Exploring the relationship between Target Costing functionality and product innovation: The role of information systems

Abstract

The role of management control practices in product innovation is a subject that receives great attention in management control literature. This research explores the relationship between target costing functionality, the quality of information systems (IS) and product innovation. We conducted an empirical research in 108 large industrial enterprises, which have R&D departments. The results showed that there is a positive relationship between target costing functionality and product innovation in terms of product newness and innovation rate. A direct effect of the quality of IS information on product innovation was not established but rather it was found that the positive association between the functionality of TC and product innovation is stronger in firms that provide IS information of higher quality as compared to firms that provide IS information of lower quality.

Keywords – product innovation, target costing functionality, quality of IS information, management control practices, innovativeness

Disclosure statement

No potential competing interest was reported by the authors.

Introduction

The literature states that management controls can help product innovation (e.g., Nixon, 1998). According to previous research, so in this work, we define Product innovation as the introduction and development of new products (Bisbe and Otley, 2004; Dunk, 2011). The idea of the work came from recent research and calls on how and why management controls can support innovation (e.g., Carlson-Wall et al., 2020; Bedford, 2015; Akroyd, et al., 2016 Adler and Chen, 2011; Chenhall and Moers, 2015). It seems that the relation between management control and innovation is positive (Chenhall et al., 2011), it emerges through a complex network of relationships (Ylinen and Gulkvist, 2014) and is subject to the influence of environmental unpredictability (Henri and Wouters, 2020). Nevertheless, the evidence about the relationship between management controls and innovation is mixed and there is need to better our understanding (Chenhall and Moers, 2015).

Previous research has linked product innovation to Management Control Systems and the types of controls (e.g., diagnostic and interactive control uses) using the Lever of Control (LOC) framework (e.g., Müller-Stewens et al., 2020; Guo et al., 2019; Bedford, 2015) and less with the management control practices and the information that these tools provide to decision makers for the introduction and development of new products (e.g., Henri and Wouters, 2020; Dunk, 2011). In this context, Dunk (2011), studying budgets as management control practices, found that the way budgets are used (planning or control mechanism) in a product innovation environment is crucial to the impact of innovation on business financial performance. More recently, Henri and Wouters (2020) investigated the relationship between two management control practices and product innovation and found that functionality of cost information and nonfinancial performance measures are complements (substitutes) under high (low) levels of environmental unpredictability, and thus contribute to product innovation. Henri and Wouters (2020) argue that the relationship between other management control practices and innovativeness should be explored in the future. There is a gap in the literature on the relationship between management control practices and product innovation (Chenhall and Moers, 2015).

This research focuses on the study of a specific management control practice, Target costing (TC) with product innovation. The choice of this practice was made for three reasons. First, because TC is related to product planning and development, while some work agrees that it is part of New Product Development (NPD) (e.g., Kato, 1993; Ansari et al., 2007; Everaert et al., 2006). TC integrates market information in the cost system instead of the cost system being purely internally focused, supports the cost reduction process in the design of new products and the redesign of existing products, encourages both faster product development and faster redesign, because of its structured and coordinated approach, connects customers 'requirements specifically to the design and redesigns costs, and minimizes the time to market for new or redesigned products

(Ibusuki and Kaminski, 2007; Kato et al., 1995). Second, this technique has been less explored and related to some other new and more popular management accounting practices, such as ABC or BSC and is worth studying (e.g., Ansari et al., 2007). Third, previous research in TC has focused mainly on the factors that influence its adoption or have dealt with its perceived benefits (Yazdifar and Askarany, 2011) and not, as far as we know, with the relationship between this management control practice and product innovation.

This study explores the relation between management control practices and product innovation by emphasizing on the effects of TC functionality on product innovation. We define TC functionality as the level of TC system sophistication, which measures the variation in the implementation of TC in an organization. TC functionality represents the design characteristics of a TC system and the level of the implementation, as suggested by TC literature in a target setting activity (e.g., Yazdifar and Askarany, 2011; Ax et al., 2008; Ibusuki and Kaminski, 2007; Everaert et al., 2006). This study also examines the extent to which the quality of information provided by a firm's information system moderates the relation between TC functionality and product innovation. In this research we focus on the decision-supporting role of management controls practices, i.e., on the information needs required to support decision making to achieve product innovation, in contrast to previous research that is based on the decision-influencing aspect of control refers to the need to direct employees' activities or behaviors (Demski and Feltham, 1976). For this reason, we chose to include information systems and their role in the relationship between management control practices and product innovation.

This work makes the following contributions. First, it provides empirical results, for the first time to the best of our knowledge, of the relationship between TC functionality and product innovation. This research explores a management control tool that has received less attention compared to other management controls, such as budgeting (e.g., Dunk, 2011; Ansari et al., 2006; Chenhall and Moers, 2015). Second, it contributes to better our understanding of how management control practices can support innovation (e.g., Akroyd, et al., 2016; Adler and Chen, 2011; Bedford, 2015) and, in particular, product innovation (e.g., Dunk, 2011). This work provides new evidence of how the information provided by management control practices contributes to support decision making for product development and supports their innovation (Henri and Wouters, 2020; Carlson-Wall et al., 2020; Guo et al., 2019). Third, it provides empirical evidence that quality of IS information moderates the relationship between TC functionality and product innovation. We conclude that the positive association between the functionality of TC and product innovation is stronger in firms that provide IS information of higher quality as compared to firms that provide IS information of lower quality. This work highlights the joint effect and complementarity that management control practices share with information systems (an un-researched moderator) in product innovation. Fourth, it provides additional insights into R&D cost, which has received little attention in the accounting literature (e.g., Shields and Young, 1994; Rockness and Shields, 1988).

The remainder of this paper is organized as follows. Research hypotheses is developed in the next section. Then we present our methodology and the empirical results. The discussion and the conclusion are included in the final section.

Theory development

Target costing and product innovation

Target costing (TC) first appeared in Japan under the name of “Genkakikaku” or “Genka Kikaku” (Nicolini et al., 2000) and later became known in the English literature in the 1990s (Cooper, 1993). This technique is also known as "cost planning" (Kato, 1993), "manufacturing cost reduction" (Dekker and Smidt, 2003), "design to cost" (Michaels and Wood, 1989) and "cost management" (Cooper and Slagmulder, 1997). TC focuses on long-term cost management efforts, making it a Strategic Management Accounting technique (e.g., Guilding et al., 2000). Significant benefits from its application have been presented in the literature, such as the proactive approach to cost management, its customer-centric approach, the removal of barriers between departments, the active participation of employees in decision-making, better cooperation with suppliers, the reduction of non-value added activities, the encouragement of the choice of activities with the lowest cost value added and the reduction of delivery time to market (e.g., Ax et al., 2008; Cooper and Slagmulder, 1997; Ansari and Bell, 1997; Hiromoto, 1989; Streib and Ellers, 1994). However, the implementation of a TC system has some disadvantages or limitations, such as increased requirements of accurate cost accounting information, increased cost of implementation and requirements for frequent time-consuming meetings (Yazdifar & Askarany, 2011; Martin et al., 1992).

TC is a management control practice that focuses on the management of product costs during the design stage of a new product (e.g., Ax et al., 2008; Kee, 2010; Ibusuki and Kaminski, 2007). It also determines market sales prices and target profit margins and reduces the total cost of products throughout their life cycle (taking into account customer requirements) by exploring ways to reduce costs in the design phase (R & D) (Cooper and Slagmulder, 1997). This technique, in a simplified form, involves two stages a) the definition of the target cost and b) its achievement (Filomena et al., 2009). Monden (1995) states that the purpose of this technique is first to reduce the cost of new products in order to achieve the desired profits while meeting the requirements of customers in terms of the price they want to pay (target price), the level of quality product, their production and distribution time and secondly to motivate the employees to make the desired profit (target profit) at the stage of designing new products. TC focuses on the product design phase as opposed to “Kaizen costing”, which focuses on the production phase and aims to improve costs during the production cycle (Cooper, 1994).

The literature argues that cost systems support product innovation (Henri and Wouters, 2020; Labro, 2004, Agndal and Nilsson, 2009). Shields and Young (1994) report that cost system functionality helps executives better monitor and control the impact of innovative activities on business operating costs. Quality cost information helps to decide on the product portfolio that will be placed on the market and determine when production and distribution should stop because it is no longer economically viable (Rabino, 2001; Anderson, 2007). Cost information includes R&D costs associated with new product development (Cooper, 1994), as well as costs in the design phase (Ansari et al., 2006). Little research in the accounting literature has looked at these costs or design costs and it is something that needs to be studied (e.g., Shields and Young, 1994). Cooper (1994) reports that 80% of the cost has been "locked in" or committed to the design phase.

In the literature there are conflicting arguments about the relationship between TC and product innovation, about whether this relationship is positive or negative and this needs further investigation. Yazdifar and Askarany (2011) report that the implementation of TC by companies can lead to delays in the development of new products due to the frequent time-consuming meetings attended by executives from different functions and organic levels of the company. In this case, TC does not lead to increased product innovation. Businesses seek to supply the market with new or redesign products to be competitive at high speed and TC may delay new product development. In addition, a functional TC system may lead to information overload. The increased information provided to executives by management control practices reduces the effectiveness of product innovation decision-making, as executives do not have the time required to process all the information available (e.g., Cardinaels and van Veen-Dirks, 2010; Schick et al., 1990). On the contrary, some researchers argue that there is a positive relationship between TC and product innovation. Kato (1993) and Monden and Hamada (1991) argue that the TC customer-centric approach allows executives to know the demands of their customers, in terms of functional features they want to incorporate in the products, and the price customers are willing to pay for them, so they can constantly design new innovative products that provide those features, as well as added value to customers. In addition, Wang et al. (2009) state that using value analysis (or value engineering), with the participation of executives from all departments of the company, as well as long-term close cooperation with suppliers, new or improved product designs are created, which have reduced costs without sacrificing functionality. Product designers using TC, the tools of disassembly, value planning and redesign, manage to eliminate unnecessary functions that increase the cost and complexity of products (Iranmanesh and Thomson, 2008). In this work, we propose that TC functionality, as a management control practice, positively affects product innovation. We assume that a TC system with adequate functionality can accelerate the design and redesign process and that it can contribute to the design of new and innovative products that have the desired functionality, quality and price for a specific market segment. It is therefore likely that companies that have a more sophisticated TC system will have higher product innovation.

Based on the above analysis, we examine the following hypothesis:

H$_1$: The functionality of TC is positively associated with product innovation.

Information systems and product innovation

The value of information in decision making is established in the literature (Schaltegger and Zvezdov, 2015). Businesses strive to develop high quality information systems (IS) in order to assist executives in exercising management control and improving decision making (Maiga et al., 2014). The quality of IS information includes the attributes of reliability, accuracy, relevance, prevision and completeness (Dunk, 2004; Teng et al., 1995). The functionality of information provided might raise managerial awareness about the significance of innovation activities on the organization (Shields and Young, 1994), more balanced product decisions (Rabino, 2001) and improved resource allocation decisions (Birnberg, 1988). The quality of information might direct managerial attention to areas of critical concern (Davila et al., 2009) and is deemed necessary for organizational functioning (Moores and Yuen, 2001). Nicolaou et al. (1995) mentions that when the quality of information improves, the usefulness of decision systems increases.

The quality of information plays an important role in decision making associated with New Product Development (NPD) (Naveh and Halevy, 2000). Previous research has shown that the quality of IS information is positively associated with the design and development of new products (Pavitt, 1990; Cook and Eining, 1993). According to Dunk (2004) and Weitz et al. (1994) the information provided by the information system characterized by increased relevance, completeness and timeliness can effectively help in the analysis of the product life cycle and in particular at the design stage. In addition, Kivimanski et al. (2000) agree that IS information contributes to problem solving in product design, production and distribution. The information provided by an information system can be both financial and non-financial and comes from all IS structures, namely supply chain management, financial resource management, customer relationship management, manufacturing resource planning and human resource management (Kivimanski et al., 2000).

In this research we assume that companies, which have information systems that provide high quality information (financial and non-financial) about their internal and external environment, are likely to constantly update their product portfolio and provide the market with new and innovative products that meet customer needs and new technological developments.

Based on the above, we formulate the following hypothesis:

H$_2$: Quality of IS information is positively associated with product innovation.

TC functionality, quality of IS information and product innovation

While H_1 and H_2 hypotheses propose direct effects on TC functionality and the quality of IS information on product innovativeness, we assume that the quality of IS information moderates the effect of TC functionality on product innovation. We use the lean of the dynamic capability theory (e.g., Eisenhardt and Martin, 2000) to support our hypothesis. This theory suggests that organizations have capabilities that help them advance strategic change (Schweizer et al., 2015). These capabilities come from various functional areas within the organizations, such as management control (e.g., Henri, 2006) and information systems (e.g., Chae et al., 2017). Teece (2018) mentions that the dynamic capabilities of the organizations may interplay and assist in new product development. We built our analysis on complementary theory (e.g., Brynjolfsson and Milgrom, 2012). This theory suggests that there is a complementarity between several sets of organizational decisions, which make up a system of complements (Brynjolfsson and Milgrom, 2012). Organizational choices may be complements, provided that the benefit of having an element design increases when another is present (Brynjolfsson and Milgrom, 2012).

Based on these theories, in this work, we argue that IS and TC are complements and have a joint effect in product innovation. Previous research has found that high quality ISs encourages the adoption and use of new management accounting practices (e.g., Dunk, 2004; Granlund and Mouritsen, 2003). The quality of IS information is likely to provide the necessary data for the best use of target costing in product innovation. According to Al-Omiri and Drury (2007) and Dillard (2000), high-quality integrated ISs collect and store data and information from various business functions, such as accounting, sales, marketing and operations. This data and information are useful and necessary for the implementation of TC, as a management control practice, in product innovation. If the information provided by information systems is not sufficient, then the use of TC in new product development will not be effective. A critical factor for the successful implementation of TC is the presence of an excellent information network (Cooper and Slagmulder, 1997; Yazdifar and Askarany, 2011) that provides high quality information. This means that, as the level of functionality of TC system increases, more and better information from the IS of the organization is needed from the external and the internal environment, such that TC can be applied and used effectively in designing and developing new products.

In this paper we emphasize on the informational needs for achieving product innovation. We assume that TC and IS are dynamic capabilities that provide different types of information, useful in product innovation. We propose that the new product development requires not only superior cost accounting information provided by a functional TC system, but also relevant, complete, accurate and up-to-date information on the characteristics of the materials that suppliers can provide, products that exist in the market, for the demands of the customers for new products, as well as for the production process regarding the resources, the quality standards and the lead time.

This information is provided by the IS of the organizations and in many cases is non-financial information. A functional TC system provides some facets that are important, but not all of the information required for product innovation. IS also provides some other information aspects, which alone are not enough for new product development. Therefore, we believe that a TC system with adequate functionality and an IS that provides quality information, act as complements, and together provide more useful, comprehensive and helpful information that contributes positively to product innovation. The diverse non-financial information complements the cost accounting information for the design and development of new products. In summary, companies with a sophisticated TC system may be able to increase product innovation more when their information systems (IS) provide more and better cost accounting information and non-financial information, as they now have full information required for new product development.

Therefore, we formulate the following hypothesis:

H_3: The positive association between the functionality of TC and product innovation is stronger in firms that provide IS information of higher quality as compared to firms that provide IS information of lower quality.

Methodology

Data collection

Data collection was completed with a web-based survey, which ensures fast data collection, higher response rates and lower data collection cost. The questionnaire was completed at the business unit level because it is possible that the use of management accounting practices differs in business units, even though they belong to the same company (e.g., Al-Omiri and Drury, 2007). For the design of the survey, all guidelines from Dillman (2000) for the development of the questionnaire were followed. A pilot test was performed on 4 academics and 8 top managers for issues of understanding, clarity and face validity (Dillman, 2000). The questionnaire was sent to Greek manufacturing business units that had a developed R&D department and employed at least 500 employees according to previous surveys (e.g., Davila et al., 2010; Davila, 2005). The sampling frame, taken from the ICAP database, ultimately included 212 business units that met the above criteria. The top executives of the business units were initially approached by phone to be informed about the purpose of the research and to be asked if they wished to participate in it. An official cover letter and a link to complete the online questionnaire were then emailed. A reminder email was sent 15 days after the original email. Initially, 115 questionnaires were received, of which 7 were not fully completed and were, therefore, removed from the sample. Finally, 108 questionnaires were used in the analysis corresponding to a response rate of 51%. There were no business units in the sample that belonged to the same company group. The questionnaire was completed by CFOs (59%), R&D managers (30%) and CEOs (11%).

Table 1 presents the characteristics of the business units that participated in the survey. To control the potential nonresponse bias, 3 analyzes were performed. First, we compared those who responded with those who did not respond over the characteristics of business units (number of employees, subindustries). Chi-square statistics did not show statistically significant differences ($p > 0.05$) between respondents and non-respondents. Second, we compared the values of the variables (constructs' measures) between the early and late respondents and found that there were no statistically significant differences ($p > 0.10$). Third, we applied Harman's single factor test, one of the best-known techniques for controlling potential nonresponse bias. We ran an unrotated factor analysis on 31 survey questions (Product newness, Innovation rate, Target costing functionality, Quality of IS information and PEU). Based on eigenvalues> 1, five factors were formed, with one factor solution explaining 23.6% of the total variance. Therefore, the one factor solution explains less than the majority of the data. So, we found that nonresponse bias was not a problem in our sample.

Table 1

Measurement of constructs

Almost all measurements were designed using existing instruments. In almost all cases where subjective data were used, they were measured using a 7-point Likert scale. Table 2 presents the questionnaire items for the constructs with the descriptive statistics, while Table 4 presents the statistics from exploratory factor analysis of all variables used in the research (loadings, variance extracted, AVEs, ICRs, cronbach's alphas), where they could be calculated. All constructs were considered reflective.

To measure *product innovation,* we used two proxies from Stock et al. (2013), which were also used by Müller-Stewens et al. (2020) a) the frequency of introduction of new products in the market (innovation rate) and b) the degree of product innovation (product newness). These are 2 of the most important characteristics of business innovation (Szymanksi et al., 2007). For the measurement of the innovation rate seven items were used and for the products newness five items were used (Table 2).

Table 2

Table 3

Table 4

The literature offers little guidance on the conceptualization of *Target Costing functionality construct*. Previous studies measured TC with a dummy variable according to whether they had adopted TC as a management control practice (e.g., Yazdifar and Askarany, 2011; Pavlatos and Kostakis, 2018). In this work we wanted to measure the level of implementation of TC in an organization and not to classify businesses into TC adopters or non-adopters. Thus, to capture the differences in TC system design, it is necessary to use a continuing multidimensional measure for the implementation that captures the TC functionality or sophistication level, defined as the extent of development of essential design characteristics, functions or processes of a TC system within a firm. Therefore, we built on previous literature for TC to develop a conceptualization of TC functionality (Ax et al., 2008; Ibusuki and Kaminski, 2007; Everaert et al., 2006; Ewert and Ernst, 1999; Laseter et al., 1997).

This construct includes 8 items which are: (1) We identify target product cost as the difference between expected price (target price) and required profit for all our product offer, (2) We adopt cost-cutting strategies at the production stage to approach the target, (3) In our company there is an intensive co-operation between many departments and different functions to archive target cost, (4) We examine all cost-reducing strategies at the planning and pre-production stages, (5) Our costing system provides detailed cost information to monitor progress towards cost reduction target, (6) We continuously compare the actual costs with the target cost, (7) We use value engineering (value analysis) to incorporate customer requirements (8) We optimize value by considering the trade-off between product functions and their cost. Respondents were asked to evaluate the above functions and processes regarding the level of implementation of TC in their business on a scale ranging from 1 "Strongly disagree" to 7 "Strongly agree" (Table 2). By using a Likert scale for these items, we are able to consider TC functionality level by a continuous variable measured by a construct with equal weighting for the 8 items. Larger mean scores indicated higher TC functionality. When the construct score is higher, so is the designed TC functionality level. To access the validity of this construct, in addition to relying on the literature, we discussed the issue during the pilot research with practitioners and academics to gain more knowledge about the domain and eliminate possible ambiguity in its measurement.

Quality of IS Information was operationalized using 5 items from the instrument of Teng et al. (1995) and used by Dunk (2004; 2007). Respondents were asked to evaluate their information system as far as reliability, relevancy, precision and completeness of information that it provides is concerned on a scale varying from "very low" to "very high" (Table 2). This construct measures the quality of information provided by the company's information system. This information can be financial or non-financial and covers all operations of the business (e.g., sales, operations, supply chain, finance, HR). Larger mean scores indicated IS provides information characterized by increased (high) reliability, relevancy, precision and completeness.

Regarding the control variables used in the analysis, the construct *Perceived Environmental Uncertainty - PEU* was measured using 6 items from the instrument of Gordon and Narayanan (1984) (Table 2). Higher mean scores indicated higher level of environmental uncertainty. *Organizational strategy* was measured with a single item adopted by Govindarajan (1988), where respondents were asked to determine the strategy followed by their business unit on a scale that takes values from "cost leadership" to "product differentiation", according to Porter (1980). *Organizational lifecycle stage* was based on the Kazanjian and Drazin (1990) self-categorization measure (Table 2). *Size* was measured with the natural logarithm of the number of employees (Table 2).

The construct *Historical Financial Performance* was measured using objective data obtained from the financial statements of the business units for a period of three years before the survey. All business units complied with the same accounting standards. This instrument was adopted by Naranjo-Gil et al. (2009). In this research we decided to use 5 indicators to measure Historical financial performance: (1) Return on Investment - ROI (EBIT / average total book value of assets), (2) Return on Sales - ROS (EBIT / sales), (3) Return on Equity- ROE (EBIT / average total book value of equity), (4) Earning per share and (5) Operating cash flow margin (Cash flow from operations / Sales). For each indicator, we calculated the mean value for the period of three years before the time of the survey. The mean values determined were used as indicators of the latent constructs (Table 2).

Reliability and validity of constructs

For the evaluation of multi-items constructs we calculated Internal Composite Reliability (ICR), Cronbach's Alphas and Average Variance Extracted (AVEs) (Table 2). In Table 2 we observe that the items loadings in the 6 constructs take values greater than 0.75, which leads us to conclude that there is satisfactory individual item reliability (Hair et al., 2017). In addition, ICR values for all constructs are greater than 0.8, which leads us to conclude that there is satisfactory composite reliability (Hair et al., 2017). The values of AVE for all constructs cover the minimum limit of 0.50, so we come to the conclusion that there is satisfactory reliability. We are led to the same conclusion for the reliability of the constructs, since the prices of Cronbach's alpha are greater than 0.70. Regarding the discriminant validity of constructs, we find that it is also satisfactory, since the AVE for each construct is greater than the squared correlations between the variables (Hulland, 1999) (Table 3). We draw the same conclusions about the discriminant validity of constructs from the Harman single factor test, which did not show only one factor, which will allow us to conclude that variables are separate constructs.

Results

To test our research hypotheses, we used Smart PLS 3.0 for the evaluation of measurements and structural models (Ringle et al., 2014). It is argued that in PLS there is no need for distributional assumptions and also it has minimal demands on measurement scales (Chin, 1998). For the above reasons, it has lately become a particularly popular technique in Management accounting literature (e.g., Chenhall, 2005). Table 2 presents the descriptive statistics of the constructs, while Table 3 presents their correlations. As we observe in Table 3, the correlations between the constructs are low, resulting in the conclusion that multicollinearity does not affect the results (Hair et al., 2017). This conclusion is confirmed by the values of VIF, which, for all constructs, range between 1,052 to 1,128, values well below the limit of 5 (Hair et al., 2017).

Table 5 presents the results of the analysis of structural models and indicates the importance of standardized b_s that resulted from a bootstrapping process that used 500 samples with replacement. For the analysis of the data with PLS, two models were calculated, the first containing only the main effects (Panel A) and the second including also the interaction effects (Panel B). To calculate the interaction terms, we first standardized the item scores and then calculated the interaction terms as a result of the standardized item scores (Chin, 1998). The results in Panel A of Table 5 show that H1 hypothesis is supported, since both the path coefficient from TC functionality to product newness is positive and statistically significant (0.292; p value = 0.002) and so is the path coefficient from TC functionality to innovation rate (0.272; p value = 0.006). On the contrary, H2 hypothesis is not supported, since the path coefficient, while it is positive, it is not statistically significant neither to the product newness (0.112; p value = 0.127) nor to innovation rate (0.108; p value = 0.132).

Regarding the control variables that entered the model with direct effects, we find that the path coefficient from Historical financial performance to product newness is negative and statistically significant (-0.202; p value = 0.018), as is to the innovation Rate (-0.190; p value = 0.024). Strategy was found to have a positive and statistically significant effect on product newness (0.167; p value = 0.031) and innovation rate (0.152; p value = 0.042). The other constructs (PEU, Organizational life cycle stage and Size) did not seem to have a statistically significant effect on the two variables of product innovation. To evaluate the structural model with the main effects, we calculated the R^2 values of each endogenous variable. The price for product newness was 23.5%, while the price for innovation rate was 21.9%, prices well above the 10% limit (Hair et al., 2017). In addition, we calculated the values of Stone-Geisser Q^2, which for both dependent variables were above zero (product newness 0.132; innovation rate 0.013), thus concluding that our model has good predictability (Hair et al., 2017).

Regarding the full model, which includes the main and the interaction effects (Table 5, Panel B), we observe the TC functionality continues to have a positive and statistically significant effect on both proxy variables of product innovation (0.296 p-value = 0.003 for product newness; 0.270 p-value = 0.006 for innovation rate). In this model, the interaction hypothesis (H3) is supported, since the TC functionality interacts with quality of IS information to provide positive significant effects on product newness (0.252 p-value = 0.007) and on innovation rate (0.285 p-value = 0.022). Therefore, we conclude that the positive association between target costing functionality and product innovation is stronger in firms that provide IS information of higher quality. Businesses that have a functional TC system and at the same time have an IS that provides quality information, have increased innovation rate and product newness, compared to companies that have only a sophisticated TC system. Hence, TC functionality and the quality of IS information complement each other, and provide comprehensive information that supports decision making and helps businesses to display greater product innovation.

Quality of IS information continues to have a positive but non-statistically significant direct effect on product newness (0.119 p value = 0.124) and innovation rate (0.118 p value = 0.127). The control variables that are statistically significant in the full model are Historical Financial Performance, which presents a negative and statistically significant effect on both proxy variables of product innovation (-0.213 p value = 0.015 for product newness; -0.198 p value = 0.022 for innovation rate) and the Strategy that shows a positive and statistically significant effect on both product newness (0.169; p value = 0.028) and innovation rate (0.159; p value = 0.038). To evaluate how much predictive value the interaction term adds to the model, we compared the R^2 and Stone-Geisser Q^2 of the model with the interactions (Panel B), with the corresponding values of the model with the main effects (Panel A). In Table 6 we observe that the values R^2, as well as the values Q^2 increased for the dependent variables; this leads us to the conclusion that the interaction term increases the exploratory power of the model. Figure 1 presents PLS results for the full model.

Table 5

Figure 1

Discussion and conclusions

The purpose of this work is to investigate the effect of TC functionality, as a management control practice, and the quality of IS information on product innovation. For this reason, an empirical survey was conducted on 106 industrial companies that have an R&D department.

This work contributes theoretically to better our understanding building on dynamic capability theory (e.g., Eisenhardt and Martin, 2000) and complementarity theory (e.g., Brynjolfsson and Milgrom, 2012) on how dynamic capabilities (TC and IS) are complements and contribute to product innovation. The results showed that the quality of IS information does not affect product innovation on its own, but it can increase it, providing it is combined with TC. We found that the positive association between the functionality of TC and product innovation is stronger in firms that provide IS information of higher quality as compared to firms that provide IS information of lower quality. Firms that have a TC system with adequate functionality and at the same time have an IS that provides quality information, have increased innovation rate and product newness, compared to companies that have only a sophisticated TC system. Although the value of information provided by IS is standard in the literature, especially when it brings together quality features (e.g., Dunk, 2004), it alone cannot increase product innovation, unless combined with the use of other management control practices. ISs provide a different kind of information than information provided by management control practices and, while this information can assist the implementation of management control practices by companies (e.g., Al-Omiri and Drury, 2007), they do not directly affect innovation. So, we conclude that the quality of IS information and TC functionality are complementary tools and, if combined, they may provide more complete information, which can improve product innovation.

From an empirical point of view, this research provides evidence that TC functionality is positively associated with product innovation. Businesses that have a more sophisticated TC system show increased innovation rate and product newness. A well-developed TC system enables companies to continuously improve their product portfolio by eliminating features that may increase costs, but the cost increase cannot be passed on to the price, as these features provide no value to the customer. A developed (more functional) TC system helps to create new and innovative products that have the desired functionality, quality and price for a specific market segment. The philosophy of TC is not focused on product development with the lowest cost, but in the direction of target cost, which reflects the requirements of customers and what the company's shareholders expect as the desired return on their investment. In addition, TC functionality can speed up the design and redesign process. In some cases, minimizing the time to market for new or redesign products is more important than reducing costs because of the sales advantages of being first in the market with a new product. Furthermore, TC functionality can improve the quality of new and redesign products. This, in combination with the market and customer focus of TC, allows the continuous renewal of the product portfolio. Therefore, we find that the findings of this research confirm previous research that management control practices have a positive effect on product innovation (e.g., Henri and Wouters, 2020; Dunk, 2011).

We further examined the relation between product innovation and several control variables. We found that strategy has a positive effect on product innovation and historical financial performance has a negative effect on product innovation. Pursuing innovation is a principal characteristic of a product differentiator (Miles and Snow, 1978). Innovation is better suited for companies that pursue a diversification strategy than a low-cost strategy (Chenhall and Moers, 2015).

The negative relationship between historical financial performance and product innovation can be explained in different ways. Within the context of real earnings management research, it can be hypothesized that higher levels of historical financial performance might create managerial incentives for (accrual or real) earnings management to avoid or reduce a decline on the level of earnings. One way to manage earnings though decisions about real operating activities is to reduce discretionary expenditures that are treated as expenses (Roychowdhury, 2006). Resource consumptions for innovation are treated as expenses and for this reason managers have incentives to reduce the intensity of innovation activities to avoid reducing current period's level of financial performance. Most notably, the negative relationship between the level of historical financial performance and innovativeness is supported by management research (Naranjo-Gil et al., 2009; Mone, et al., 1998). Firms that experienced economic slowdown in the past, tend to take risks and to change their structure (Mone et al., 1998; Zajac and Kraaz, 1993). Organizational changes are usually implemented though innovation. For instance, prior empirical evidence has documented that firms experiencing low profitability increase the level of R&D expenses (Hundley et al.,1996; Greve, 2003) and tend to be more willing to engage in structural innovation with high risk (Bolton, 1993).

Yet, our empirical evidence is subject to specific limitations. First, it deals with one type of product-related innovation and not with other types, such as process innovation. Second, this research is static and does not investigate the relationship between TC functionality and innovativeness and how the quality of IS information moderates this relationship over time. Thirdly, each generalization of data attempted needs attention, since data came from industrial companies that had an R&D department and employed more than 500 people.

This study motivates the research interest for expanding our research findings in various ways. First, it could be investigated how certain contingent factors moderate the relationship between TC functionality and product innovation, such as perceived environmental uncertainty, structure decentralization and business culture (e.g., Chenhall and Moers, 2015). Second, the relationship between some other management control practices with product innovation could be explored, such as balance scorecard and internal controls. Third, an investigation of whether the characteristics of top and middle managers (age, tenure, education background) are related to business innovation is worth exploring further.

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List of Legends for Figure and Tables

Tables

Table 1
Demographic data of the business units that participated in the survey and managers who filled the questionnaires

Panel A: Job position		
	N	%
R+D managers	32	30
CFO	64	59
CEO	12	11
	108	100

Panel B: No of employees (size)		
	N	%
501-650	14	13
651-700	32	30
701-850	32	30
851-901	18	17
901+	12	11
	108	100

Panel C: Sub-industry		
	N	%
Machinery and equipment	28	26
Chemical and chemical products	23	21
Pharmaceutical products	19	18
Computer, electronic, and optical products	15	14
Electrical equipment	14	13
Other	9	8
	108	100

Table 2
Descriptive statistics (n= 108).

1st measure for Product Innovation: Product newness (pn) Items:	Mean	S.D.	Min	Max
Please evaluate the following statements regarding the product program of your business unit (1= Strongly disagree, 7: Strongly agree)	4,33	1,35	1	7
pn_1: New products are novel	4,62	1,33	1	7
pn_2: New products are inventive	4,38	1,35	1	7
pn_3: New products differ significantly in terms of their newness from existing products of competitors	4,18	1,44	1	7
pn_4: New products are exceptional	4,23	1,38	1	7
pn_5: New products are innovative	4,25	1,29	1	7
2nd measure for Product Innovation: Innovation rate (inr) Items:	Mean	S.D.	Min	Max
Please evaluate the following statements regarding the innovation rate of your business unit (1= Strongly disagree, 7: Strongly agree)	4,64	1,33	1	7
inr_1: Our product offer is continuously updated with new products	4,52	1,33	1	7
inr_2: Our products are subject to permanent innovations	4,48	1,35	1	7
inr_3: We continuously improve the attributes of the firm's product	4,68	1,16	1	7
inr_4: Almost every year we launch new products that are based on new technologies	4,49	1,52	1	7
inr_5: Our products are continuously supplemented with new features	4,62	1,19	1	7
inr_6: Our company frequently replenishes or adds novel products to its product offer.	4,78	1,59	1	7
inr_7: Our company plans to introduce several new products on the market during the next five years	4,92	1,19	1	7
Target Costing functionality Items:	Mean	S.D.	Min	Max
Please evaluate the following statements regarding Target costing application in your business unit (1= Strongly disagree, 7: Strongly agree)	4,43	1,52	1	7
TC_1: We identify target product cost as the difference between expected price (target price) and required profit for all our product offer	4,78	1,69	1	7
TC_2: We adopt cost-cutting strategies at the production stage to approach the target	4,59	1,56	1	7
TC_3: In our company there is an intensive co-operation between many departments and different functions to archive target cost	4,53	1,48	1	7
TC_4: We examine all cost-reducing strategies at the planning and pre-production stages	4,39	1,51	1	7
TC_5: Our costing system provides detailed cost information to monitor progress towards cost reduction target	4,28	1,36	1	7
TC_6: We continuous compere the actual costs with the target cost.	4,31	1,42	1	7
TC_7: We use value engineering (value analysis) to incorporate customer requirements	4,26	1,53	1	7
TC_8: We optimize value by considering the trade-off between product functions and their cost	4,29	1,61	1	7

Table 2 (Continued)				
Quality of IS information Items:	Mean	S.D.	Min	Max
Please rate the computerized information system of your business unit (1 = Very low, 7: Very high)	4,47	1,21	1	7
Qua_1: Its accuracy	4,68	1,17	1	7
Qua_2: Its precision, i.e., the variability of the output information from that which it purports to measure	4,25	1,18	1	7
Qua_3: Its reliability, i.e., the consistency and dependability of the output information	4,62	1,24	1	7
Qua_4: Its completeness, i.e., the comprehensiveness of the output information	4,27	1,28	1	7
Qua_5: Its relevance, i.e., the degree of congruence between what is required and what is provided	4,51	1,16	1	7
Historical Financial Performance (Objective Data)	Mean	S.D.	Min	Max
	0,41	0,21	0,20	0,68
ROI	0,47	0,12	0,23	0,75
ROS	0,48	0,18	0,26	0,68
ROE	0,41	0,25	0,22	0,71
EPS	0,35	0,29	0,12	0,59
Operating Cash Flow Margin	0,41	0,21	0,20	0,68
Perceived Environmental Uncertainty	Mean	S.D.	Min	Max
Please evaluate the following statements regarding perceived environmental uncertainty facing your business unit (1= Strongly disagree, 7: Strongly agree)	5,24	1,23	1	7
PEU_1: The economic external environment facing your business unit hanging rapidly	5,12	1,38	1	7
PEU_2: Many new products in the industry have been marked during the past 5 years	5,14	1,41	1	7
PEU_3: it is becoming more difficult to predict the market activities of your competitors during the past 5 years	5,34	1,19	1	7
PEU_4: It is becoming more difficult to predict the tastes and preferences of your customers during the past 5 years	5,28	1,12	1	7
PEU_5: The price competition in the industry is extremely intense.	5,22	1,25	1	7
PEU_6: During the past 5 years, the legal, political, technological, and economic constraints surrounding your firm have proliferated greatly	5,34	1,16	1	7
Strategy	Mean	S.D.	Min	Max
How would you best describe our practice's strategic emphasis? (1= Cost leadership, 7: Product differentiation)	5,15	1,25	1	7
Organizational Life Cycle Stage	Mean	S.D.	Min	Max
Please indicate the Organizational Life cycle stage of your business unit (1 = Birth – formation, 2: Growth, 3: Mature, 4: Realignment -revival, 5: Decline)	3,46	1,14	1	5
Size	Mean	S.D.	Min	Max
Please provide the number of employees in your business unit	712	122,8	501	1.228

Table 3

Correlations from PLS model (n=108)

Variable	1	2	3	4	5	6	7	8	9
1. Product newness	1								
2. Innovation rate	0.30*	1							
3. Target Costing functionality	0.27*	0.29*	1						
4. Quality of IS	0.28	0.17	0.19**	1					
5. Historical Financial Performance	-0.22*	-0.26*	0.22*	0.26					
6. PEU	0.25	0.22	0.29	0.12	0.27	1			
7. Strategy	0.18*	0.20*	0.22	0.12	0.11	0.18	1		
8. Organizational Life cycle stage	0.15	0.25	0.24	0.23	0.26	0.24	0.17	1	
9. Size	0.20	0.21	0.19	0.21	0.24	0.18	0.12	0.26	1

Notes: * indicates Correlations is significant at the .05level (2 tailed) **indicates Correlations is significant at the .01 level (2 tailed).

Table 4:
Exploratory factors analysis, reliability and validity analysis (n= 108)

Items	1 Product newness	2 Innovation rate	3 Historical Financial Performance	4 Target Costing Sophistication	5 Quality of IS Information	6 PEU
pn_1	**0.782**	0.104				
pn_2	**0.794**					
pn_3	**0.812**			0.115		
pn_4	**0.804**	0.192				
pn_5	**0.816**			0.209		
inr_1		**0.798**				
inr_2	0.124	**0.813**				
inr_3		**0.819**				
inr_4		**0.866**	-0.106			
inr_5		**0.844**				
inr_6		**0.810**				
inr_7	-0.124	**0.797**				
ROI			**0.824**			
ROS			**0.802**			
ROE			**0.796**			
EPS			**0.757**			
Operating Cash flow margin			**0.812**			
TC_1				**0.814**		
TC_2				**0.795**		-1.252
TC_3				**0.833**		
TC_4		-0.126		**0.841**		
TC_5				**0.812**		
TC_6				**0.756**		
TC_7				**0.762**		
TC_8				**0.758**		
Qua_1					0.852	
Qua_2					0.834	
Qua_3					0.861	
Qua_4					0.891	
Qua_5					0.875	
PEU_1						**0.812**
PEU_2						**0.823**
PEU_3						**0.815**
PEU_4			0.129			**0.833**
PEU_5						**0.841**
PEU_6						**0.854**
Cronbach's alpha	0.82	0.84	0.81	0.85	0.89	0.87
Variance Extracted	62.4%	63.5%	72.8%	69.4%	73.1%	63.9%
Average variance extracted (AVE)	0.642	0.674	0.613	0.633	0,703	0.695
Internal composite reliability (ICR)	0.822	0.832	0.812	0.824	0.801	0.819

Notes: We used maximum likelihood with promax rotation to calculate the factor analyses and to extract all factors with eigenvalues >1. Rotation method: promax with Kaiser normalization. Cross-loadings below absolute 0.1 are suppressed.

Table 5:
Results from PLS analysis (n= 108)

Path	**Path coefficient**	**p - value**
Main effects only		
Target costing functionality -> Product newness	**0.292***	**0.002**
Quality of IS -> Product newness	0.112	0.127
Target costing functionality -> Innovation rate	**0.272***	**0.006**
Quality of IS -> Innovation rate	0.108	0.132
Control Variables		
Historical Financial Performance -> Product newness	**-0.202**	**0.018**
PEU -> Product newness	0.085	0.231
Strategy -> Product newness	**0.167***	**0.031**
Organizational Life cycle stage -> Product newness	0.117	0.133
Size -> Product newness	0.134	0.089
PEU -> Innovation rate	0.117	0.133
Historical Financial Performance -> Innovation rate	**-0.190***	**0.024**
Strategy -> Innovation rate	**0.152***	**0.042**
Organizational Life cycle stage -> Innovation rate	0.118	0.129
Size -> Innovation rate	0.158	0.119
R^2 (Product newness) = 0.235		
R^2 (Innovation rate) = 0.219		
Q^2 (Product newness) = 0.132		
Q^2 (Innovation rate) = 0.113		
Full model		
Target costing functionality -> Product newness	**0.296***	**0.003**
Quality of IS -> Product newness	0.119	0.124
Target costing functionality * Quality of IS -> Product newness	**0.252**	**0.007**
Target costing functionality -> Innovation rate	**0.270***	**0.006**
Quality of IS -> Innovation rate	0.118	0.127
Target costing functionality * Quality of IS -> Innovation rate	**0.285***	**0.003**
Control Variables		
Historical Financial Performance -> Product newness	**-0.213***	**0.015**
PEU -> Product newness	0.089	0.227
Strategy -> Product newness	**0.169***	**0.028**
Organizational Life cycle stage -> Product newness	0.119	0.130
Size -> Product newness	0.142	0.085
Historical Financial Performance -> Innovation rate	**-0.198***	**0.022**
PEU -> Innovation rate	0.110	0.135
Strategy -> Innovation rate	**0.159***	**0.038**
Organizational Life cycle stage -> Innovation rate	0.121	0.127
Size -> Innovation rate	0.162	0.115
R^2 (Product newness) = 0.278		
R^2 (Innovation rate) = 0.256		
Q^2 (Product newness) = 0.163		
Q^2 (Innovation rate) = 0.148		

Notes: * indicates Correlations is significant at the .05level (2 tailed)