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Exploring innovation across organizations: the role of contracts and management controls

Ariela Caglio[1] · **Mario Daniele**[2] · **Angelo Ditillo**[3]

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Abstract
This paper addresses a gap in the management accounting literature by examining the relationship between innovation, contract completeness, and the use of management controls in buyer–supplier relationships. Early evidence shows that uncertainty significantly affects contracts and controls, reducing both contract completeness and the inclusion of control specifications in contracts. However, little is known about the role of innovation in shaping inter-organisational relationships. Our study leverages survey evidence collected in the fashion industry, where innovation is both a source of competitive advantage and an intrinsic feature of the production process. Results indicate that process innovation has a negative relationship with contract completeness and reduces the formalisation of controls in contracts, while product innovation has no significant association. This study highlights the importance of designing contracts that balance completeness and flexibility in innovation activities, and the crucial role that trust plays, as a substitute for contractual control mechanisms, in improving buyer–supplier relationships.

Keywords Innovation · Contracts · Interorganizational relationships · Management controls

1 Introduction

Inter-organisational settings constitute a rich field for management accounting research [for a review, see Caglio and Ditillo (2008, 2021) and Dekker (2016)]. Among these, buyer–supplier relationships have been studied as a typical example

✉ Mario Daniele
mario.daniele@unicatt.it

[1] SDA Bocconi School of Management, BIDSA, BAFFI-CAREFIN, Bocconi University, Milan, Italy

[2] Università Cattolica del Sacro Cuore, Milan, Italy

[3] SDA Bocconi School of Management, BIDSA, Bocconi University, Milan, Italy

of formal, non-equity-based, contractual inter-organisational relationships; they are activated with the aim of dealing with complex joint activities (Grandori, 1997) by procuring resources or outsourcing production with varying degrees of uncertainty.

The management of the relationship between two legally independent but interdependent parties is crucial: contracts are intended to "set the ground rules" and minimise conflicts, acting as a governance mechanism of the relationship (Eisenhardt, 1984). At the same time, they must deal with uncertainty and coordination difficulties, in conjunction with a system of management controls.

By leveraging transaction cost economics (TCE) theory (Coase, 1937; Williamson, 1975), a relevant number of papers within the management accounting literature have analysed contracts and management controls adopted in collaborations between buyers and suppliers. For example, van der Meer-Kooistra and Vosselman (2000) suggested that institutional, strategic, cultural, and historical factors influence the control structure. Langfield-Smith and Smith (2003) examined how outcome/social controls and trust are used to achieve control. Anderson and Dekker (2005) provided evidence on whether transaction and supplier characteristics influence formal control structures. More recently, Krishnan and Mani (2019) disentangled the relationship between uncertainty and compensation design in inter-firm contracts.

The underlying assumption in the related extant literature (Chua, 2011; Homburg & Stebel, 2009) is that uncertainties—which are inherent in buyer–supplier relationships—may be dealt with within the appropriate structure of formal and informal controls. However, while uncertainty has been related to "the difficulty of defining *ex ante* and verifying *ex post* the products and services for which the parties are contracting" (Anderson & Dekker, 2005), much less attention has been dedicated to the uncertainty generated by the need to produce innovation within buyer–supplier relationships.

As suggested by Davila et al. (2009), innovation is not a monolithic phenomenon but an ensemble of processes that coexist and require different types of control systems. Accordingly, the conclusions drawn in the existing literature cannot necessarily be automatically extended to buyer–supplier relationships that involve innovation. Innovation may introduce new problems and require different forms of contracts and controls (Ditillo & Caglio, 2018).

The management accounting literature has already investigated the interplay between innovation and control. Chenhall et al. (2011) observed that product differentiation is associated with innovation and that the former is linked with each dimension of the management control system; Bedford (2015) focused on the relation between the use of management control systems and innovation and the effects on firm performance; Chenhall and Moers (2015) identified how the design and use of management control systems evolved in order to support innovation; Pan Fagerlin and Lövstål (2020) studied the use of formal and informal controls in product innovation processes; Taylor et al. (2019) investigated how different organisations use management controls to achieve innovation; Ditillo and Caglio (2018) analysed the control mechanisms adopted in inter-organisational settings aimed at innovation from a theoretical point of view.

However, none of these contributions specifically focused on buyer–supplier relationships aimed at innovation or studied them empirically and, therefore, little

is known about the design of the contracts and the use of management controls in these forms of agreement. Innovating outside the boundaries of an organisation can be critical, particularly in industries characterised by a continuous creative process. Collaboration with third parties can serve as a catalyst for innovation. However, the absence of intra-organisational constraints and procedures necessitates a system of controls aimed at protecting the outcomes of innovation.

Our study aims to fill this gap by building a bridge between the ample literature aimed at investigating buyer–supplier relationships and the stream of literature focused on the influence of innovation on management controls. To the best of our knowledge, this is the first study to investigate the association of innovation with contract completeness and with the use of management controls in buyer–supplier relationships.

We addressed our research question by leveraging a sample of 48 surveys collected in the fashion industry between 2015 and 2016. Our research setting is particularly interesting because the fashion industry represents a highly innovative environment (Caglio & Ditillo, 2012a; Davila & Ditillo, 2017) where innovation is both an important source of competitive advantage and an intrinsic feature of the production process. Indeed, the continuous creation of new collections and the constant development of new products permeate the whole environment in this industry.

Our main analyses employed structural equation modelling-partial least squares (SEM-PLS) models, which are more suitable for small samples. Our findings indicate that process innovation is inversely correlated with contract completeness and leads to a reduction in the formalisation of controls within contracts. Conversely, product innovation shows no significant relationship with these variables, underscoring the multifaceted aspect of innovation. The uncertainty surrounding the integration of innovation into production processes tends to simplify contracts and contractualised controls to enhance adaptability and flexibility. In contrast, product innovation is not relevant in shaping buyer–supplier contractual relationships. Moreover, our analysis reveals no significant link between (process and product) innovation and the use of non-contractual controls, thus indicating that innovation does not influence the extent of the controls employed by parties to govern their buyer–supplier dynamics. Interestingly, trust demonstrates a positive correlation with non-contractual controls, serving as a supplement to these mechanisms. Conversely, when controls are integrated into a contract, trust appears to substitute them (there is a negative association between trust and contractualised controls). This evidence offers a potential explanation for certain conflicting findings in the literature regarding the interplay between trust and controls. To further test the robustness of our results, we employed OLS parametric models and also used alternative scales.

This study makes several contributions. First, we contribute to the understanding of how innovation impacts management controls (Chenhall & Moers, 2015) in the context of interorganisational relationships. In particular, as we consider the multifaceted nature of innovation (Davila et al., 2009), we enrich the existing literature on the relationship between innovation and controls by distinguishing between the effects of product and process innovation on management controls. This distinction highlights how the unique characteristics of each type of innovation shape the design of control systems. Second, we complement this analysis by considering the

impact of innovation on the characteristics of contracts (Grandori & Furlotti, 2009). In particular, we study how innovation shapes the design and contractual terms of contracts. Third, we also differentiate between management controls included in contracts and those that are not. This is because contextual factors, especially different levels of trust, may suggest an opportunity to include management controls in a contract or not, depending on the flexibility that parties would like to achieve in the management of the relationship.

By doing this, our study specifically addresses Caglio and Ditillo's (2021) call for research on contracts and management accounting and controls in inter-organisational settings aimed at innovation. Finally, the use of survey data complements those studies that have qualitatively analysed management controls in inter-organisational relationships.

The paper is organised as follows. In Sect. 2, we discuss the existing literature and develop our hypotheses. The research design is presented in Sect. 3. In Sect. 4, we report our results, while Sect. 5 contains robustness checks. Finally, we discuss our results in Sect. 6, and we present our conclusions in Sect. 7.

2 Literature review and hypotheses development

Inter-organisational relationships aimed at innovation may present significant specificities in terms of contractual agreements (Grandori & Soda, 1995) and forms of management control (Caglio & Ditillo, 2008). In these contexts, both contractual arrangements and control mechanisms may be affected by the need to address specific issues that are unique to these settings. To pursue the objective of innovation, inter-firm relationships not only serve the purpose of coordinating tasks along the value chain, but they also need to foster the learning efforts of partners (Feller et al., 2013; Hagedoorn & Duysters, 2002,) and grant access to critical complementary resources (Cummings, 1984). This advantage, however, entails some complexity that requires the adaptation of contracts and control mechanisms aimed at coordinating different resources (both physical and knowledge) in developing new products or processes (Grandori, 1997) and at addressing value appropriation concerns (Ditillo & Caglio, 2018).

Within the TCE literature, it is well established that, under conditions of uncertainty and strong interdependencies, contracts are inherently incomplete and cannot address all contingencies that may arise from the relationship (van der Meer-Kooistra & Vosselman, 2000). To overcome these limitations, trust and mutual adaptation are often necessary to ensure successful collaboration. TCE scholars have extensively analysed how contracts function in environments of high uncertainty (Hart, 1988; Williamson, 1975). While uncertainty is indeed a core feature of innovative settings, some insights from these studies can be applied to innovation-related contexts (Bajari & Tadelis, 2001; Battigalli & Maggi, 2008; Crocker & Reynolds, 1993). Specifically, uncertainty in these settings means that parties may lack the knowledge required to solve emerging problems, and they may not have reciprocal visibility over inputs or outputs due to lacking the technical

expertise needed to interpret them. This creates a need for ongoing mutual adaptation to coordinate effectively (Grandori, 1997).

However, TCE typically treats uncertainty as a broad, generalised concept, focusing on unforeseen contingencies that challenge the completeness of contracts, such as market fluctuations, economic volatility, or unpredictable behaviour (Hart, 1988; Williamson, 1975). In contrast, our study focuses on a more specific type of uncertainty tied to innovation. Drawing on organisational theory, we consider the uncertainty that arises from what is unknown or unexpected in the innovation process—this includes new, untested technologies, unpredictable shifts in market needs, and unforeseen outcomes of research and development efforts.

This distinction is critical because, in contexts of innovation, the nature of uncertainty goes beyond the typical concerns of TCE. In innovation-driven contexts, uncertainty extends beyond the limitations of traditional contracting frameworks, requiring control systems that are capable of handling the unknown and unexpected while at the same time stimulating new ideas. Therefore, a deeper analysis of the specific characteristics of innovation-related uncertainty is needed, as these characteristics demand more flexible, adaptive control mechanisms than those typically proposed by TCE. Furthermore, in relationships aimed at creating innovation, it is necessary to implement organisational routines facilitating both the transfer of knowledge and the integration of this knowledge between parties. This is viable to a certain extent, as long as there is mutual understanding between the parties.

At higher levels of complexity, effective collaboration between parties requires the activation of interfaces that allow for the integration of their outputs. Instead of relying solely on the transfer of knowledge, the focus shifts to coordinating through the combination of outputs to ensure integration (Ditillo, 2004; Grandori, 2001). This type of collaboration is often managed through social, peer-based interactions (Grandori, 1997; Ouchi & Bolton, 1988), where continuous information sharing and communication are critical to sustaining the relationship (Ditillo, 2016). These aspects of collaboration, which rely heavily on informal exchanges and adaptive behaviours, are difficult to fully incorporate into formal contracts. Consequently, in contexts characterised by high uncertainty, such as innovation settings, the literature highlights that parties may benefit from "optimally incomplete contracts"—arrangements that allow flexibility for ongoing adjustments and mutual adaptation (Grandori & Furlotti, 2009).

While existing literature suggests there is a negative relationship between innovation-related uncertainty and contract completeness, the distinct control challenges inherent in different types of innovation indicate that the mechanisms through which innovation impacts contract completeness vary depending on whether the parties are addressing process or product innovation.

In the case of process innovation, uncertainty is tied to the transformation process itself, which gives rise to specific control challenges related to task analysability, the number of exceptions, and the level of knowledge about the process (Abernethy & Brownell, 1997; Rockness & Shields, 1984). In contrast, when dealing with product innovation, different control issues arise due to the uncertainty surrounding the final product, such as verifiability and measurability

(Davila, 2000). These control problems are inherently different from the ones arising from process innovation, thus requiring specific control mechanisms (Davila, 2000).

Accordingly, our first hypotheses are as follows:

H1a. The higher the level of process innovation, the lower the level of contract completeness.
H1b. The higher the level of product innovation, the lower the level of contract completeness.

If contracts can be viewed as an ensemble of clauses and provisions that are comprehensive or necessarily incomplete, then they can also be analysed from a managerial perspective in terms of the mechanisms they embody. Within inter-firm relationships, contracts act as a governance mechanism of the relationship (Eisenhardt, 1984). In that context, when setting the rules of the relationship, parties can decide to formalise a set of controls embedded in the contractual framework or, alternatively, rely on non-contractual controls (e.g. procedures or reporting systems that are introduced despite not being required contractually).

Previous literature has already indicated that contracts are flexible tools that can be adapted in line with their purpose [for a review, see Roehrich et al. (2019)]. Accordingly, it is possible to observe a wide spectrum of contracts, from complete formal contracts that codify roles, responsibilities, and duties required by both parties to incomplete "relational" contracts that are focused on general procedures and commitments, complemented by extra-contractual mechanisms (Grandori, 2006). Recently, Grandori and Furlotti (2018) theorised a third type of contract, which attempts to reduce the distance between complete formal contracts and "relational" contracts (Baker et al., 2002), namely "constitutional" contracts. These contracts set out the fundamental rules of the relationships, avoiding the inclusion of strict provisions that are not suitable in the context of uncertainty, balancing flexibility and formalisation (Grandori, 2006).

While our definition of contract completeness (H1) considers the entire set of contractual clauses regardless of their content, we now focus on those clauses related to formal *ex ante* management controls. These controls, once included in the contract, are structurally rigid and cannot be easily adapted. Generally, the greater contractual hazards embedded in innovation should increase the inclusion of control specifications in the contract. At the same time, the uncertainty derived from innovation should lead to more flexibility, which is consistent with less inclusion of control specifications in the contract (Furlotti, 2007). To avoid an abundance of rigidity deriving from contracts, the definition of control mechanisms would not be included in the contract, given that its inclusion would require the *ex ante* definition of the contribution of each party toward the final output and how to achieve it, and this could be unfeasible in innovative contexts where the way to develop the innovative output is not necessarily known in advance (Caglio & Ditillo, 2021).

Accordingly, we posit that:

H2a. The higher the level of process innovation, the lower the degree of inclusion of control specifications in the contract.
H2b. The higher the level of product innovation, the lower the degree of inclusion of control specifications in the contract.

The expected negative relation between innovation and the inclusion of control specifications should not be intended as an absence of formal controls. Indeed, it has been observed that, in contexts characterised by high uncertainty, relational contracting is beneficial for ensuring that both parties fulfil their commitments (Carson et al., 2006) without increasing rigidity. While contracts may be incomplete, parties can still jointly decide to rely on formal controls that exist outside of the contract, referred to as "formal non-contractual controls", in line with a formal-relational pattern of controls (Keller et al., 2021).

Unlike contractual controls, which are explicitly defined within the contract and enforceable through legal mechanisms, non-contractual controls (such as the activation of ad hoc procedures) operate more flexibly and are often based on mutual understanding and informal agreements. High uncertainty, low output measurability, and the need for flexibility are expected to hinder the *ex ante* formalisation of control mechanisms during the contractual phase (Vedel & Geraldi, 2022), making the adoption of a bureaucratic control pattern less viable (Caglio & Ditillo, 2008).

In innovative contexts, the role of uncertainty and flexibility is critical. The unpredictable nature of innovation often necessitates adaptive control approaches rather than rigid contractual agreements. Formal *ex post* management control systems, in this scenario, can ensure output control by providing mechanisms for assessing performance *ex post*. These systems help mitigate communication issues arising from different levels of technical knowledge among parties, thereby facilitating mutual adjustments and supporting an environment favourable to innovation (Ditillo & Caglio, 2018). For instance, in contexts characterised by low output measurability, *ex post* controls (such as reports) allow parties to evaluate contributions based on performance outcomes rather than predefined expectations, thus enhancing adaptability and responsiveness.

Moreover, the characteristics of process innovation and product innovation influence the use of non-contractual controls across different pathways. Process innovation often involves changes to operational workflows and internal systems, which may require more flexibility in control mechanisms to accommodate ongoing adjustments. In contrast, product innovation typically focuses on the final output, where the emphasis may be on verifying and measuring the output.

Accordingly, we posit that:

H3a. The higher the level of process innovation, the higher the use of non-contractual controls.
H3b. The higher the level of product innovation, the higher the use of non-contractual controls.

3 Research design

The list of target companies was obtained from the Amadeus database, using the "NACE Rev 2 classification".[1] Amadeus was chosen to ensure that our sample also included private companies. We applied a filter for geography (to isolate Italian companies) and size, in order to only include enterprises that reported at least €10 million[2] in revenues in the list. We retrieved a list of 1250 firms, which were then subjected to a preliminary screening through institutional websites to take out all those companies that did not have their own brands (so they were pure subcontractors), firms that were undergoing liquidation, and companies focused on unrelated businesses, such as safety shoes, plastic bags, or the soles of shoes. At the end of this process, we proceeded to direct-call the resulting 419 companies to introduce the research and ask for a contact in a product manager or analogue role. Once obtained, we sent the questionnaire via email, along with a guarantee of confidentiality and allowing access to the study's final results. Initial messages and follow-up emails were sent between 2015 and 2016. In particular, the follow-up emails increased the response rate, with 53 questionnaires being collected and 48 being found to be usable for our analysis.

The focus on the fashion industry was motivated by the need to observe a context where the requirement to innovate is explicit and intertwined with other activities (Davila & Ditillo, 2017). Moreover, fashion companies must deal with the renewal of their collections (product innovation) and activities (process innovation) in conjunction with their suppliers. Indeed, in contrast to other industries, where innovation is handled internally, fashion firms are used to outsourcing design activities to suppliers (Caniato et al., 2015; Shen et al., 2016), increasing both the risk of value appropriation and the need for coordination among parties. In addition, the choice to focus on companies based in a single country was made to ensure that our results were not driven by comparability issues between different legal frameworks. Moreover, within European countries, Italy provides a suitable research setting, given the relevance of the fashion industry in the country. Indeed, the Italian fashion industry generates 1.2% of the national GDP, with 75% of national production. Moreover, Italy emerged as the foremost producer of high fashion in the world (Mediobanca, 2024). These characteristics allowed us to observe a highly dynamic sector, where

[1] Among the wide set of codes related to the fashion industry, we specifically identified those referencing a production process, while excluding trading companies without production. In particular, the search strategy included the following codes: 14—manufacture of garments; 15—manufacture of leather and related products; 4641—wholesale of textiles; 4642—wholesale of clothing and footwear; 4771—retail sale of clothing in specialised stores; 4772—retail sale of footwear and leather goods in specialised stores.

[2] The choice to include only companies with a minimum of €10 million in sales is intended to exclude micro and small companies, as defined by the European Commission (Recommendation 2003/361). This choice is motivated by the need to focus on contexts where contract and control formalisation plays a more significant role. Micro and small entities, by contrast, tend to regulate their relationships using interpersonal and trust-based mechanisms (Murthy & Paul, 2016), where contracts may have a different impact on shaping buyer–supplier relationships.

inter-organisational relationships are necessary to cope with design and production processes and where innovation is at the core of both activities.

Data were collected through a survey instrument. In order to develop the questionnaire, we analysed eight contractual documents provided by firms, which then participated in the survey. Referring to the literature about contracts (e.g. Anderson & Dekker, 2005), we identified those contractual elements considered by previous contributors to be relevant for regulating the transactions in buyer–supplier relationships (e.g. purchase prices—terms of payment, warranties, inspections, duration, quality control before acceptance of delivered goods, related timing). We made a list of all these elements, and we cross-checked all the documents to verify how often they were included as part of the contractual clauses. We then used this cross-checked list to operationalise the dimensions included in contracts and to formulate our survey questions. In addition, we interviewed practitioners in different roles (supply chain managers, controllers, operations managers) to understand the most important aspects of the relationships with suppliers to include in the questions, to validate the measures (and related language) and the plausibility of the hypotheses. The set of questions focused on the respondents, their firms' characteristics, a supplier chosen by each respondent (termed "supplier ALPHA"), and a related product supplied by ALPHA (termed "product BETA"). All of the characteristics of "supplier ALPHA", the underlying relationship, and the level of delegation/outsourcing to "supplier ALPHA" were investigated. Some questions specifically focused on product BETA and process innovation. Further questions were related to the features of the contract stipulated with ALPHA relative to BETA and to the different management controls, potentially used together with the contract, for managing the relationship with ALPHA relative to BETA.

3.1 Variable definition and measurement[3]

3.1.1 Innovation

In our study, based on previous literature, we distinguished two dimensions of innovation: process innovation and product innovation.

3.1.1.1 Process innovation Drawing on Bensaou and Venkatraman (1995), we operationalised process innovation by using several questions, measured on a Likert scale from 1 to 7, to assess the extent to which: tasks managed by supplier ALPHA, with reference to product BETA, are the same; there is a clear sequence of steps for performing the work; duties are repetitive; there are established know-hows, procedures and practices that guide the work carried out by supplier ALPHA.

3.1.1.2 Product innovation To define and measure product innovation, we adapted the approach used by Davila (2000) and asked whether product BETA was: a simple

[3] The full list of questions and variables is reported in Appendix 1.

adaptation of an existing model (e.g. a new colour or pattern), a simple redesign of an existing model (e.g. a new fabric), a major redesign of an existing model (e.g. a new cut style), a new model replacing an existing model, or a completely new model. With this question, we represented situations characterised by an increasing level of product innovation (where the first situation represents the lowest and the last situation represents the highest, on a scale from 1 to 5).

3.1.2 Contract completeness

Contract completeness pertains to the number of specific terms and provisions that were included in formal contracts, and the extent of their inclusion. It has been measured in different ways in the literature. Reuer and Ariño (2005), in line with Parkhe (1993), used a weighted average of eight indicators. Drawing on these contributions, we first analysed a sample of contracts to identify the most recurrent terms and provisions used in the fashion industry to regulate the relationship with suppliers. We identified 20 items and then asked the respondents the extent to which (on a Likert scale from 1 to 7) these different items were included in their contracts with supplier ALPHA.

3.1.3 Inclusion of control specifications and use of non-contractual controls

The inclusion of control specifications refers to the extent to which management controls were explicitly included in the contract as mechanisms to be used between the parties. We also asked respondents whether specific management control mechanisms were used to manage the relationship with supplier ALPHA, despite them not being included in the contract. We drew on the work by van den Bogaard and Speklé (2003), van der Meer-Kooistra and Vosselman (2000), Abernethy and Brownell (1997), Govindarajan and Fisher (1990), and Ouchi (1979) to identify the relevant control mechanisms that could be adopted to support inter-organisational relationships. In particular, we asked respondents to specify whether the identified mechanisms were indicated in the contract or not and the extent to which they were used during transactions and contract execution.

3.1.4 Controls

In our analyses, we employed several controls drawing on extant relevant contributions. First, we considered some *features of the relationship* between the company and the supplier. In line with the literature on relational contracting in high-uncertainty contexts (Carson et al., 2006), we included a variable to reflect *Trust.* Based on Bensaou and Venkatraman (1995), we characterised the relationship between the company and supplier ALPHA in terms of the amount of work that was delegated to the supplier, i.e. the Level of Delegation (*Deleg*). We also added a variable to control for the duration of the relationship (*Duration*) and for whether the relationship is equity-based (*Eq_Particip)* (Anderson et al., 2013; Caglio & Ditillo, 2012b). Second, we considered three *supplier's characteristics*—the number of employees of the supplier (*Nu_Employees)*, the degree of knowledge of the activities performed

by supplier ALPHA (*Deg_Know)*, and the number of alternative suppliers (*Alt_Suppliers*)—that could mainly impact on the relative bargaining power of the contracting firms (Grandori, 2006). Third, we controlled for the level of satisfaction of the buying firm (i.e. the respondent's company) with reference to several dimensions of supplier ALPHA's activities (Delivery, Quality, Price, Conformity, and Interaction) to introduce a proxy for the *supplier's performance* into our analysis (*Sat_Delivery*, *Sat_Quality*, *Sat_Price*, *Sat_Conform*, *Sat_Interact)*. Fourth and finally, in relation to supplier performance [in line with Brown and Potoski (2005) and Ouchi (1979)], we also controlled for the *level of measurability of output and performance* (*Output_Meas* and *Perf_Meas*), as well as for the *ease of monitoring* of activities of supplier ALPHA (Activ_*Meas*). All of the questions referring to controls are reported in Appendix 1.

In order to test our hypotheses, the variables of interest (Contract Completeness, Degree of Inclusion of Control specifications, and Use of Non-contractual Controls) were included as dependent variables in a set of partial least squares-structural equation modelling (PLS-SEM) models. Product Innovation and Process Innovation represented our test-independent variables. As we acknowledge that other factors may influence controls in inter-organisational settings, our models included several control variables.

To observe the relation between the level of innovation and our test variables, a set of PLS-SEM models was built using SmartPLS 4, an approach that is particularly suitable for small samples like ours. All of the models presented were calculated using the bootstrapping procedure (5,000 repetitions) with a PCA factor weighting scheme. The coefficients and p-value of the variables measuring both product and process innovation were then observed in order to validate our hypotheses. In order to corroborate the robustness of our results, a set of parametric OLS models, estimated using SPSS, are provided in the Robustness Checks section.

Our models can be summarised as follows (Fig. 1):

In the different model specifications, the dependent variable *Contractual and Non Contractual controls* comprised:

- Contract completeness (H1);
- Degree of inclusion of control specifications (H2); and

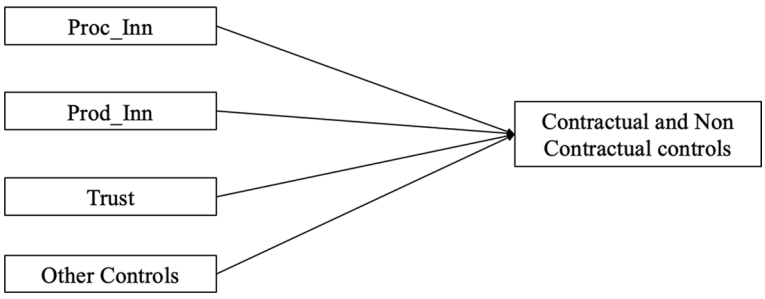

Fig. 1 General PLS-SEM model representation

– Use of non-contractual controls (H3).

Prod_Inn and *Proc_Inn* represent proxies for product and process innovation. All the models included a set of control variables which were consistent with the previous related literature (*Trust*, *Deleg*, *Nu_Employees*, *Deg_Know*, *Eq_Particip*, *Alt_Suppliers*, *Sat_Delivery*, *Sat_Quality*, *Sat_Price*, *Sat_Conform*, *Sat_Interact*, *Duration*, *Output_Meas*, *Activ_Meas*, and *Perf_Meas*).

4 Results

4.1 Descriptive statistics

Table 1 reports descriptive statistics for the variables used in our analyses. We observe that, on average, contract completeness, in its different dimensions, is moderate, with approximately one formal control included in the contract. The average use of non-contractual controls is 3.23 (on a 1–7 scale). Moreover, in our sample, process innovation is higher, on average, than product innovation. With regard to our control variables, we observe that both trust and delegation are relevant. Overall, supplier performance is high, while only 4% of sampled companies have an equity participation in the supplier. Finally, on average, the relationship with suppliers has been in place for 36 months.

In terms of respondent characteristics, we involved product managers holding senior positions within the company hierarchy, such as managing directors or production managers. The average respondent is 47 years old, with a tenure of 13 years in his/her current role.

Firms represented in our sample primarily engaged in mono-business activities, focusing on the production of clothing and accessories, despite operating for multiple brands.

Given that respondents were contacted at three distinct time points, we compared the average values of the first and last respondent groups. No significant differences were observed between the group means. Since the later respondents were closer to non-respondents (Groves & Peytcheva, 2008), the potential non-response bias should be mitigated. In addition, since our survey instrument was designed to collect both the independent and dependent variables, a Harman's one-factor test was performed to mitigate common method bias concerns. This test was performed using SPSS. The total variance extracted by a single factor, comprising all the variables included in the models, is equal to 18.6% and below the 50% threshold, suggesting that our variables cannot be grouped together into a single factor.

Finally, missing values (which constituted less than 10% of all the answers for each observation) of continuous variables were replaced with the sample mean. Any missing values for dummy variables were replaced with the sample mode.[4]

[4] To further check our results, we replaced missing values of continuous variables with the sample median. All the main results remain unchanged.

Table 1 Descriptive statistics

Variable name	Construct	Obs	Mean	Median	Min	Max	SD
ProdOp_Asp_1	Contract completeness	48	4.024	4.024	1.000	7.000	1.909
ProdOp_Asp_2	Contract completeness	48	3.610	3.610	1.000	7.000	1.619
ProdOp_Asp_3	Contract completeness	48	4.122	4.122	1.000	7.000	1.544
ProdOp_Asp_4	Contract completeness	48	3.976	4.000	1.000	7.000	1.521
ProdOp_Asp_5	Contract completeness	48	3.714	3.714	1.000	7.000	1.662
ProdOp_Asp_6	Contract completeness	48	3.300	3.300	1.000	7.000	1.710
ProdOp_Asp_7	Contract completeness	48	3.951	4.000	1.000	7.000	1.527
AdmLe_Asp_1	Contract completeness	48	3.439	3.000	1.000	7.000	1.780
AdmLe_Asp_2	Contract completeness	48	4.171	4.171	1.000	7.000	1.825
AdmLe_Asp_3	Contract completeness	48	3.878	4.000	1.000	7.000	1.782
AdmLe_Asp_4	Contract completeness	48	4.048	4.000	1.000	7.000	1.837
AdmLe_Asp_5	Contract completeness	48	3.452	3.452	1.000	7.000	1.971
AdmLe_Asp_6	Contract completeness	48	4.268	4.268	1.000	7.000	1.969
Dur_Ter_1	Contract completeness	48	4.405	4.405	1.000	7.000	2.072
Dur_Ter_2	Contract completeness	48	4.119	4.119	1.000	7.000	2.033
Contr_Contract	Inclusion of contractual controls	48	1.122	1.000	0.000	8.000	1.610
Use_Non_Contr	Use of non contractual controls	48	3.231	3.250	1.200	6.000	1.003
Prod_Inn	Product innovation	48	3.778	3.778	1.000	5.000	1.120
Proc_Inn_1	Process innovation	48	5.047	5.000	3.000	7.000	1.098
Proc_Inn_2	Process innovation	48	5.070	5.000	3.000	7.000	0.987
Proc_Inn_3	Process innovation	48	4.837	5.000	2.000	7.000	1.135
Proc_Inn_4	Process innovation	48	4.762	5.000	2.000	7.000	1.133
Proc_Inn_5	Process innovation	48	4.628	5.000	1.000	7.000	1.155
Proc_Inn_6	Process innovation	48	4.791	5.000	2.000	7.000	0.926
Proc_Inn_7	Process innovation	48	4.558	5.000	2.000	7.000	0.897
Proc_Inn_8	Process innovation	48	4.721	5.000	2.000	7.000	0.943
Trust_1	Trust	48	5.064	5.000	1.000	7.000	1.180
Trust_2	Trust	48	5.213	5.000	1.000	7.000	1.413
Trust_3	Trust	48	5.426	5.426	1.000	7.000	1.319
Trust_4	Trust	48	5.660	6.000	4.000	7.000	0.873
Deleg	Delegation	48	4.935	5.000	2.000	7.000	1.297
Nu_Employees	Supplier's characteristics	48	4.000	4.000	1.000	7.000	2.051
Deg_Know	Supplier's characteristics	48	4.844	5.000	2.000	7.000	0.865
Eq_Particip	Supplier's characteristics	48	0.042	0.000	0.000	1.000	0.200
Alt_Suppliers	Supplier's characteristics	48	4.022	4.000	2.000	6.000	0.989
Sat_Delivery	Supplier's performance	48	4.511	4.511	3.000	6.000	0.781
Sat_Quality	Supplier's performance	48	4.800	5.000	3.000	7.000	0.753
Sat_Price	Supplier's performance	48	4.356	4.000	3.000	7.000	0.939
Sat_Conform	Supplier's performance	48	4.822	5.000	2.000	6.000	0.744
Sat_Interact	Supplier's performance	48	5.044	5.000	2.000	7.000	0.978
Duration	Duration of the relationship	48	38.175	36.000	0.000	276.000	49.948
Output_Meas	Level of measurability	48	4.884	5.000	3.000	7.000	0.713

Table 1 (continued)

Variable name	Construct	Obs	Mean	Median	Min	Max	SD
Activ_Meas	Level of measurability	48	4.395	4.395	2.000	6.000	0.869
Perf_Meas	Level of measurability	48	4.419	4.419	2.000	7.000	0.847

4.2 Principal component analysis (PCA)

In order to reduce the dimensions and test the validity and reliability of our first dependent variable, i.e. Contract Completeness, PCA was applied. Since we are testing the dimensionality of several scales existing in the literature, PCA is used with a confirmatory approach. In this context, the aim is to examine whether the observed data support the proposed dimensional structure of the scale.

When performing the analyses, we included only the components with eigenvalues greater than one, to focus on the most influential and informative dimensions of the data. With the goal of achieving distinct and easily interpretable factor loadings, we used varimax rotation. Finally, for estimating the factor score coefficients used in the ordinary least squares (OLS) models reported in the Robustness Checks section, we employed the regression method available in the SPSS PCA package.

As reported in Table 2, a three-component structure emerged for Contract Completeness. The first component includes seven items representing Production and Operational Aspects; the second component includes six items measuring the presence of Administrative and Legal Aspects; finally, the third component measures Duration Terms. The one-dimensional nature of the three components is confirmed by the factor loadings, which are all above 0.5; their reliability was tested with Cronbach's alphas, which are higher than 0.7.

Our measure for Process Innovation was similarly factorised. PCA confirmed the presence of a single component including all eight items. Both the validity and reliability of the measure are confirmed by the factor loadings and the Cronbach's alpha. To adjust for item direction, our models included the inverse value of the factor scores (Table 3).

We also applied PCA to reduce the dimensions of one of our control variables, i.e. Trust. The results confirm the presence of a single component structure (alpha = 0.844) (Table 4).

4.3 Bivariate analysis

After defining the factors, we calculated the correlations between all dependent, independent and control variables. We also checked for potential multicollinearity problems: our results do not indicate any issues in this respect (Table 5).

Table 2 PCA on contract completeness

Component	Items	Factor loading	Scale statistics
Production and operational aspects	ProdOp_Asp_1	0.763	Cronbach's alpha: 0.914; eigenvalue (variance explained): 7.322 (48.8%)
	ProdOp_Asp_2	0.884	
	ProdOp_Asp_3	0.763	
	ProdOp_Asp_4	0.812	
	ProdOp_Asp_5	0.703	
	ProdOp_Asp_6	0.763	
	ProdOp_Asp_7	0.822	
Administrative and legal aspects	AdmLe_Asp_1	0.777	Cronbach's alpha: 0.907; eigenvalue (variance explained): 2.330 (15.5%)
	AdmLe_Asp_2	0.807	
	AdmLe_Asp_3	0.785	
	AdmLe_Asp_4	0.822	
	AdmLe_Asp_5	0.796	
	AdmLe_Asp_6	0.702	
Duration terms	Dur_Ter_1	0.89	Cronbach's alpha: 0.749; eigenvalue (variance explained): 1.338 (8.9%)
	Dur_Ter_2	0.724	

ProdOp_Asp_1, Likert-type variable indicating the extent to which the contract includes raw material issues; ProdOp_Asp_2, Likert-type variable indicating the extent to which the contract includes prototype approval; ProdOp_Asp_3, Likert-type variable indicating the extent to which the contract includes finished product approval; ProdOp_Asp_4, Likert-type variable indicating the extent to which the contract includes price determination mechanisms; ProdOp_Asp_5, Likert-type variable indicating the extent to which the contract includes payment terms; ProdOp_Asp_6, Likert-type variable indicating the extent to which the contract includes technical specifications; ProdOp_Asp_7, Likert-type variable indicating the extent to which the contract includes quality issues; AdmLe_Asp_1, Likert-type variable indicating the extent to which the contract includes purchase orders procedures; AdmLe_Asp_2, Likert-type variable indicating the extent to which the contract includes confidentiality issues; AdmLe_Asp_3, Likert-type variable indicating the extent to which the contract includes contract termination—time and conditions; AdmLe_Asp_4, Likert-type variable indicating the extent to which the contract includes insurance, risks and liabilities; AdmLe_Asp_5, Likert-type variable indicating the extent to which the contract includes obligations and responsibilities; AdmLe_Asp_6, Likert-type variable indicating the extent to which the contract includes warranties; Dur_Ter_1, Likert-type variable indicating the extent to which the contract includes duration of the contract; Dur_Ter_2, Likert-type variable indicating the extent to which the contract includes renewal/termination conditions

Table 3 PCA on process innovation

Component	Items	Factor loading	Scale statistics
Process Innovation	Proc_Inn_1	0.768	Cronbach's alpha: 0.916; eigenvalue (variance explained): 5.067 (63.3%)
	Proc_Inn_2	0.755	
	Proc_Inn_3	0.872	
	Proc_Inn_4	0.823	
	Proc_Inn_5	0.852	
	Proc_Inn_6	0.71	
	Proc_Inn_7	0.817	
	Proc_Inn_8	0.756	

Proc_Inn_1, Likert-type variable indicating to what extent there is an understandable sequence of steps that can be followed by the supplier in doing its work; Proc_Inn_2, Likert-type variable indicating to what extent there is an understandable sequence of steps that can be followed by the supplier in carrying out its work; Proc_Inn_3, Likert-type variable indicating to what extent suppliers' task are repetitive; Proc_Inn_4, Likert-type variable indicating to what extent there is a clearly known way to do the major types of work normally encountered by the supplier; Proc_Inn_5, Likert-type variable indicating to what extent the supplier performs repetitive activities in carrying out its work; Proc_Inn_6, Likert-type variable indicating to what extent the work of the supplier is considered routine; Proc_Inn_7, Likert-type variable indicating to what extent there is a clearly defined body of knowledge of subject matter which can guide the work done by the supplier; Proc_Inn_8, Likert-type variable indicating to what extent the personnel of the supplier relies on established procedures and practices

Table 4 PCA on trust

Component	Items	Factor loading	Scale statistics
Trust	Trust_1	0.831	Cronbach's Alpha: 0.844; eigenvalue (variance explained): 2.777 (69.4%)
	Trust_2	0.877	
	Trust_3	0.818	
	Trust_4	0.804	

Trust_1, Likert-type variable indicating to what extent conflicts are expected to be resolved fairly, even if no guidelines were given by formal agreements; Trust_2, Likert-type variable indicating to what extent both parties are expected to share helpful information to an extent beyond that required by the formal agreements; Trust_3, Likert-type variable indicating to what extent both parties hold mutual expectations that each of them will be flexible and responsive to requests by the other, even if not obliged to by formal agreements; Trust_4, Likert-type variable indicating to what extent both parties understand that problems arising during the relationship will be solved jointly through communication and cooperation rather than just referring to their formal agreements

Table 5 Correlation matrix

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1	ProdOp_Asp	1.000																					
2	AdmLe_Asp	0.000	1.000																				
3	Dur_Terms	0.000	0.000	1.000																			
4	Contr_Contract	0.137	0.352*	0.042	1.000																		
5	Use_Non_Contr	− 0.059	0.225	− 0.008	− 0.447*	1.000																	
6	Proc_Inn	0.222	− 0.004	0.146	0.143	0.029	1.000																
7	Prod_Inn	− 0.289*	− 0.083	0.139	− 0.329*	− 0.141	− 0.095	1.000															
8	Trust	− 0.143	− 0.121	0.374*	− 0.398*	0.367*	0.074	0.073	1.000														
9	Deleg	− 0.006	− 0.197	0.097	− 0.314*	− 0.114	− 0.001	0.256	0.267	1.000													
10	Nu_Employees	− 0.226	0.200	0.098	0.264	− 0.013	0.245	− 0.042	− 0.045	− 0.179	1.000												
11	Deg_Know	− 0.072	0.326*	0.275	0.163	0.038	0.068	0.154	− 0.070	− 0.093	0.376*	1.000											
12	Eq_Particip	− 0.086	− 0.003	0.247	0.049	0.092	0.245	− 0.012	0.026	− 0.070	0.102	0.158	1.000										
13	Alt_Suppliers	− 0.078	0.209	0.292*	0.131	0.327*	0.016	− 0.220	0.234	− 0.211	0.205	0.150	0.206	1.000									
14	Sat_Delivery	− 0.128	− 0.131	0.115	0.058	− 0.231	0.130	0.108	0.080	0.021	0.156	0.172	0.264	− 0.014	1.000								
15	Sat_Quality	− 0.106	0.132	0.133	0.028	− 0.087	0.128	0.060	0.267	0.021	− 0.027	0.211	0.194	0.173	0.376*	1.000							
16	Sat_Price	− 0.173	− 0.097	0.421*	0.000	0.195	0.296*	0.121	0.200	0.171	0.443*	0.372*	0.032	0.216	0.137	0.094	1.000						
17	Sat_Conform	− 0.149	0.298*	0.140	0.136	0.005	0.038	0.128	0.324*	0.108	0.205	0.316*	0.050	0.175	0.434*	0.684*	0.264	1.000					
18	Sat_Interact	− 0.189	0.166	0.227	− 0.014	0.202	0.082	0.138	0.264	− 0.066	0.228	0.352*	0.204	0.214	0.354*	0.492*	0.370*	0.525*	1.000				
19	Duration	0.073	0.033	0.013	− 0.273	0.143	− 0.029	0.133	0.082	0.059	0.022	0.146	0.003	− 0.119	0.105	0.070	− 0.064	− 0.097	0.124	1.000			

Table 5 (continued)

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
20	Output_Meas	0.254	− 0.066	− 0.206	− 0.054	− 0.057	0.438*	0.040	− 0.115	0.076	− 0.123	− 0.040	0.034	− 0.116	− 0.017	0.012	− 0.145	0.094	0.038	− 0.004	1.000		
21	Activ_Meas	− 0.164	0.021	0.094	0.277	− 0.152	0.237	0.122	0.124	− 0.048	0.173	0.288*	0.145	− 0.082	0.010	0.169	0.248	0.320*	0.168	− 0.035	0.234	1.000	
22	Perf_Meas	− 0.099	0.090	0.240	0.162	0.029	0.317*	− 0.008	0.302*	− 0.122	0.189	0.222	0.143	0.337*	0.151	0.292*	0.330*	0.413*	0.395*	− 0.218	0.382*	0.619*	1.000

*p value < 0.05

ProdOp_Asp: component comprising the seven items for production and operational aspects (contract completeness); AdmLe_Asp: component comprising the six items for administrative and legal aspects (contract completeness); Dur_Terms: component comprising the two items for duration terms (contract completeness); Contr_Contract: variable measuring the number of controls included in the contract; Use_Non_Contr: variable indicating the average degree of use of non-contractual controls; Prod_Inn: Likert-type variable measuring product innovation; Proc_Inn: component comprising the eight items for process innovation; Trust: component comprising the four items of trust; Deleg: variable measuring the percentage of the total job delegated to the supplier; Nu_Employees: variable measuring the number of supplier's employees; Deg_Know: variable measuring the degree of knowledge of the supplier and of its activities; Eq_Particip: dummy variable indicating the presence of an equity participation in the supplier; Alt_Suppliers: variable measuring the number of alternative suppliers; Sat_Delivery: Likert-type variable measuring the level of satisfaction with reference to delivery aspects; Sat_Quality: Likert-type variable measuring the level of satisfaction with reference to quality aspects; Sat_Price: Likert-type variable measuring the level of satisfaction with reference to price aspects; Sat_Conform: Likert-type variable measuring the level of satisfaction with reference to conformity aspects; Sat_Interact: Likert-type variable measuring the level of satisfaction with reference to interaction aspects; Duration: variable measuring the duration of the relationship in months; Output_Meas: Likert-type variable measuring output measurability; Activ_Meas: Likert-type variable measuring activity measurability; Perf_Meas: Likert-type variable measuring performance measurability

4.4 PLS-SEM results

4.4.1 Contract completeness

In order to test our hypotheses for Contract Completeness (H1a and H1b), four PLS-SEM regression models were estimated. The first model, summarised in Fig. 2, relates our independent and control variables with all 15 items measuring Contract Completeness. The results support the presence of a strong negative relation between Process Innovation (at the 0.01 level) and Contract Completeness, while Product Innovation is not significantly related to the latter.

The negative relationship between Process Innovation and Contract Completeness may reflect a strategic choice by firms to maintain flexibility in highly innovative environments, where rigid contracts could hinder adaptation and experimentation. The limited knowledge of the transformation process inherent in process innovation incentivises parties to rely on incomplete contracts allowing them to adjust terms as uncertainties arise and new information becomes available. In contrast, the lack of a significant relationship between Product Innovation and Contract Completeness suggests that product innovations may not require the

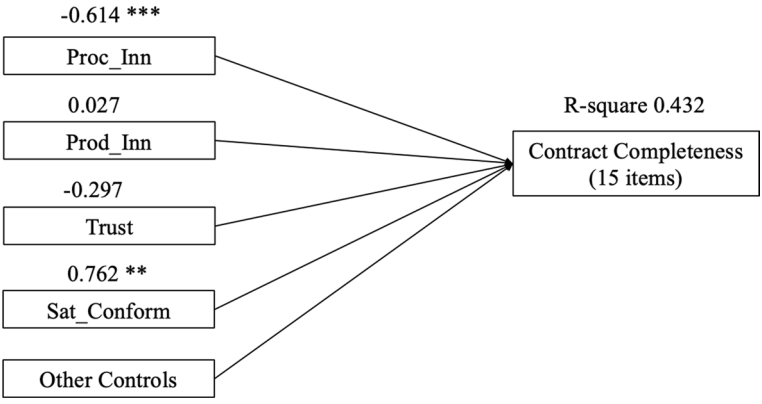

Fig. 2 PLS-SEM model for contract completeness (general). The figure summarises the coefficients and significance of a PLM-SEM model regressing contract completeness (general) on process and product innovation. The model includes the following variables. Contract Completeness: component comprising the fifteen items for contract completeness. Prod_Inn: Likert-type variable measuring product innovation; Proc_Inn: component comprising the eight items for process innovation; Trust: component comprising the four items of trust; Deleg: variable measuring the percentage of the total job delegated to the supplier; Nu_Employees: variable measuring the number of supplier's employees; Deg_Know: variable measuring the degree of knowledge of the supplier and of its activities; Alt_Suppliers: variable measuring the number of alternative suppliers; Sat_Delivery: Likert-type variable measuring the level of satisfaction with reference to delivery aspects; Sat_Quality: Likert-type variable measuring the level of satisfaction with reference to quality aspects; Sat_Price: Likert-type variable measuring the level of satisfaction with reference to price aspects; Sat_Conform: Likert-type variable measuring the level of satisfaction with reference to conformity aspects; Sat_Interact: Likert-type variable measuring the level of satisfaction with reference to interaction aspects; Duration: variable measuring the duration of the relationship in months; Output_Meas: Likert-type variable measuring output measurability; Activ_Meas: Likert-type variable measuring activity measurability; Perf_Meas: Likert-type variable measuring performance measurability. ***$p < 0.01$; **$p < 0.05$; *$p < 0.10$

same level of contractual flexibility, possibly because innovative product characteristics are more tangible and predictable than those of process innovations.

Accordingly, H1a (*The higher the level of process innovation, the lower the level of contract completeness*) is supported, while H1b (*The higher the level of product innovation, the lower the level of contract completeness*) is rejected.

As for the other control variables, we observe that Contract Completeness is positively associated with the level of satisfaction related to conformity aspects (at the 0.05 level), while the other control variables are not significant.

In order to assess whether the associations between our independent and control variables change, with reference to different dimensions of Contract Completeness (i.e. with the nature of the different clauses included in the contract), we also built three models considering the three components of Contract Completeness emerging from the PCA analysis, separately, specifically: Production and Operational Aspects, Administrative and Legal Aspects, and Duration Terms. A graphical representation of these results is presented in Appendix 2. The results support the presence of a negative relation between the degree of Process Innovation and Contract Completeness, in terms of Production and Operational Aspects (Fig. 5) and Administrative and Legal Aspects (Fig. 6), significant at the 0.01 level. We also observe a weak negative relation (0.1 level) between the degree of Process Innovation and Contract Completeness, with respect to Duration Terms (Fig. 7).

As for the other control variables, the level of Trust is not related to any specific dimension of Contract Completeness. Finally, we observe that Administrative and Legal Aspects in the contract are negatively associated with the level of satisfaction related to delivery and price aspects, while these aspects are positively associated with the level of satisfaction related to conformity aspects.

4.4.2 Degree of inclusion of control specifications in the contract

The empirical model testing the Degree of Inclusion of control specifications (H2a and H2b) is presented in Fig. 3. Our model confirms the negative relation between Process Innovation and the test variable, while Product Innovation is not significant. These results are consistent with the findings from the analyses of contract completeness, which are valid both when considering the entire set of contractual clauses and when focusing on those clauses introducing formal ex-ante control mechanisms.

Accordingly, H2a (*The higher the level of process innovation, the lower the degree of inclusion of control specifications in the contract*) is supported, while H2b (*The higher the level of product innovation, the lower the degree of inclusion of control specifications in the contract.*) is rejected.

As for the control variables, we observe that the level of trust is significantly and negatively related to the Degree of Inclusion of control specifications. With the exclusion of output measurability, which has a weak negative effect (0.1 level) on the test variable, the other control variables included in the model do not have any significant associations.

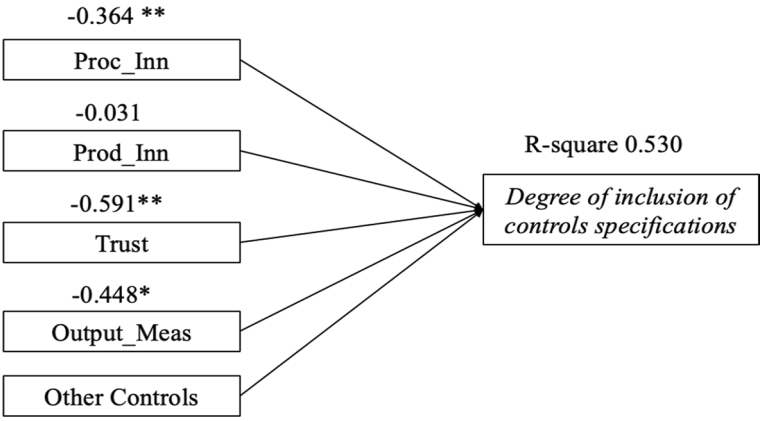

Fig. 3 PLS-SEM model for degree of Inclusion of control specifications. The figure summarises the coefficients and significance of a PLM-SEM model regressing the degree of inclusion of control specifications on process and product innovation. The model includes the following variables. Contr_Contract: variable measuring the number of controls included in the contract; Prod_Inn: Likert-type variable measuring product innovation; Proc_Inn: component comprising the eight items for process innovation; Trust: component comprising the four items of trust; Deleg: variable measuring the percentage of the total job delegated to the supplier; Nu_Employees: variable measuring the number of supplier's employees; Deg_Know: variable measuring the degree of knowledge of the supplier and of its activities; Alt_Suppliers: variable measuring the number of alternative suppliers; Sat_Delivery: Likert-type variable measuring the level of satisfaction with reference to delivery aspects; Sat_Quality: Likert-type variable measuring the level of satisfaction with reference to quality aspects; Sat_Price: Likert-type variable measuring the level of satisfaction with reference to price aspects; Sat_Conform: Likert-type variable measuring the level of satisfaction with reference to conformity aspects; Sat_Interact: Likert-type variable measuring the level of satisfaction with reference to interaction aspects; Duration: variable measuring the duration of the relationship in months; Output_Meas: Likert-type variable measuring output measurability; Activ_Meas: Likert-type variable measuring activity measurability; Perf_Meas: Likert-type variable measuring performance measurability. ***$p < 0.01$; **$p < 0.05$; *$p < 0.10$

4.4.3 Use of non-contractual controls

Figure 4 contains our model for the use of non-contractual controls (H3a and H3b). The results of the PLS-SEM model do not confirm the direct impact of either Product or Process Innovation. Instead, Trust has a positive relation with the dependent variable. The result for Trust must be read in conjunction with those arising from the previous model. Indeed, Trust negatively influences the presence of contractual controls, and the same variable is positively related to the degree of use of non-contractual controls. The coefficients for our control variables suggest that the use of non-contractual controls is positively affected by the number of alternative suppliers and negatively by satisfaction, with reference to the delivery aspects.

Thus, we conclude that H3a (*The higher the level of process innovation, the higher the use of non-contractual controls)* and H3b (*The higher the level of product innovation, the higher the use of non-contractual controls)* are both rejected.

The lack of a significant direct impact of either Product or Process Innovation is unexpected, given the expectation that in contexts characterised by innovation,

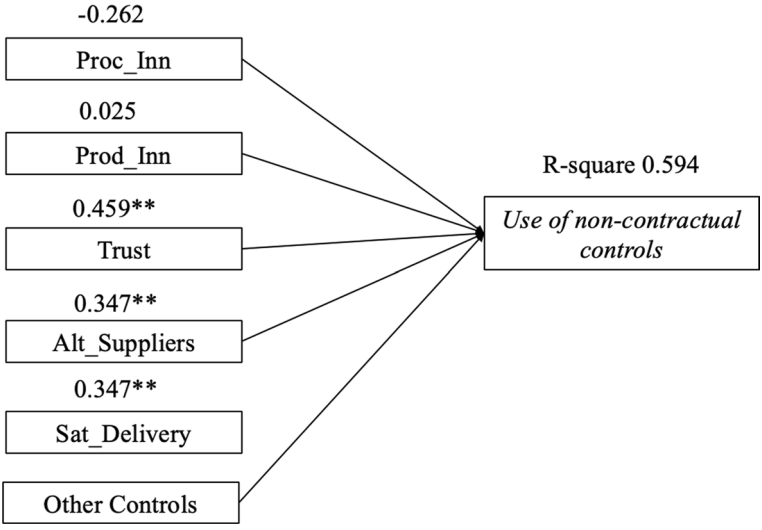

Fig. 4 PLS-SEM model for use of non-contractual controls. The figure summarises the coefficients and significance of a PLM-SEM model regressing the use of non-contractual controls on process and product innovation. The model includes the following variables. Use_Non_Contr: variable indicating the average degree of use of non-contractual controls; Prod_Inn: Likert-type variable measuring product innovation; Proc_Inn: component comprising the eight items for process innovation; Trust: component comprising the four items of trust; Deleg: variable measuring the percentage of the total job delegated to the supplier; Nu_Employees: variable measuring the number of supplier's employees; Deg_Know: variable measuring the degree of knowledge of the supplier and of its activities; Alt_Suppliers: variable measuring the number of alternative suppliers; Sat_Delivery: Likert-type variable measuring the level of satisfaction with reference to delivery aspects; Sat_Quality: Likert-type variable measuring the level of satisfaction with reference to quality aspects; Sat_Price: Likert-type variable measuring the level of satisfaction with reference to price aspects; Sat_Conform: Likert-type variable measuring the level of satisfaction with reference to conformity aspects; Sat_Interact: Likert-type variable measuring the level of satisfaction with reference to interaction aspects; Duration: variable measuring the duration of the relationship in months; Output_Meas: Likert-type variable measuring output measurability; Activ_Meas: Likert-type variable measuring activity measurability; Perf_Meas: Likert-type variable measuring performance measurability. ***$p < 0.01$; **$p < 0.05$; *$p < 0.10$

parties might rely on *ex post* controls to manage uncertainty. One possible explanation for this finding is that firms rely more on other relational mechanisms (e.g. continuous communication and coordination and reciprocal adaptation) rather than non-contractual formal controls when navigating the uncertainties introduced by innovation. This suggests that the role of innovation in influencing control mechanisms may be more nuanced and contingent upon specific contextual factors. It is well known that fashion firms, in fact, tend to consolidate the relationships with suppliers given that it is not necessarily easy to identify alternative parties that can complete similar tasks.

All in all, these findings offer a comprehensive view of how innovation interacts with management controls. Specifically, the negative relationship between Process Innovation and Contract Completeness, as well as the Degree of

Inclusion of control specifications, suggests that firms prioritise flexibility over formalisation when dealing with the uncertainties inherent in process innovation. In contrast, the lack of significant findings for Product Innovation in all our models indicates that product innovation may not require the same degree of contractual adaptation, potentially due to its more tangible and predictable nature. Finally, trust emerges as a key relational mechanism, positively influencing the use of non-contractual controls while reducing the reliance on formal contractual controls.

5 Robustness checks

5.1 OLS model estimation

In order to test the robustness of our results, we built a series of OLS regression models with robust standard errors.

The models can be represented by the following equation:

$$Contractual\ and\ Non\ Contractual\ controls = \beta_0 + \beta_1 Prod\_Inn + \beta_2 Proc\_Inn + \beta_i CONTROLS + \varepsilon \quad (1)$$

In the different model specifications, the dependent variable *Contractual and Non-Contractual controls* is, respectively:

- Contract completeness in terms of Production and Operational Aspects (Model 1);
- Contract completeness in terms of Administrative and Legal Aspects (Model 2);
- Contract completeness in terms of Duration Terms (Model 3);
- Degree of inclusion of control specifications (Model 4);
- Use of non-contractual controls (Model 5).

Despite the presence of some differences in the sign or coefficient of some control variables included in the OLS models, all of the main results for process and product innovation, resulting from the PLS-SEM estimation, are confirmed.

Furthermore, since both independent and target variables were measured using the same survey instrument, we calculated the variance inflation factor (VIF). We observe that the mean VIF is moderate (2.23), hereby mitigating the multicollinearity concerns in our sample (Table 6).

5.2 Alternative scale

To ensure the robustness of our findings and mitigate potential biases associated with scale selection, we transformed all seven-item scales to five-item scales. Subsequently, we re-estimated all of the PLS-SEM and OLS models presented above. The analyses confirmed all the main results for both Process and Product innovation variables, thereby mitigating concerns regarding the selection of a specific scale.

Table 6 OLS regression models

	Contract completeness			Degree of inclusion of control specifications	Use of non-contractual controls
	ProdOp_Asp (Model 1)	AdmLe_Asp (Model 2)	Dur_Term (Model 3)	Contr_Contract (Model 4)	Use_Non_Contr (Model 5)
Proc_Inn	− 0.398**	− 0.453***	− 0.131	− 0.631***	− 0.056
Prod_Inn	0.154	− 0.138	− 0.003	− 0.027	0.097
Controls					
Trust	− 0.141	− 0.394**	0.243	− 0.960**	0.384**
Deleg	− 0.047	0.035	0.030	− 0.011	− 0.255*
Nu_Employees	− 0.169	0.002	− 0.094	0.038	− 0.124*
Deg_Know	0.184	0.246	0.264	− 0.047	0.069
Eq_Particip	− 0.381	0.136	0.998	− 0.963	1.019**
Alt_Suppliers	− 0.012	0.073	0.064	0.413	0.103
Sat_Delivery	− 0.201	− 0.610***	− 0.013	0.071	− 0.501***
Sat_Quality	− 0.243	− 0.533**	− 0.131	− 0.359	− 0.520*
Sat_Price	− 0.045	− 0.628***	0.271	− 0.578*	0.338*
Sat_Conform	0.391	1.142***	0.008	0.685	0.515
Sat_Interact	− 0.102	0.118	− 0.043	0.085	0.147
Duration	0.003	0.005	0.001	− 0.005	0.004
Output_Meas	0.119	− 0.832***	− 0.369	− 1.001***	0.152
Activ_Meas	− 0.358	− 0.322*	− 0.154	0.657**	− 0.377*
Perf_Meas	0.073	0.510**	0.257	0.127	− 0.132
Constant	0.949	3.836*	− 0.340	1.540	4.863*
R^2	0.296	0.571	0.407	0.540	0.540
Robust S.E	Yes	Yes	Yes	Yes	Yes
Mean VIF	2.230	2.230	2.230	2.230	2.230

Table 6 (continued)

	Contract completeness			Degree of inclusion of control specifications	Use of non-contractual controls
	ProdOp_Asp (Model 1)	AdmLe_Asp (Model 2)	Dur_Term (Model 3)	Contr_Contract (Model 4)	Use_Non_Contr (Model 5)
N	48	48	48	48	48

The table summarises the results of five OLS models with robust standard errors respectively regressing: Contract completeness in terms of Production and Operational Aspects (Model 1), Contract completeness in terms of Administrative and Legal Aspects (Model 2), Contract completeness in terms of Duration Terms (Model 3), Degree of inclusion of controls specifications (Model 4), and Use of non-contractual controls (Model 5) on process and product innovation. The model includes the following variables. ProdOp_Asp: component comprising the seven items for production and operational aspects (contract completeness); AdmLe_Asp: component comprising the six items for administrative and legal aspects (contract completeness); Dur_Terms: component comprising the two items for duration terms (contract completeness); Contr_Contract: variable measuring the number of controls included in the contract; Use_Non_Contr: variable indicating the average degree of use of non-contractual controls; Prod_Inn: Likert-type variable measuring product innovation; Proc_Inn: component comprising the eight items for process innovation; Trust: component comprising the four items of trust; Deleg: variable measuring the percentage of the total job delegated to the supplier; Nu_Employees: variable measuring the number of supplier's employees; Deg_Know: variable measuring the degree of knowledge of the supplier and of its activities; Eq_Particip: dummy variable indicating the presence of an equity participation in the supplier; Alt_Suppliers: variable measuring the number of alternative suppliers; Sat_Delivery: Likert-type variable measuring the level of satisfaction with reference to delivery aspects; Sat_Quality: Likert-type variable measuring the level of satisfaction with reference to quality aspects; Sat_Price: Likert-type variable measuring the level of satisfaction with reference to price aspects; Sat_Conform: Likert-type variable measuring the level of satisfaction with reference to conformity aspects; Sat_Interact: Likert-type variable measuring the level of satisfaction with reference to interaction aspects; Duration: variable measuring the duration of the relationship in months; Output_Meas: Likert-type variable measuring output measurability; Activ_Meas: Likert-type variable measuring activity measurability; Perf_Meas: Likert-type variable measuring performance measurability

***$p < 0.01$; **$p < 0.05$; *$p < 0.10$

6 Discussion

This study contributes to the literature investigating the characteristics of management controls in inter-organisational relationships, with a specific focus on inter-organisational relationships aimed at innovation. Given the important role that innovation plays in the survival of firms, understanding how inter-organisational relationships aimed at innovation are controlled is an important domain to investigate, in order to better understand a firm's success. Collaboration among firms activated to innovate may be characterised by relevant differences that trigger or reinforce control problems. There may be forms of control that are ineffective or that are detrimental because, by introducing rigidity into the management of activities, they stifle innovation. This may depend on the characteristics of the contract and on whether control mechanisms are incorporated into it. In our opinion, giving consideration to the contractual dimension adds value to the literature and suggests that the same control mechanisms may have a different impact on the management of inter-organisational relationships, depending on whether they are also included in the contract or not. By introducing this specific aspect, we may contribute to a better explanation of the different roles that management control mechanisms have in managing inter-organisational relationships, as described in the literature.

In fact, to the best of our knowledge, no previous studies have distinguished between management control mechanisms included in contracts and those not included. This distinction is relevant as the former are more rigid and legally enforceable and, as such, they are less appropriate in context characterised by uncertainty. At the same time, controls not included in the contract are expected to offer greater flexibility and adaptability, allowing firms to respond to unforeseen changes and uncertainties more effectively. Moreover, our findings offer novel insights by unpacking the different dimensions of innovation, which is generally treated as a "black box" in prior research.

Our evidence provides specific insights in this area, starting from drawing a distinction between product and process innovation. In particular, the results of our models for Contract Completeness (Figs. 5, 6 and 7) suggest that process innovation has an impact on contract completeness (H1a), while product innovation does not appear to influence the specific terms and provisions included in formal contracts (H1b). These findings are in line with the stream of literature that studied the characteristics of contractual agreements in contexts characterised by high uncertainty (Grandori & Furlotti, 2009). Specifically, while we observe that product innovation has no impact on contract completeness, our results support the idea that, in the presence of process innovation, parties prefer "incomplete contracts". This incompleteness allows flexibility and mutual adaptation in coping with unexpected events related to a limited knowledge of the transformation process. The lack of impact from product innovation is also an interesting finding in itself. This divergence suggests that the nature of innovation—whether it involves changes to processes or products—shapes the perceived need for flexibility in contracting differently. Product innovation may not prompt the same uncertainty about transformation processes, as it often builds upon established production methods, thereby reducing the need

for contractual flexibility. This contrasts with process innovation, where uncertainty is more acute, calling for greater adaptability. These distinctions have not been fully explored in prior studies, making our contribution particularly relevant in highlighting the different dynamics at play.

When focusing on the inclusion of controls in contracts (H2a and H2b), it can be seen that, while product innovation has no impact on the dependent variable, process innovation reduces the extent to which controls are formalised in contracts. Indeed, contractual controls are a typical example of *ex ante* control mechanisms (Bedford & Ditillo, 2021; Dekker, 2004) that are difficult to define in the presence of process innovation. In these contexts, parties prefer *ex post* non-contractual control mechanisms to adapt to the contingencies that innovation generates. This reinforces the argument that the unpredictability inherent in process innovation renders formal control mechanisms less effective or desirable. What remains less explored in the literature, however, is the reason behind the complete absence of a relationship between product innovation and contractual controls. It is possible that product innovations, which might adhere more closely to traditional and understood frameworks, do not disrupt existing control structures to the same extent as process innovations do. Thus, formal contractual controls remain largely unaffected by introduction of product innovation.

While our results do not support the presence of a direct relation between innovation and the use of non-contractual controls (H3a and H3b), we observe that these forms of controls are common among the respondents and that trust has a positive impact on their use, thus confirming a complementary relationship between trust and control (Fig. 4). At the same time, trust is negatively related to the degree of inclusion of control specifications (Fig. 3). Overall, trust appears to act as a complement to *ex post* control mechanisms and as a substitute for *ex ante* mechanisms (Caglio & Ditillo, 2021; Cao & Lumineau, 2014). This finding opens the door to further investigation into how trust and control evolve in different types of innovation contexts. While trust substitutes for formal control mechanisms when process innovation is present, the absence of a direct link between innovation and non-contractual controls suggests that there may be additional mediating factors at play, such as the specific industry, the maturity of the partnership, or the strategic goals tied to innovation. Further research should unpack these complexities to enable better understanding of the interactions between innovation, trust, and control in varying inter-organisational environments.

7 Conclusions

Our contribution concentrates on the interplay between innovation and control mechanisms, focusing on the design of contracts and the use of contractual controls and non-contractual controls in buyer–supplier relationships aimed at innovation. In doing so, we have contributed to the literature in different ways.

Firstly, while previous research has studied the relation between innovation and controls (Abernethy & Brownell, 1997; Bedford, 2015; Chenhall & Moers, 2015; Chenhall et al., 2011; Davila, 2000, among others), there is a lack of knowledge on

buyer–supplier relationships aimed at innovation. The distinction between contract completeness, the inclusion of control specifications in the contract and the use of non-contractual controls, allows us to investigate the triadic relationship between innovation, controls, and interorganisational relationships that has never been studied before. Moreover, focusing on the fashion industry, the results extend our existing knowledge by also specifically addressing the role of trust and delegation in shaping this relation.

Secondly, the distinction between product and process innovation allows for a comprehensive examination of how uncertainty associated with product innovation (Davila, 2000) and the knowledge of the transformation process (Abernethy & Brownell, 1997; Rockness & Shields, 1984) influences contracts and management controls. This multifaceted approach underscores the importance of recognising the varied impacts of different types of innovation on management practices, as highlighted by our empirical results. In doing so, we not only enrich the existing literature but also challenge previous frameworks by highlighting the differential responses of contractual and non-contractual controls to innovation dynamics.

Finally, the separate analysis of controls included in contracts and those not included enriches the current debate (Biswas & Akroyd, 2022; Cao & Lumineau, 2014; Carson et al., 2006; Chenhall & Moers, 2015) by revealing how these distinct categories of controls are related to innovation in buyer–supplier relationships. This differentiation allows us to understand that contractual controls may impose constraints that limit adaptability, while non-contractual controls foster flexibility and innovation through trust and informal mechanisms. Our findings extend the work initiated by Caglio and Ditillo (2021) by not only addressing the need for more research in this area but also by providing empirical evidence that highlights the different relationships between these control mechanisms and process and product innovation, thus potentially contributing to explaining some of the contradiction in the literature on the use of management control mechanisms.

The managerial implications of this study are significant for organisations engaged in innovation projects, with broader relevance for corporate governance in the context of interorganisational settings. Our study provides insights to firms on how to govern the relationships with suppliers by focusing on the specific mechanisms that have to be implemented to maintain a balance between the need to control counterparts and prevent their opportunistic behaviours, while at the same time allowing for the necessary flexibility needed to achieve innovation. Managers need to carefully design contracts that align with the unique characteristics of innovation projects. This involves striking a balance between contract completeness and the design of controls. At the same time, building and nurturing trust is crucial as it acts as a substitute for formal control mechanisms, allowing for greater collaboration and mutual adaptation. Managers should focus on fostering trust within their relationships with suppliers. By considering the dual role of contracts and trust as governance mechanisms in the context of interorganisational relationships, organisations can enhance their approach to managing innovation in buyer–supplier relationships.

To conclude, our results should be viewed as a first attempt to study the relation between innovation and control mechanisms in inter-organisational relationships.

The use of survey data complements studies that have qualitatively analysed management controls in inter-organisational relationships by providing broader evidence than a single case study. This methodological approach enables us to capture a wider array of perspectives and relationships, while also allowing for an in-depth analysis of the characteristics of the contracts and the respondents. While we acknowledge that the limited sample size of 48 usable responses restricts the generalisability of our findings, we believe this concern is mitigated by the robustness of our data collection methods. The sensitivity of the information gathered made it challenging to secure a larger sample. To address this, we supplemented our survey data with in-depth interviews and analyses of actual contracts, providing richer contextual insights and ensuring the quality and relevance of our findings.

Additional empirical evidence is required to fully understand the implications of this research. In order to study a highly innovative environment, our research focused on the fashion industry. Extending the study to other industries with different innovation dynamics and buyer–supplier relationships would enhance the generalisability of the findings. Finally, since buyer–supplier relationships change during different stages of the innovation lifecycle, a longitudinal analysis of the interplay between managerial controls and innovation could further extend our results.

Appendix 1

Process Innovation (Bensaou & Venkatraman, 1995)	
Proc_Inn_1	To what extent is there an understandable sequence of steps that can be followed by supplier ALPHA in doing its work?
Proc_Inn_2	To what extent is there an understandable sequence of steps that can be followed by supplier ALPHA in carrying out its work?
Proc_Inn_3	How repetitious are the duties of supplier ALPHA?
Proc_Inn_4	To what extent is there a clearly known way to do the major types of work normally encountered by supplier ALPHA?
Proc_Inn_5	Does supplier ALPHA perform repetitive activities in doing its jobs?
Proc_Inn_6	To what extent would you say the work of the supplier ALPHA is routine?
Proc_Inn_7	To what extent is there a clearly defined know-how that can guide the work carried out by supplier ALPHA?
Proc_Inn_8	To perform its work, to what extent can the personnel of supplier ALPHA rely on established procedures and practices?
Item excluded (factor loading < 0.7)	To what extent are the tasks of supplier ALPHA the same from day to day?
Item excluded (factor loading < 0.7)	To what extent do the people at supplier ALPHA perform the same job in the same way most of the time?
Likert scale from 1 (null) to 7 (total)	
Product Innovation (Davila, 2000)	
Which of the following sentences best describes product BETA:	

1	Product BETA was a simple adaptation of an existing model (e.g. a new colour or pattern)
2	Product BETA was a simple redesign of an existing model (e.g. a new fabric)
3	Product BETA was a major redesign of an existing model (e.g. a new cut)
4	Product BETA was a new model replacing an existing model
5	Product BETA was a completely new model
Answers were coded on a scale (**Prod_Inn**) where sentence number 1 is equal to 1 (the lowest) and sentence number 5 is equal to 5 (the highest)	

Contract Completeness

To what extent does the contract include the following aspects?

ProdOp_Asp_1	Raw materials issues
ProdOp_Asp_2	Prototype approval
ProdOp_Asp_3	Finished product approval
ProdOp_Asp_4	Price determination mechanisms
ProdOp_Asp_5	Payment terms
ProdOp_Asp_6	Technical specifications
ProdOp_Asp_7	Quality issues
AdmLe_Asp_1	Purchase orders procedures
AdmLe_Asp_2	Confidentiality issues
AdmLe_Asp_3	Contract termination—time and conditions
AdmLe_Asp_4	Insurance, risks and liabilities
AdmLe_Asp_5	Obligations and responsibilities
AdmLe_Asp_6	Warranties
Dur_Term_1	Duration of the contract
Dur_Term_2	Renewal/termination conditions
Item excluded (factor loading < 0.7)	Product technical specifications
Item excluded (factor loading < 0.7)	Intellectual property protections
Item excluded (factor loading < 0.7)	Delivery terms and conditions
Item excluded (factor loading < 0.7)	Force majeure
Item excluded (factor loading < 0.7)	Sanctions and penalties
Likert scale from 1 (Not at all) to 7 (To a very great extent)	

Control system contractualization and use of non-contractual controls

Indicate with an 'X' (in the first column) whether the following controls were included in the contract. Indicate with an 'X' (in the second column) whether these controls—no matter whether they were included in the contract or not—were used during contract execution with supplier ALPHA

1	Mechanisms for monitoring the achieved targets (van der Meer Kooistra and Vosselman 2000)
2	Mechanisms for controlling target achievement through the monitoring of decisions and actions of the façonist ALPHA on an ongoing basis
3	Sanctions related to missing the targets defined
4	Joint committees for conflict resolution (van den Bogaard & Speklé, 2003)

5	Direct supervision (e.g. inspection or direct monitoring) (Ouchi, 1979)
6	Mechanisms for measuring and reporting the financial performance (Abernethy & Brownell, 1997)
7	Mechanisms for measuring and reporting the operating performance (e.g. quantity and quality of products)
8	Rules and procedures (Ouchi, 1979)
9	Pre-approval of the ways in which the façonist ALPHA carries out activities (Govindarajan & Fisher, 1990)
10	Shared IT infrastructure and/or software to exchange data in electronic form

Likert scale from 1 (null) to 7 (total)

Answers were coded in order to measure the number of controls included in the contract (**Contr_Contract**). Furthermore, for controls not included in the contract, we calculated the average value of their use declared by each firm (**Use_Non_Contr**)

Trust (Carson et al., 2006)

Indicate with an 'X' the level of agreement with the following statements:

Trust_1	Your company and supplier ALPHA expect that conflicts would be resolved fairly, even if no guidelines are given within your formal agreements (i.e. contracts)
Trust_2	Your company and supplier ALPHA are expected to share helpful information beyond what is required by formal agreements
Trust_3	Your company and supplier ALPHA hold mutual expectations that each party will be flexible and responsive to requests by the other, even if not required by your formal agreements
Trust_4	Your company and supplier ALPHA understand that problems arising during contract execution will be solved jointly through communication and cooperation rather than just referring to your formal agreements
Item excluded (factor loading < 0.7)	Your company and supplier ALPHA agree on the main values and beliefs
Item excluded (factor loading < 0.7)	Your company and supplier ALPHA hold mutual expectations that supplier ALPHA's responsibilities go beyond what was specified formally in the contract
Item excluded (factor loading < 0.7)	There are performance goals for supplier ALPHA that are understood and accepted by the parties even though not specified in any formal agreement
Item excluded (factor loading < 0.7)	When an unexpected situation arises, your company and supplier ALPHA have the confidence that a win–win solution would be found, even if it could contradict the formal agreements
Item excluded (factor loading < 0.7)	Your company and supplier ALPHA understand that each one will adjust to changing circumstances, even if not required by your formal agreements

Likert scale from 1 (total disagreement) to 7 (total agreement)

Level of delegation (Adapted from Bensaou & Venkatraman, 1995)

How much of the total job, with reference to product BETA, was carried out by

Deleg	supplier ALPHA?

2	your company?
A percentage (from 0 to 100)	
Number of employees	
Nu_Employees	Indicate the number of employees of supplier ALPHA
Categorical variable with ranges from 1 (< 10) to 7 (> 250)	
Degree of knowledge	
Deg_Know	What is your level of knowledge of supplier ALPHA's activities?
Likert scale from 1 (null) to 7 (total)	
Equity stake	
Does you firm have an equity participation in supplier ALPHA?	
Eq_Particip	Yes
2	No
Alternative suppliers	
Alt_Suppliers	How many alternative suppliers, other than supplier ALPHA, are there for product BETA?
Level of satisfaction	
Sat_Delivery	With reference to supplier ALPHA in general, how satisfied you are with reference to delivery aspects?
Sat_Quality	With reference to supplier ALPHA in general, how satisfied you are with reference to quality aspects?
Sat_Price	With reference to supplier ALPHA in general, how satisfied you are with reference to price aspects?
Sat_Conform	With reference to supplier ALPHA in general, how satisfied you are with reference to conformity to technical specifications aspects?
Sat_Interact	With reference to supplier ALPHA in general, how satisfied you are with reference to conformity of interaction aspects?
Likert scale from 1 (null) to 7 (total)	
Duration	
Duration	Indicate the duration of the relationship (in number of months) with supplier ALPHA
Output measurability (Adapted from Brown & Potoski, 2005)	
Output_Meas	Indicate with an X to what extent the output of supplier ALPHA's activity is easy to measure
Likert scale from 1 (null) to 7 (total)	
Activity monitoring (Adapted from Brown & Potoski, 2005)	
Activ_Meas	Indicate with an X to what extent it is straightforward to monitor supplier ALPHA's activities, necessary to provide product BETA
Likert scale from 1 (null) to 7 (total)	
Performance measurability (Ouchi, 1979)	
Perf_Meas	Indicate with an X to what extent it is feasible to define, with reasonable precision, the performance that is expected from supplier ALPHA
Likert scale from 1 (null) to 7 (total)	

Appendix 2

See Figs. 5, 6, and 7.

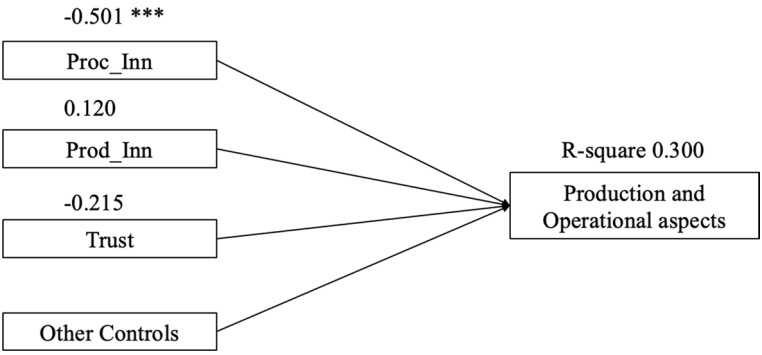

Fig. 5 PLS-SEM model for contract completeness (production and operational aspects). The figure summarises the coefficients and significance of a PLM-SEM model regressing contract completeness (in terms of production and operational aspects) on process and product innovation. The model includes the following variables. ProdOp_Asp: component comprising the seven items for production and operational aspects (contract completeness); Prod_Inn: Likert-type variable measuring product innovation; Proc_Inn: component comprising the eight items for process innovation; Trust: component comprising the four items of trust; Deleg: variable measuring the percentage of the total job delegated to the supplier; Nu_Employees: variable measuring the number of supplier's employees; Deg_Know: variable measuring the degree of knowledge of the supplier and of its activities; Alt_Suppliers: variable measuring the number of alternative suppliers; Sat_Delivery: Likert-type variable measuring the level of satisfaction with reference to delivery aspects; Sat_Quality: Likert-type variable measuring the level of satisfaction with reference to quality aspects; Sat_Price: Likert-type variable measuring the level of satisfaction with reference to price aspects; Sat_Conform: Likert-type variable measuring the level of satisfaction with reference to conformity aspects; Sat_Interact: Likert-type variable measuring the level of satisfaction with reference to interaction aspects; Duration: variable measuring the duration of the relationship in months; Output_Meas: Likert-type variable measuring output measurability; Activ_Meas: Likert-type variable measuring activity measurability; Perf_Meas: Likert-type variable measuring performance measurability. ***$p < 0.01$; **$p < 0.05$; *$p < 0.10$

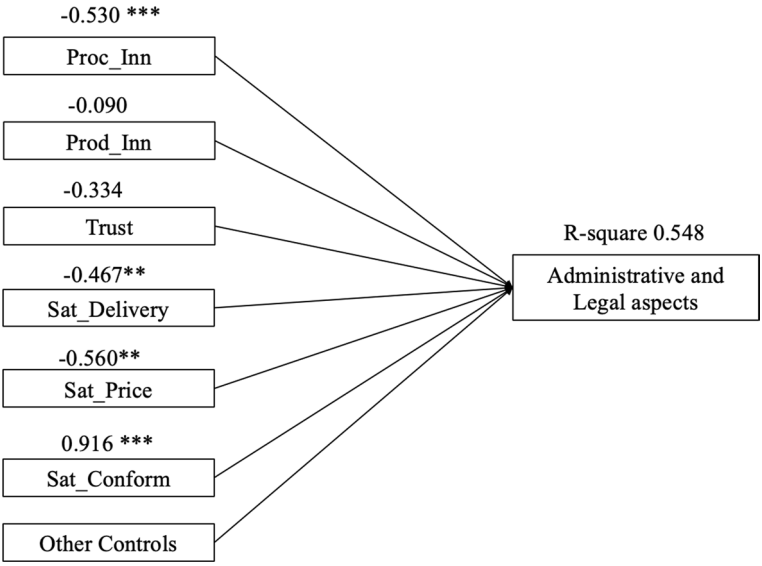

Fig. 6 PLS-SEM model for contract completeness (administrative and legal aspects). The figure summarises the coefficients and significance of a PLM-SEM model regressing contract completeness (in terms of administrative and legal aspects) on process and product innovation. The model includes the following variables. AdmLe_Asp: component comprising the six items for administrative and legal aspects (contract completeness); Prod_Inn: Likert-type variable measuring product innovation; Proc_Inn: component comprising the eight items for process innovation; Trust: component comprising the four items of trust; Deleg: variable measuring the percentage of the total job delegated to the supplier; Nu_Employees: variable measuring the number of supplier's employees; Deg_Know: variable measuring the degree of knowledge of the supplier and of its activities; Alt_Suppliers: variable measuring the number of alternative suppliers; Sat_Delivery: Likert-type variable measuring the level of satisfaction with reference to delivery aspects; Sat_Quality: Likert-type variable measuring the level of satisfaction with reference to quality aspects; Sat_Price: Likert-type variable measuring the level of satisfaction with reference to price aspects; Sat_Conform: Likert-type variable measuring the level of satisfaction with reference to conformity aspects; Sat_Interact: Likert-type variable measuring the level of satisfaction with reference to interaction aspects; Duration: variable measuring the duration of the relationship in months; Output_Meas: Likert-type variable measuring output measurability; Activ_Meas: Likert-type variable measuring activity measurability; Perf_Meas: Likert-type variable measuring performance measurability. ***$p < 0.01$; **$p < 0.05$; *$p < 0.10$

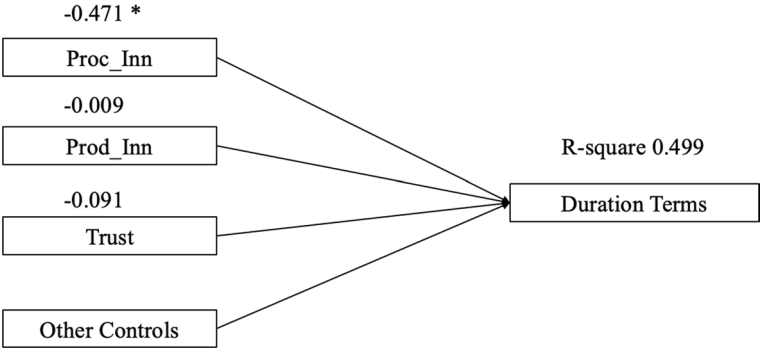

Fig. 7 PLS-SEM model for contract completeness (duration terms). The figure summarises the coefficients and significance of a PLM-SEM model regressing contract completeness (in terms of duration terms) on process and product innovation. The model includes the following variables. Dur_Terms: component comprising the two items for duration terms (contract completeness); Prod_Inn: Likert-type variable measuring product innovation; Proc_Inn: component comprising the eight items for process innovation; Trust: component comprising the four items of trust; Deleg: variable measuring the percentage of total job delegated to the supplier; Nu_Employees: variable measuring the number of supplier's employees; Deg_Know: variable measuring the degree of knowledge of the supplier and of its activities; Alt_Suppliers: variable measuring the number of alternative suppliers; Sat_Delivery: Likert-type variable measuring the level of satisfaction with reference to delivery aspects; Sat_Quality: Likert-type variable measuring the level of satisfaction with reference to quality aspects; Sat_Price: Likert-type variable measuring the level of satisfaction with reference to price aspects; Sat_Conform: Likert-type variable measuring the level of satisfaction with reference to conformity aspects; Sat_Interact: Likert-type variable measuring the level of satisfaction with to interaction aspects; Duration: variable measuring the duration of the relationship in months; Output_Meas: Likert-type variable measuring output measurability; Activ_Meas: Likert-type variable measuring activity measurability; Perf_Meas: Likert-type variable measuring performance measurability. ***$p < 0.01$; **$p < 0.05$; *$p < 0.10$

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Data availability The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

Code availability Not applicable.

Declarations

Conflict of interest The authors declared that they have no conflict of interest.

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Ariela Caglio Bocconi University and SDA Bocconi School of Management (Italy) Associate Professor of the Accounting Department at Bocconi University and Director of the Accounting Knowledge Area at SDA Bocconi. Her diverse research interests include sustainability reporting and performance measurement, CFO roles, compensation design, supply chains, and the football industry.

Mario Daniele holds a Ph.D. in Management and Innovation from the Catholic University of the Sacred Heart in Milan, where he is currently a Research Fellow in Business Economics at the Faculty of Economics. His research primarily focuses on financial accounting and auditing with a particular focus on private firms.

Angelo Ditillo Bocconi University and SDA Bocconi School of Management (Italy) Associate Professor of the Accounting Department and Director of the BSc in Business Administration and Management at Bocconi University. His diverse research interests include Blockchain Technology, Artificial Intelligence, Diversity, Equity and Social Inclusion, Incentives for Creativity, Performance Measurement and Control Systems of Professional Service Firms and Inter-Organizational Relationships.