Likert scales, which capture the amount of each specific dimension in each pair of PMS mechanisms assessed, with low values associated to no coupling, high values to tight coupling and values in the middle to loose coupling (Table 1; Panel A). *Strength* captures the extent to which one PMS mechanism changes due to a change in another PMS mechanism (Table 1; A.1.). *Directness* assesses the extent to which one PMS mechanism affects target setting in another PMS mechanism (Table 1; A.2.). *Consistency* considers the extent to which changes in the external environment have similar effects on other PMS mechanisms (Table 1; A.3.). Finally, *Dependence* is defined by the extent to which two PMS mechanisms share the same set of performance measures (Table 1; A.4.).

Distinctiveness is defined by three dimensions: emphasis on control, use, and discretion. These dimensions are again measured by 7-point Likert scales, this time for each PMS mechanism separately rather than using pairwise comparisons (Table 1; Panel B).[3] *Emphasis on control* considers the extent to which a PMS mechanism shows a planning (ex-ante) approach, associated with low values, a controlling (ex-post) approach, linked to high values, or an even mix of the two, signaled by values in the middle of the scale (Table 1; B.1.). The dimension of *use* is measured by three variables representing the sub-mechanisms previously identified in the literature (Bisbe et al., 2007; Simons, 1995), namely the use of PMS mechanisms to detect *strategic uncertainties* (Table 1, B.2.), facilitate the *superior-subordinate involvement* (Table 1, B.3.), and regular review the assumptions and scenarios embedded in a PMS mechanism (*face-to-face*; Table 1, B.4.). For each sub-dimension of use, low values are associated to limited interactive use of the PMS mechanism, whereas high values to an extremely extensive interactive use. *Discretion* assesses the extent to which the information provided by a PMS mechanism is based on either subjective or objective judgment. High values of this variable are associated with entirely objective judgement, low values with entirely subjective judgment, with an even mix of the two associated to values in the middle of the scale (Table 1, B.5.).

3.2. Operationalization of the PMS coupling index

In order to assist in the development and validation of these measures, we use the responses gathered in a small research study that is described later in this paper (see Section *PMS coupling index in use*), with the specific questionnaire items used shown in Appendix. Firstly, the four dimensions of responsiveness and the five of distinctiveness were entered into a single factor analysis, which showed just one eigenvalue >1, but also a second above 0.90. As we expected two factors, the analysis was forced onto two factors, where the first four variables then loaded onto one factor and the second five onto the second, indicating they were measuring two distinct concepts. Further, separate factor analyses were then run for responsiveness and for distinctiveness; as expected, these each loaded onto a single factor with Cronbach alphas of 0.909 and 0.855 respectively showing that the dimensions could be combined into a single measure for each construct.

Secondly, a confirmatory factor analysis (CFA) was run on the items for both responsiveness and distinctiveness. Since both constructs are multidimensional emergent models, a structural equation modelling (SEM) approach (Bollen & Lennox, 1991) was used.[4] Results of the SEM analysis provided positive and statistically significant coefficients for all of the dimensions of responsiveness and distinctiveness (Table 2). Table 2 shows that goodness-of-fit indexes of the measurement model are satisfactory for both the responsiveness and distinctiveness constructs (Hu & Bentler, 1999).

3.3. Development of responsiveness and distinctiveness variables

Having developed robust measures of the elements of responsiveness and distinctiveness, we now turn to applying them to the assessment of each of the three control mechanisms considered in the initial empirical study. For *responsiveness*, the coupling state is measured directly by analyzing the responsiveness dimensions in each pair of PMS mechanisms. Then, the responsiveness characteristic is developed as a dummy variable, which is set to one if all the four responsiveness items are above three, and zero otherwise (Fig. 1, Panel B). The choice of this threshold is aimed at excluding the no coupling state, which is associated to low scores, since it mirrors little or no interaction between the PMS mechanisms. Consistent with Orton and Weick's (1990) conceptualization of coupling patterns, this means that either a loose or a tight coupling state is associated to the *responsiveness* characteristic. This measurement system assures that *responsiveness* occurs in all four dimensions for each analyzed pair of PMS mechanisms for the overall system to be assessed as responsive.

For *distinctiveness*, the coupling state of each dimension is not

[3] This approach is motivated by the fact that, in the pilot test of the empirical study, the coupling state of these dimensions (particularly those related to the PMS use) emerged as more difficult to assess in detail, compared with the responsiveness dimensions.

[4] SEM is a statistical method used in the management accounting field to test the measurement model of emergent latent variables (Bisbe et al., 2007; Smith & Langfield-Smith, 2004).

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Table 2
Structural Equation Modelling (SEM) results of the variables included into the PMS coupling index.

PMS coupling characteristic	Variable	Coeff.	Chi^2 (p-value)	RMSEA (pclose)	CFI	SRMR
Responsiveness	Strength	0.882***	2.33	0.034	1	0.010
	Directness	0.861***	(0.312)	(0.430)		
	Consistency	0.821***				
	Dependence	0.817***				
Distinctiveness	Emphasis on control	0.472***	8.96	0.075	0.95	0.042
	Use (strategic uncertainty)	0.455***	(0.111)	(0.248)		
	Use (superior-subordinate involvement)	0.479***				
	Use (face-to-face)	0.594***				
	Discretion	0.570***				

*** p-values are significant at the 0.001 level.
RMSEA is the root mean-square error of approximation. pclose is the test of close fit for RMSEA. CFI is the comparative fit index. SRMR is the standardized root mean square residual.

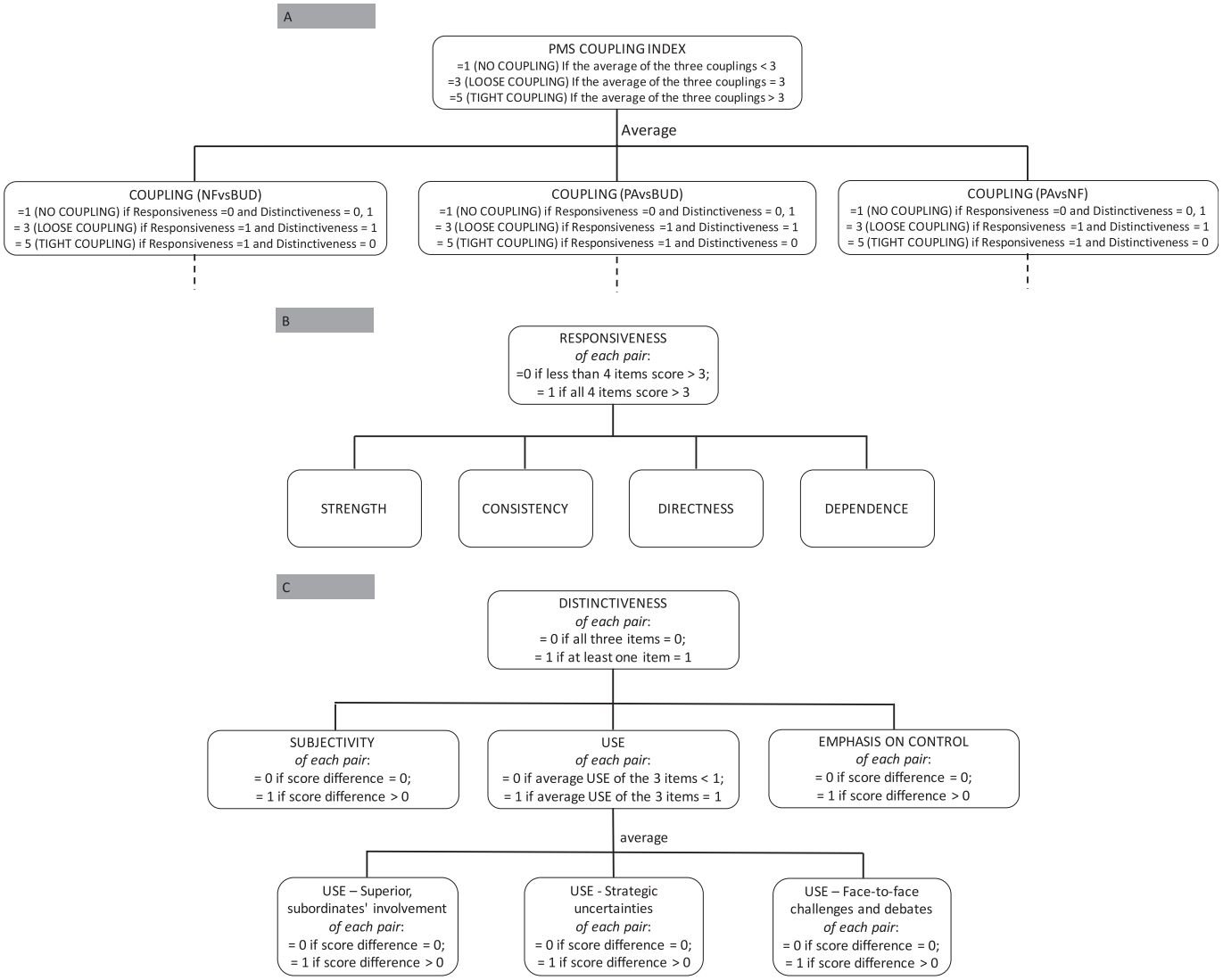

Fig. 1. The PMS coupling index measurement system.
NF is the non-financial performance measurement mechanism; BUD is budgeting mechanism; PA is the performance appraisal mechanism.

directly assessed. Rather, the differences between scores on each dimension are calculated for each pair of PMS mechanisms. This approach captures the differences in control behavior (i.e. distinctiveness) of the analyzed pair. Each score difference is translated into a dummy variable that is equal to one when the absolute value of the difference is higher than zero, and zero otherwise (Fig. 1, Panel C). Moreover, the assessment of *distinctiveness* with regard to the *use* of the PMS mechanism is based on three sub-dimensions, namely (a) *subordinates and superiors' involvement*, (b) *strategic uncertainties*, and (c) *face-to-face interactions to challenge and*

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debate the underlying PMS assumptions (Bisbe et al., 2007; Simons, 1995). In order to ensure that all the items related to *use* are aligned, we first averaged the score differences of each sub-dimension of *use*. Then, a dummy variable was developed and set to zero if the average of *use* is below 1, and one otherwise. Finally, the *distinctiveness* characteristic is itself developed as a dummy variable, which is equal to zero when all the three distinctiveness items are equal to zero, and one otherwise (Fig. 1, Panel C). This approach ensures that the desired level of distinctiveness is achieved by the PMS to adapt to local control needs.

3.4. PMS coupling index construction

We now move onto the final stage of computing an overall coupling index (PMSCI) to include all three of the PMS mechanisms involved in the prior analysis. The aim is to produce a single measure of overall coupling across the three major control mechanisms being considered. Following Orton and Weick (1990), the PMSCI assumes different values (no, loose, tight coupling) according to different configurations of the two underlying coupling features. A pair of loose coupling PMS mechanisms simultaneously show responsiveness and distinctiveness features set to one (Fig. 1, Panel A). Otherwise, the pair can be considered as either no coupling (responsiveness = 0, and any value of distinctiveness)[5] or tight coupling (responsiveness = 1, and distinctiveness = 0; Fig. 1, Panel A). Furthermore, to translate nominal categories of coupling into an ordinal variable of coupling tightness, with no coupling at the bottom of the scale and tight coupling at the top, different values are assigned to the three coupling states (no coupling = 1; loose coupling = 3; tight coupling = 5). Thus, the different values of coupling attached to each pair of PMS mechanisms are averaged to generate the overall PMSCI.[6]

Consistent with prior theoretical development, this approach allows different coupling patterns to co-exist in different parts of the PMS, and to generate an emergent coupling approach of the overall PMS at the same time. The PMSCI pools the average values into the three categories of couplings. Following prior studies (e.g., Kurtulus & Davis, 1982), we decided to categorize the PMSCI according to the following cuts, since they can be conceived as natural breaks in the observed distributions of the data gathered. *No coupling* refers to all those observations whose value of the PMSCI is below three. *Loose coupling* regards observations with a value equal to three, whereas *Tight coupling* is assigned when the PMSCI value is higher than three.

4. PMS coupling index in use: effects on organizational outcomes

To empirically assess the validity and reliability of the PMSCI, this Section conceptually develops and empirically tests the adoption of the PMSCI in an organizational context and its effects on some relevant outcomes. Hence, consistent with prior research, this study retained the minimum number of PMS mechanisms, i.e. three, to test the effect of the one-to-many relationships in a PMS (Otley, 1999; Shields, 2015; van Hengel et al., 2014). Following Dubin, three control practices were chosen according to the following criteria for both theory building and theory testing (Dubin, 1978), as well as study replication purposes (Shields, 2015). First, they have to be applicable to a variety of PMS frameworks, in order to possibly add knowledge on the effect of PMS coupling in a variety of PMS designs (Otley, 2016). Second, the PMS mechanisms need to be relevant for the selected organizational outcomes (Chenhall & Moers, 2015; Shields, 2015). Third, they have to be widespread across a variety of organizations and industries, to possibly enhance replicability (Otley & Franco-Santos, 2019; Shields, 2015). From the application of these criteria, the budgeting mechanism, the non-financial performance measurement mechanism, and the performance appraisal mechanism were identified as meeting the aims of this study. The pairwise combination of these PMS mechanisms informs the analysis of three pairs of couplings.[7]

The first coupling addresses the relationship between budgeting and non-financial performance measurement mechanism, which is considered of paramount importance to align the financial to the non-financial measures, and in turn effectively fulfill organizational efficiency and flexibility (Ahrens & Chapman, 2004; Bisbe & Otley, 2004). On the one hand, this coupling is expected to show a *responsive* behavior in order to provide the coordination needed to attain overall organizational objectives (Kaplan & Norton, 1996). On the other hand, it is assumed here that the two PMS mechanisms might not completely overlap in use (Frow, Marginson, & Ogden, 2010), emphasis on control (Gibbons & Kaplan, 2015), or degrees of performance discretion (Malina & Selto, 2001), thus showing *distinctive* behavior.

The second coupling investigates the relationship between budgeting and performance appraisal, which is deemed to deserve further attention as it affects managerial motivation (Otley, 1999). Agency theory predicts that a *responsive* linkage between budgeting and appraisal mechanism helps ensure the achievement of budgetary objectives (Demski, 1976). However, some uses of budgeting to undertake performance appraisal have been criticized (Hope & Fraser, 2003). Thus, a more *distinctive* approach in designing and using the budget to inform performance appraisal and vice-versa might foster the adoption of value-based budgeting and enhanced performance (Libby & Lindsay, 2010).

Third, the non-financial performance measurement mechanism and performance appraisal mechanism link is seen as pivotal in aligning employee's contribution to the fulfillment of objectives that make up an organization competitive advantage, particularly those relating to innovation (Ittner et al., 2003). Nonetheless, this relationship requires further theoretical and practical development (Luft, 2009). Prior studies found that non-financial measures are more used in performance appraisal when they are common to all of the organizational units, compared to unique ones (Lipe & Salterio, 2000). Hence, *responsiveness* in the link between non-financial performance and performance appraisal provides a 'comfort zone' to managers making their judgment on performance. However, when managers rely on a balanced set of performance to evaluate subordinates, they tend to subjectively adjust their judgment drifting away from non-financial indicators to focus more on financial performance (Ittner et al., 2003). Therefore, prior research highlights options to both include non-financial indicators into performance appraisal mechanisms and adapt indicators to the local needs of specific organizational units, providing a more *distinctive* approach to the relationship between these two PMS mechanisms (Banker, Chang, & Pizzini, 2004; Ittner, 2008).

Thus, all three pairs of relationship selected possess the attributes needed to allow loose coupling, although whether this actually exists is an empirical matter. In the following sub-sections the literature investigating the linkages between the selected PMS mechanisms and their effect on two main organizational outcomes

[5] Decoupling PMS is embedded into the category of no coupling.

[6] These coding decisions are essentially arbitrary and different methods could be investigated in future applications.

[7] Using more PMS mechanisms would increase the number of couplings to be examined substantially (e.g. 5 mechanisms would produce 10 [N*(N-1)/2] coupling pairs).

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will be reviewed.

4.1. The effects of the PMSCI on perceived managerial effectiveness

Traditionally, tight coupling has been seen as conducive to managerial effectiveness in terms of enhanced efficiency and organizational performance (Anthony, 1965; Otley, 2016). Tight couplings between non-financial performance measurement mechanism and strategic objectives are also expected to result in better performance in the public sector (Modell, 2004). PMS showing tight couplings are more effective in more predictable environments and cybernetic control systems (Chenhall, 2003). However, a stream of research has addressed the unintended consequences of tight coupling in PMS. Notably, tight coupling PMS are *expensive* due to the high cost of coordination required by such coupling pattern (Covaleski & Dirsmith, 1983). Moreover, Roberts (2007) assumed a tight coupling and highlighted the effect of a local solution on the overall organizational system,

> *"Changes in one aspect of the organization aimed at effecting one particular change in behaviour can alter other aspects of behaviour in ways that necessitate further changes on other dimensions of the design. Thus, the usual approach to fixing the problems that arise as organizations evolve – find an intervention whose first-order effect is to solve the problem, take everything else as given, and pull the lever – is fundamentally flawed. It only sets off a potentially unending stream of response, intervention, further unanticipated response, and yet another intervention."* (p. 282)

Hence, tight coupling PMSs are *less effective* when environmental uncertainty is high and changing conditions require the PMS to adapt some of its mechanisms, even at the cost of losing perfect internal consistency (Otley, 2016).

In contrast, loose coupling PMSs work as a "buffering" system, whereby issues in one part of the system can be isolated and managed locally, with the rest of the PMS being unaffected (Weick, 1976). Therefore, loose coupling PMSs are able to absorb accounting changes by focusing managerial attention to local needs and adapting consistently (Ahrens & Chapman, 2002), whilst preserving the organizational identity at the same time (Nor-Aziah & Scapens, 2007). Hence, *flexibility* is ensured by the coexistence of *change and stability* within loose coupling PMSs (Lukka, 2007). Consistently, a good fit between the scope of PMS change and the coupling of the PMS will result in more successful change management processes (Sulaiman & Mitchell, 2005). Therefore, system-wide changes will have higher success rates in tight coupling PMSs (Firestone, 1984), whereas the modularity of loose coupling allows for successful changes to occur in PMS mechanisms (Brusoni et al., 2001).

Another stream of the literature contended that loose coupling fosters a *loose means-ends relationship* between performance measures and managerial responses, whereby responses are only loosely related to metrics (Ahrens & Chapman, 2002), enabling both flexibility and efficiency (Ahrens & Chapman, 2004). Likewise, loose coupling has been conceived as both a process and an outcome of a PMS (Nor-Aziah & Scapens, 2007). Finally, when the units of analysis are *rules and routines*, decoupling may be useful to reduce conflicts, as well as manage competing institutional pressures (Lukka, 2007; Meyer & Rowan, 1977). Nonetheless, these pressures can be offset by loose coupling PMSs also (Major, Cruz, & Scapens, 2009; Nor-Aziah & Scapens, 2007).

Thus, it is argued here that loose coupling provides a flexible type of control, which allows effective management through reliance on the distinctiveness side of loose coupling, without losing too much of the efficiency side of control. Since in most practical situations, there is sufficient uncertainty to make the need for flexibility important (Ahrens & Chapman, 2002; Chenhall, 2003), we developed the following expectation:

Hypothesis 1. Loose coupling of PMS mechanisms will have a greater positive impact on the perceived effectiveness of the overall PMS, compared to no coupling and tight coupling.

4.2. The effects of the PMSCI on process innovation

Literature on the effect of PMS coupling on innovation is not abundant (Moll, 2015). Most studies have argued that tight coupling inhibits innovation, because it can "kill" creativity, which is one of its main determinants (Amabile, 1998). Likewise, firms focusing more on tight relationships and a diagnostic use of PMS are more likely to attain efficiency at the cost of capabilities that are conducive to innovation (Davila, 2005), such as innovativeness, market orientation and entrepreneurship (Henri, 2006). Additionally, tight coupling PMSs produce rigidity in interdepartmental relationships (Abernethy & Lillis, 1995). More specifically, Merchant found that a tight link between target setting and the rewarding mechanism can lead to short-termism, and hence limit the development of new ideas (Merchant, 1990).

Since loose coupling systems better fit dynamic environments (Weick, 2001), loose coupling PMSs are more suitable to mitigate task uncertainty, which is inherent to *innovation development and implementation* (Chenhall & Moers, 2015; Mitchell & Zmud, 1999). Consistently, Simons pinpointed a possible coexistence between the different use of control and innovation (Simons, 1994). Others argued that PMS ought to be a set of "flexible and dynamic frames adapting and evolving to the unpredictability of innovation, but stable to frame cognitive models, communication patterns, and actions" (Davila et al., 2009, p. 327). A wider perspective sees the potential for loose coupling PMSs to spur *break-through innovation* too. By allowing enough flexibility, loose coupling PMSs generate a 'research space' where failure is acceptable, since the knowledge acquired through failures might trigger future successful projects (Farjoun, 2010). In Teece's terms, "Innovation requires an organization that is creative and, in the implementation phase, responsive" where the balance between "work groups [that] are tightly coupled or only loosely aligned can influence the product architectures (e.g., integrated or modular) that the firm is able to support" (Teece, 2018, p. 46). As part of a wider PMS, budgeting can be loosely combined with more informal controls to achieve interdepartmental goals, such as innovation (Frow, Marginson, & Ogden, 2005). Prior research shows that a loose coupling between the performance measurement mechanism and the individual performance appraisal contributes to the "exploitation of existing capabilities and the search for and identification of new strategic opportunities" (Grafton et al., 2010, p. 689). Similarly, Malina and Selto (2001) provided empirical evidence of the relationships between effective management control, motivation, strategic alignment, and changes in processes and improvements in both the BSC and customer-oriented services.

No coupling PMS can cause unintended outcomes, such as *innovation drifts* (Revellino & Mouritsen, 2015). Thus, accounting as a calculative practice results in a combination of control mechanisms that need to be linked to provide organizations with a desirable level of coordination to support innovation (Chenhall & Moers, 2015).

For the purpose of this study, the relationship between PMS coupling and innovation will be restricted to process innovations. The *rationale* for this choice is threefold. First, process innovation encompasses a wide range of innovations, both technological and organizational as well as marketing-based ones. Second, it can be

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Table 3
Sample description.

Industry (N. of organizations)	N. of administered questionnaires	N. of completed questionnaires	Response Rate
Banking (2)	107	65	60.65%
Consulting (1)	22	21	95.45%
Manufacturing (1)	14	10	71.43%
Healthcare (4)	62	44	69.35%
Total	**205**	**140**	**68.29%**

linked to either new manufacturing practices (Young & Selto, 1991), or to new manufacturing processes, which transcend a technological base (Davenport, 1993). Thirdly, there is a call to move management accounting research beyond product innovation to investigate innovation in "services, processes and business models" (Chenhall & Moers, 2015, p. 10). Finally, managers at all levels and in all roles are likely to be involved in process innovations even if other innovations are outside their sphere of influence. The concept of *process innovation* can be conveniently addressed by the definition provided by the Oslo Manual (OECD, 2005), i.e. "a new or significantly improved production or delivery method. This includes significant changes in techniques, equipment and/or software" (p. 49).

From these theoretical arguments, it can be argued that loose coupling PMS mechanisms allow distinctiveness, which results in both exploration and exploitation innovation activities, whilst avoiding unintended effects of innovation through only responsiveness (Brusoni et al., 2001). We therefore suggest that:

Hypothesis 2. Loose coupling of PMS mechanisms will more positively affect process innovation, compared to no coupling and tight coupling.

4.3. Data collection and methodology

To test these theoretical hypotheses a small empirical study was designed. Since the concept of loose coupling is relatively new to the management control literature, and previous studies have used only qualitative methods (Brown et al., 2009, pp. 1–19; Mundy, 2015; Sandelin, 2008) we designed a questionnaire-based study to test these ideas. Hence, this study aims at responding to the call for more survey research in the loose coupling PMS field "in order to find more relevant explanations" (van Hengel et al., 2014, p. 70).

The unit of analysis is the responsibility centre – a branch or a business department – managed by a supervisor. Each responsible supervisor was asked to answer the questions that were specifically related to her/his area of supervision in their current job within the company. This approach provided independent observations, despite groups of respondents being drawn from the same organization, since each interviewee provided responses relating to her/his area of work rather than a company-wide overview (Govindarajan & Fisher, 1990; Ittner et al., 2003).

Data was collected from a sample of senior and middle managers (see Table 3 for sample details). In order to make sure that a formal PMS would be in place in each organization, at the time of the survey they were all employing more than 100 employees and reporting a revenue higher than € 10 million. Furthermore, to make questions on the PMS mechanisms more relevant to respondents, the instrument administered in each of the surveyed organization was slightly adjusted to capture the exact name of the non-financial performance measurement and the individual performance appraisal mechanism. It was also established that all three mechanisms were of considerable importance in each of the organizations concerned.[8] Paper-based questionnaires were mailed to them. Two follow-ups resulted in 140 valid questionnaires being received (68.3%).[9] On average, the surveyed managers had worked with their company for 13.6 years, and for 4.1 years in their latest position in the company. 20.7% of the respondents were female. An independent sample *t*-test showed no significant differences between early and late respondents, so no early-late respondent bias seemed to occur.

Procedural and statistical remedies were adopted to minimize the effect of common method bias (CMB; Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). Procedural remedies refer to the questionnaire design. Firstly, this study used the same source (survey respondent) to collect data for all the constructs included in the study. Following Conway and Lance (2010), self-reporting is the best way to collect data when perceptual variables are being analyzed. Secondly, respondents' anonymity and reduced evaluation apprehension are protected by explicitly stating in the questionnaire that there are no right or wrong answers and that respondents should answer questions as honestly as possible (Podsakoff et al., 2003). Therefore, to assure respondents' anonymity, the temporal, proximal, psychological, or methodological separation of measurement cannot be used (Podsakoff et al., 2003). The face validity of the items and constructs of this study was validated by sending the questionnaire to a set of academics, whereas wording and content validity was checked through a pilot test of the questionnaire to 20 managers of other Italian organizations. Moreover, the questionnaire provides a detailed description and definition of the coupling concept. Feedback collected in the pilot phase was used to modify the final version of the questionnaire (see Appendix). Bias was also minimized by using different scale endpoints and formats for the predictor and criterion measures (Podsakoff et al., 2003). Furthermore, acquiescence bias was reduced by avoiding the use of bipolar numerical scale values and providing verbal labels for the midpoints of scales. Regarding the statistical procedures, Harman's single factor test and partial correlation procedures were applied to check for the presence of CMB (Podsakoff et al., 2003). Results show that CMB is not a great concern in this study (non-tabulated).

[8] First, following Daniel and Reitsperger (1991), control system adaptation is a proxy for its adoption, hence for each PMS mechanism we asked for its specific name within the organization, to ensure that it was in place and used. Then, we checked with our contact person in each organization whether there was a director in charge of the design and use of the mechanism. According to Simons (1991), indeed, the use of formal mechanisms by top managers "focus[es] organizational attention and learning, and thereby shape[s] the formation of new strategies" (p. 49). Lastly, we asked to what extent the mechanism was used within the organization and we made sure that each PMS mechanism was used on a regular basis (Simons, 1991).

[9] 5 questionnaires missed relevant data; 1 questionnaire was filled in by a manager who had been with the firm for less than 6 months. These were excluded from the analysis.

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Table 4
Perceived PMS effectiveness, Process innovation. Construct validity.

	Communality
Perceived effectiveness of PMS - Rate the effectiveness of the overall control system used within your unit in providing information … (Cronbach's Alpha = .932)	
…To help achieve your unit's goals (from extremely unsatisfactory (1) to extremely satisfactory (7))	.758
…To support operational decisions of your unit (from extremely unsatisfactory (1) to extremely satisfactory (7))	.846
… To enable flexibility/adaptability of your unit (from extremely unsatisfactory (1) to extremely satisfactory (7))	.786
Process Innovation (Cronbach's Alpha = .969)	
a) During the last three years, your unit introduced very much less (1) to much greater new processes (7) than sector's average	.901
b) During the last three years, your unit introduced very much less (1) to much greater significantly improved processes (7) than sector's average	.907
c) During the last three years, your unit introduced very much less (1) to much greater new-to-the-industry processes (7) than sector's average	.885

4.4. Variable measurement and analytical models

Perceived PMS effectiveness. For the overall PMS, perceived PMS effectiveness (PMSEFF) was measured by asking respondents to rate the effectiveness of the information provided by the PMS according to a set of questions drawn from prior studies (Abernethy & Guthrie, 1994; Chenhall & Morris, 1986; Rodan & Galunic, 2004; Table 4). The CFA showed a good level of communality among three retained items: *effectiveness in goal achievement*, *decision-making* and *flexibility*, which are added together to capture PMSEFF for the overall PMS.

Process innovation. Process innovation (INN) has been measured by using three dimensions (OCSE, 2005; Table 4). The sum of these dimensions represents the value of INN.

Table 4 shows construct validity statistics for PMSEFF and INN constructs, and Table 4·Table 5reports frequencies for distinctiveness and responsiveness in the three observed couplings. Results show that loose coupling is the most frequent coupling pattern, with regard to the non-financial performance measurement mechanism and the performance appraisal mechanism pair as well as for the budgeting and the performance appraisal mechanism pair of mechanisms, followed by no and tight coupling states, within the observed sample.

Before proceeding to hypothesis testing, we checked for normality of data through both Shapiro-Wilk (1965) and Shapiro-Francia (1972) statistics, which showed that there were issues of nonnormality in the analyzed sample (non-tabulated). Thus, the use of non-parametric statistical tests was indicated. To test hypotheses 1 and 2, a Kruskal-Wallis test was performed (Kruskal & Wallis, 1952), with a *post hoc* Dunn's test to allow multiple group-wise comparisons (Dunn, 1961).

5. Results

Table 5·Table 6 shows descriptive statistics for the surveyed sample. Each measure shows an average value roughly in the middle of the possible range and each has a good spread of variation around that value, indicating a good degree of dispersion in the data. Although the INN mean value is not very high, results have a high dispersion, since some respondents stated there had been no innovation during the previous three years. In those cases, INN was set to zero. Descriptive statistics for the PMSCI show a mean value slightly lower than the theoretical average, although it characterizes the loose coupling PMS (loose coupling was coded as 3 in the PMSCI) with a wide spread of values.

Test of hypotheses H1 and H2 were performed by first assessing the mean values of PMSEFF and INN under the three coupling patterns. As shown in Table 7, the mean value of PMSEFF and INN is highest in the loose coupling case, with tight coupling ranking second, whereas no coupling is the least effective option. This shows strong evidence that no coupling is associated with substantially worse outcomes for both effectiveness and innovation, compared with either tight or loose coupling. Unexpectedly, the differences in outcomes between tight and loose coupling were small. The means of both outcomes were highest for loose coupling as hypothesized, but not all the differences reached conventional levels of statistical significance as indicated below.

Following prior studies analyzing the differences between management techniques and their impact on management accounting practices (Geiger & Ittner, 1996), we conducted the non-parametric Kruskal-Wallis H test (Kruskal & Wallis, 1952) with a *post hoc* test for group-wise comparison on three pairs of couplings (Dunn, 1961), to test the statistical significance of the difference in the three couplings with regard to both organizational outcomes (Table 7·Table 6). The fourth column in Table 6 Table 7shows that loose coupling is associated with higher perceived PMS effectiveness and innovation compared to no coupling. Similarly, the sixth column demonstrates the superiority of tight coupling over no coupling for effectiveness. However, the fifth column shows results that are insignificant for perceived effectiveness, and only marginally significant for innovation. Hence, H1 is only weakly supported and caution should be used in generalizing results with regard to the slightly superior performance shown by loose against tight coupling in terms of effectiveness. Results regarding innovation achieve a satisfactory level of significance only for no coupling patterns, being associated with inferior performance. Although loose coupling appears to give the higher levels of innovation, compared to tight coupling, these results reach only a modest level of significance on the basis of this analysis ($p = 0.07$ one-tailed). Overall, these analyses show only weak evidence for the curvilinear effect of PMS coupling on the PMSEFF and INN variables hypothesized.

6. Discussion

The previous results did not support the hypotheses that performance and innovation have the expected simple relationship with coupling. Rather no coupling was shown to have relatively low levels of both performance and innovation, whereas tight and loose coupling had higher levels, but these levels could not clearly be distinguished from each other.

In order to better understand why this occurred, we adjusted the measure of coupling to provide a more continuous variable rather than the three-state categorization. The original simple categorization was used to be consistent with Orton and Weick (1990) and in order to most easily detect the expected differences between tight and loose coupling, but requires amendment for a more detailed examination of the effects of coupling when different relationships may exist. Indeed, although the categorization approach is consistent with the initial theory of loose coupling (Orton & Weick, 1990), using a categorical variable could limit its explanatory power. The use of a continuous approach could allow

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Table 5
Frequency distribution for coupling distinctiveness and responsiveness.

	Distinctiveness	Responsiveness	
		0	1
Non-financial performance vs. Budgeting	0	9 (no coupling)	25 (tight coupling)
	1	52 (no coupling)	54 (loose coupling)
Non-financial vs. Performance appraisal	0	8 (no coupling)	28 (tight coupling)
	1	45 (no coupling)	59 (loose coupling)
Budgeting vs. Performance appraisal	0	6 (no coupling)	26 (tight coupling)
	1	43 (no coupling)	65 (loose coupling)

Table 6
Descriptive statistics.

n = 140	Theoretical range	Min	Max	Mean	SD
Perceived effectiveness of PMS	(3–21)	3	21	14.68	3.66
Process innovation	(0–21)	0	21	11.19	6.05
Coupling Index	(1–5)	1	4.33	2.60	1.28
Distinctiveness (non-financial performance vs. budgeting)	(0–1)	0	1	0.76	0.43
Responsiveness (non-financial performance vs. budgeting)	(0–1)	0	1	0.56	0.50
Distinctiveness (non-financial performance vs. performance appraisal)	(0–1)	0	1	0.74	0.44
Responsiveness (non-financial performance vs. appraisal)	(0–1)	0	1	0.62	0.49
Distinctiveness (budgeting vs. performance appraisal)	(0–1)	0	1	0.77	0.42
Responsiveness (budgeting vs. performance appraisal)	(0–1)	0	1	0.65	0.48

more complex explanations to be explored. We therefore aggregate the three sub-dimensions of coupling by taking a simple average, which results in six categories[10] of a more continuous variable (designated as C) ranging from no to tight coupling. The average outcomes of performance, innovation and also environmental uncertainty were then calculated for each value in order to detect any underlying relationships. In addition, simple correlation coefficients were calculated between coupling and each of these variables.

We find no obvious linear relationship between coupling and these variables (see Table 7·Table 8). The most likely explanation for such a finding rests on a contingency hypothesis, namely that managers adjust the degree of coupling required to the circumstances faced. Environmental uncertainty was originally measured in an attempt to ensure our sample did not show significant variation with regard to this aspect of external circumstances, but it does not appear to have any explanatory power, perhaps due to its limited range of variation.

The one feature that does appear from this analysis is a possible curvilinear relationship between coupling and both effectiveness and innovation (Fig. 2). We therefore computed correlation coefficients for both the lower levels of coupling ($C \leq 3$) and the higher levels ($C \geq 3$) (see Table 9). These show a positive relationship ($r = +0.52$) with effectiveness for lower levels of coupling, which becomes very small at higher levels. For innovation we find a distinct curvilinear relationship, with a positive slope at lower levels of coupling ($r = +0.33$) and a negative slope at higher levels ($r = -0.29$). This seems to indicate that even innovation benefits from a moderate degree of coupling which is lost at higher levels. Thus this analysis using a continuous coupling variable shows evidence of a curvilinear relationship for both effectiveness and innovation, although somewhat differently in each case (see Table 9).

Thinking about this from the point of view of ambidexterity, we find that there appears to be a point of balance between both effectiveness and innovation that optimized both. As a simple calculation, we constructed an overall performance measure by adding together both the effectiveness and innovation scores.[11] This shows a clear optimum point at $C = 3$, with a positive slope at values less than 3 ($r = +0.51$) and a negative slope beyond that point ($r = -0.25$). This is suggestive of a 'sweet spot' at around medium values of coupling that allows both a considerable degree of effectiveness with high levels of innovation. Indeed, the average values reported in Table 7·Table 8 show effectiveness having its second highest value at $C = 3$, with innovation also being at its maximum. It also shows that a modest degree of coupling actually increases rather than decreases innovation. But it should be noted that the differences in average values shown in this Table are not all statistically different, due to the relatively small sample size, although the correlation coefficients themselves are highly significant, and thus support our original hypotheses (H1 and H2).

As previously suggested, it may be that contingent variables can help to further explain both the choice of coupling levels and their effects. It would be useful for further studies to look at other relevant contingent variables to investigate how managers make their choices of coupling states. It might also be helpful to bear in mind that managers are likely motivated to select the lowest level of coupling consistent with their needs, given that establishing more tightly coupled systems is probably expensive.

However, it is also important to recognize that such managerial decisions are not only driven by external contingencies. Managers

[10] Note that one scale point ($C = 4.33$) had just one sample point, so it was amalgamated into $C = 3.67$, giving five categories.

[11] We recognize that this is an arbitrary and crude measure, as it assumes that scores from both scales can be simply aggregated, and that both are given equal weight.

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Table 7
Average values, average rank values, and Kruskal-Wallis values with a Dunn's test for group-wise comparison on both the perceived managerial effectiveness of PMS and process innovation performance.

	NO COUPLING PMS (n = 71)	LOOSE COUPLING PMS (n = 30)	TIGHT COUPLING PMS (n = 39)	Dunn's group-wise comparison		
				No vs. Loose coupling	Loose vs. Tight coupling	No vs. Tight coupling
PERCEIVED EFFECTIVENESS: Average values	13.113(L)	16.633(H)	16.026(M)			
Average rank values	51.570 (L)	93.100 (H)	87.577 (M)	- 4.744**	0.566 (p = 0.143)	- 4.494**
PROCESS INNOVATION: Average values	10.197(L)	13.467(H)	11.256(M)			
Average rank values	64.352 (L)	81.650 (H)	73.115 (M)	- 1.975*	0.874 (p = 0.069)	- 1.093 (p = 0.096)

Results are significant at the * (0.05) and ** (0.01) level (one-tailed).
H = high-level performance, M = medium-level performance, L = low-level performance.

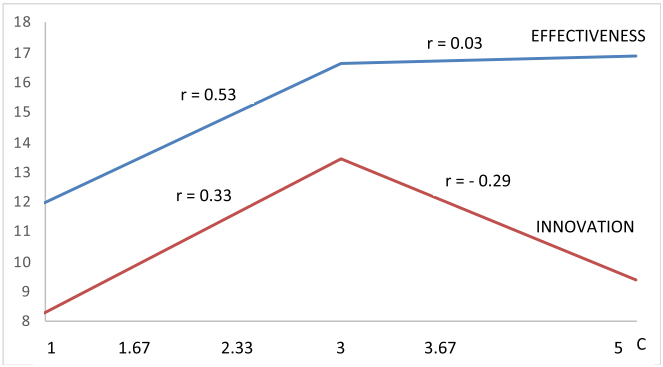

Fig. 2. The relationship between the PMS coupling index and Perceived PMS effectiveness or Process Innovation.
C is the continuous PMS coupling index.

will also be making a choice as to the best trade-off they can establish between their needs for effectiveness and innovation, thus achieving an optimum degree of ambidexterity. It is probable that tighter coupling produces more effectiveness (maybe up to a certain point), but that looser levels of coupling lead to more innovation (maybe down to another such a point). However, it is probable that, in general, neither of these choices can be optimized independently – rather a choice has to be made as to the most satisfactory level of coupling to provide an appropriate compromise solution. Therefore, any future study should try to establish the aims of managers in selecting the degrees of effectiveness and efficiency required. This may be affected by current circumstances (e.g., the degree of pressure to perform effectively versus the need for more innovation).

This decision might not be made by the lower levels of management included in a study, but imposed from above. We would suggest that such higher-level imposition might likely tend towards a greater degree of coupling arising from the desire of senior managers to be able to aggregate information from lower levels in a coherent and systematic manner. This implies a greater degree of central control and tighter coupling. Thus, a non-optimal level of coupling might be imposed on some lower level organizational units. One way of exploring this issue might be to examine results from different hierarchical levels or different functional departments (e.g., operations, marketing and R&D) where different requirements exist and where central imposition might lead to sub-optimal outcomes for the individual units concerned.

Our study represents an initial attempt to establish whether the degree of coupling between different PMS mechanisms (or subsystems) affects effectiveness and innovation. The results did not demonstrate the simple effects we initially postulated, and this section attempts to conjecture (on the basis of the evidence we collected) possible reasons for this. As such, we believe that it provides a number of interesting possibilities for future studies to explore. In particular, it emphasizes the point that it is important for studies to be able to recognize the existence of curvilinear relationships, and to explore the implications of attempts by organizations to achieve ambidexterity.

7. Conclusion

This study sought to conceptually develop and empirically test a construct of coupling. We argued that this construct could help move the debate on the design of PMSs beyond the dichotomy between PMS packages and systems. According to this view, the links in a PMS can range along a spectrum from a lack of interaction, which is associated with no coupling, to strong ties, which are related to tight coupling, with loose coupling in between. Following prior conceptual development, loose coupling PMSs can emerge from either all loose interactions within the overall PMS or a mix of tight, loose and no coupling linkages between different control practices in different places in the organization. Such PMS design is consistent with what happens in practice, where "full coordination is precluded for several reasons, most notably the rapid pace of change and the addition of new or amended systems at a faster rate than the coordination process can develop" (Otley, 2016, p. 45).

Building on prior literature, we "unpacked" the concept of loose coupling, its determinants and its effect in several stages (Collier,

Table 8
Mean values of Perceived effectiveness of PMS, Process innovation and Environmental Uncertainty by Coupling value.

Coupling value	Perceived PMS effectiveness	Process innovation	Overall performance	Environmental uncertainty
1 (*n = 33*)	11.939	8.303	20.242	12.152
1.667 (*n = 19*)	13.316	12.105	25.421	13.368
2.333 (*n = 19*)	14.947	11.579	26.526	11.526
3 (*n = 30*)	16.633	13.467	30.1	14.667
3.667 (*n = 23*)	15.435	12.565	28	14.217
5 (*n = 16*)	16.875	9.375	26.25	14

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Table 9
Correlation matrix.

Panel A - PMS Coupling index (C) ≤3				
	PMS Coupling index	Perceived PMS effectiveness	Process innovation	Overall performance (Inn + Perceived effectiveness)
Perceived PMS effectiveness	0.527** (0.000)			
Process innovation	0.331**(0.001)	0.244* (0.014)		
Overall performance (Inn + Perceived effectiveness)	0.506** (0.000)			
Environmental uncertainty	0.238* (0.017)	0.226* (0.023)	0.256* (0.010)	0.305** (0.002)
$n = 101$				
Panel B − PMS Coupling index (C) ≥3				
	PMS Coupling index	Perceived PMS effectiveness	Process innovation	Overall performance (Inn + Perceived effectiveness)
Perceived PMS effectiveness	0.036 (0.766)			
Process innovation	−0.291* (0.015)	−0.039 (0.750)		
Overall performance (Inn + Perceived effectiveness)	−0.245* (0.043)			
Environmental uncertainty	−0.100 (0.413)	−0.028 (0.819)	0.111 (0.366)	0.086 (0.480)
$n = 69$				

Results are significant at the * (0.05) and ** (0.01) level (two-tailed).

2001, p. 470). First, starting from the loose coupling theory we analyzed the effect of two drivers of loose coupling, that is responsiveness and distinctiveness, in both the organizational and performance management literature. Then, we relied on the literature regarding the adoption of loose coupling in PMS design and use, and identified the items forming responsiveness and distinctiveness. Finally, we developed the overall PMSCI and tested it against two main organizational outcomes, namely perceived managerial effectiveness and process innovation. Our empirical findings show that the coupling approach is useful in assessing the effect of different PMS coupling states on both outcomes.

Consistent with theoretical development (H1), loose coupling PMS are associated to higher PMS perceived effectiveness, compared to both no and tight coupling PMSs, although results do not reach conventional levels of statistical significance in the latter case. This small difference in perceived effectiveness was smaller than we expected, although the use of a continuous coupling variable helped justify the hypothesis more clearly, showing that peak effectiveness was attained at medium levels of coupling. However, there was clear evidence for the relatively poor performance of no coupling. One possible reason for this result is that tight coupling is expensive to achieve, requiring a considerable amount of managerial time and effort. Thus, companies may make a conscious choice to invest in it only where they believe it is essential to achieve the levels of performance they require. Other companies may decide that loose coupling is adequate for their needs, and that they are able to achieve adequate performance without incurring the extra expense of developing tight coupling. Certainly, this is a possibility that should be considered in future studies.

In line with our expectations (H2), higher process innovation is associated with loose coupling PMS, compared with both no and tight coupling systems, although the difference between tight and loose coupling was relatively small in the initial analysis. Again, use of the continuous variable produced more clear-cut results. Evidence from this study supports that part of the literature in which loose coupling is shown to be conducive to both a desired level of coordination for effective innovation development and implementation (Chenhall & Moers, 2015), and the flexibility to perform exploration of innovative initiatives (Farjoun, 2010; Teece, 2018). It also shows that a certain (low) level of coupling is helpful for innovation. Thus, further studies could look at the impact of the coupling on different stages of innovation. Another line of investigation could be related to the choice of innovation other than the process type. Prior studies indeed pinpointed that different types of innovation have different control needs in terms of both control practices (Guo, Paraskevopoulou, & Santamaría Sánchez, 2018) and the types of linkages between practices (Bedford, 2015).

However, we also found that the loose coupling category combines a range of different patterns, and that a more continuous measure was helpful in teasing out relationships. In particular, we found that, although effectiveness increased with tighter coupling, this effect became negligibly small after medium levels were attained. By contrast, although innovation declined at higher levels of coupling, it also showed an increase from no to medium levels, indicating that modest levels of coupling are beneficial to innovation as well as to effectiveness. The reasons for this latter finding deserve further exploration in future studies.

Findings from this study contribute to management control theory and practice in several ways. First, the PMS coupling approach advances knowledge on the design, use and diagnosis of PMS beyond the extant dichotomy between control systems and packages (Bedford et al., 2016; Grabner & Moers, 2013). Hence, the proposed PMS coupling framework helps overcome the partial and unintended effects of reductionist approaches (Ferreira & Otley, 2009; Grabner & Moers, 2013; Otley, 2016). Second, the operationalization of the PMSCI is a starting point to "unpack" the "concept of loose coupling" (Collier, 2001, p. 470) and "to find more relevant explanations" in the field of PMS coupling (van Hengel et al., 2014, p. 70). This approach might foster additional work in the validation, adjustment and comparison of this construct against other possible competing ones. In particular, our study suggests that the development of a continuous measure of coupling is desirable. Third, the observed effects of coupling on perceived effectiveness and process innovation extends the literature, and sets the ground for future debate, on the need for both coordination and flexibility in management control (Bedford, 2015; Speklé et al., 2017).

The managerial relevance of the present research relates to the introduction of a new criterion for designing, or redesigning, the relationships between PMS mechanisms – the PMSCI – in a variety of economic sectors, which provides improved perceived PMS effectiveness through a more effective balance between control and flexibility that drives the organization towards long-run survival.

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This study clearly has limitations due to its small sample size, but these preliminary findings provide a basis for future research in the PMS literature. It is recognized that the procedures followed to develop the PMSCI use arbitrary choices to select cut-off points, although these seem consistent with the observed data and subjective assessment of the state of affairs in the organizations studied. However, future work could usefully consider the impact of selecting different cut-off points. Additionally, the measurements of the dimensions could be combined in ways that better preserve the continuous nature of the underlying data. But it is important to preserve the theoretical consideration that for coupling to exist both the dimensions of distinctiveness and responsiveness need to be combined in an appropriate way.

Moreover, as this work has been exploratory, caution should be used in generalizing the results of this study, and more work is required to establish whether the results can be replicated in other settings in terms of both the types of organization and the managerial levels involved. Furthermore, it could be worthwhile to investigate whether some contingent variables, such as sector, corporate strategy, and managerial intentions might moderate the effect of coupling on the outcome variables.

Larger samples could also support the use of more sophisticated research models, to better analyze the possible non-linear relationships between the variables under investigation and in the construction of an overall coupling index. Additional PMS mechanisms could also be included to address whether more complex PMS structures show different coupling behaviors. Finally, qualitative research could develop further the concept of PMS coupling, investigating how various types of coupling emerge in different types of PMSs.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.aos.2019.101072.

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