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# Disentangling the impact of ICT adoption on SMEs performance: the mediating roles of corporate social responsibility and innovation

**JEL Classification:** *A11*

**Keywords:** *information and communication technologies, ICT; corporate social responsibility, CSR; innovation; firm performance; Partial Least Squares-Structural Equations Modeling-PLS-SEM*

**Abstract**

**Research background:** The literature on the effects of Information and Communication Technologies (ICT) on performance is extensive and shows a significant positive effect. Likewise, the use of ICT to facilitate and report on Corporate Social Responsibility (CSR) practices implement-

ed by Small and Medium Enterprises (SMEs) contributes to improve business performance. Moreover, through innovative activities, firms also obtain competitive advantages that impact positively on their performance, even more so when they are impacted by CSR. For this reason, it is expected that the adoption of ICTs in companies through a CSR-oriented strategy will increase their impact on business performance.
**Purpose of the article:** This article tries to examine how ICT affects SMEs' performance through CSR and innovation.
**Methods:** We tested our hypotheses using a sample of 2,825 Spanish SMEs and by applying a Partial Least Squares Path Modeling (PLS-PM) with a double confirmatory and predictive purpose: to identify the causal relationships between latent variables, and to evaluate the ability of the model to make predictions for individual cases.
**Findings & value added:** The results show that CSR-oriented ICT impacts innovation by changing strategies and business model in companies. Moreover, the implementation of CSR practices gave them competitive advantages to increase their performance. We highlight how innovation gives companies greater capacity to respond to changes in their environment and how innovation positively impacts the link between CSR and performance. Finally, our research makes two significant contributions to the literature by incorporating two sequential mediating effects into the model. On the one hand, the indirect effect of ICT on innovation through CSR. On the other hand, the indirect effect of CSR on SME performance through innovation.

## Introduction

The use of Information and Communication Technologies (ICT) provides companies with a significant capacity to reduce costs and increase production, thus helping to enhance their performance (Alam & Mohammad Noor, 2009). Many authors have addressed the factors that determine the performance of SMEs (Małkowska & Uhruska, 2022). As a result, the literature on the effect of ICT on performance is extensive and shows a positive and significant effect (Bharadwaj, 2000; DeStefano *et al*., 2018; Garcia-Alcaraz *et al*., 2017; Liang *et al*., 2010), particularly in Micro, Small and Medium Enterprises (SMEs) (Chege *et al*., 2020; Jang & Kim, 2018; Tarutė & Gatautis, 2014; Yunis *et al*., 2018).

Likewise, the use of ICT to facilitate and report on CSR practices carried out by companies contributes to improve business performance. This is due to the competitive advantages that CSR brings to companies, through increased business reputation (Berthelot *et al*., 2012; Cho *et al*., 2012; Dobele *et al*., 2014; Rodriguez *et al*., 2013), employee motivation (Santos-Jaén *et al*., 2021), the sustainability of its products and services *(Nyeadi et al*., 2018; Schaltegger *et al*., 2012; Szekely & Strebel, 2013), and increased market stability (Valls Martínez *et al*., 2022; Valls Martínez & Martín Cervantes, 2021). For this reason, it is expected that the adoption of ICTs in companies through a CSR-oriented strategy will have a greater impact on corporate performance. Moreover, by carrying out innovative activities, companies also obtain competitive advantages, that have a positive impact

on their performance (Bacinello *et al*., 2021), even more so when this impact stems from Corporate Social Responsibility (CSR) (Palacios-Manzano *et al*., 2021).

This research attempts to verify how ICT impact on SMEs' performance through both CSR and innovation. The main research questions that this paper seeks to answer are: Does CSR affects innovation in SMEs?; Is the effect of CSR on performance mediated by innovation?; Is the impact of ICT on innovation mediated by CSR?. We tested our hypotheses using a sample of 2,825 Spanish SMEs and by applying a Structural Equations Model based on Partial Least Squares (PLS-SEM) with two purposes; a confirmatory aim in order to comprehend the casual relationships between latent variables (Henseler, 2018), and a predictive purpose to determine if the model is able to make predictions for individual cases (Shmueli *et al*., 2016). We analyzed this specific group for two main reasons. On the one hand, because SMEs play a significant role in worldwide economies, and on the other , we have chosen a specific country, Spain, because a country's rate of ICT adoption is intimately correlated with its national culture (Erumban & De Jong, 2006). Moreover, regarding the impact of CSR on performance, the findings of previous research may vary significantly because of cultural and legal differences between countries (López-Arceiz *et al*., 2020). Thus, with our sample we cover a gap in the current literature.

Few studies analyze the effect of ICTs on CSR, and the results obtained are disparate (Avotra *et al*., 2021; Charumathi & Padmaja, 2018). On the contrary, there is a great deal of research on the impact of ICTs on innovation (Ebrahimi *et al*., 2018; Karakara & Osabuohien, 2020; Valdez-Juárez *et al*., 2018). In relation to innovation, considerable research in recent years has shown the existence of a direct and positive relationship between innovation and company performance (Carrasco-Carvajal & García-Pérez-de-Lema, 2021; Donbesuur *et al*., 2020; Roach *et al*., 2016; Zhu *et al*., 2019). Regarding CSR, the study of the effect of CSR on innovation has aroused the interest of many researchers. These studies have shown the catalytic effect of CSR on innovation (Bocquet *et al.,* 2019; Palacios-Manzano *et al*., 2021; Santos-Jaén *et al*., 2021; Zastempowski & Cyfert, 2021). Similarly, more recent research has addressed the effects of CSR on the performance of SMEs (Gimeno-Arias *et al*., 2021; Martinez-Conesa *et al*., 2017; Palacios-Manzano *et al*., 2021; Sinha *et al*., 2018). These results have reported, in most cases, the existence of a direct and positive effect. However, as far as we know, previous literature did not examine the possible existence of mediating effects among ICT and innovation through CSR or CSR and performance through innovation.

We contribute to previous studies by demonstrating that ICTs, CSR and innovation are essential tools for SME performance. Furthermore, our results show that these effects are not only direct and positive, but that there are also two sequential indirect effects. The existence of an indirect effect of ICT on innovation through CSR, and of an indirect effect of CSR on SME performance through innovation has been demonstrated. In sum, the confluence of both effects generates a positive impact of ICT on SME performance. Similarly, the results have an important practical implication, encouraging managers to establish a CSR strategy in their firms, to improve company performance and achieve greater performance to survive in the current changing environment.

To meet the objectives, the study begins in section 2 which shows the development of the hypotheses. Section 3 sets out the methodological aspects, while the findings found are presented and discussed in sections 4 and 5. Section 6 concludes by describing the practical and theoretical implications and limitations.

## Literature review

### *ICT adoption and CSR*

In recent years, CSR studies have become an interesting area of research (Hadj *et al*., 2020), which has led to a growing interest from academics and professionals (García-Piqueres & García-Ramos, 2020; Hsu & Chen, 2020; Palacios Manzano *et al*., 2019). Despite its many definitions, and according to Aguinis and Glavas (2012), we perceive CSR as context-specific organizational strategies that incorporate the triple bottom line of social, environmental, and economic performance in addition to stakeholders' expectations. Through CSR, companies seek to mitigate the adverse social and environmental effects of their activities and gain legitimacy in the eyes of society (Valls Martínez *et al*., 2022).

ICT comprises a range of computerized technologies that facilitate communication and allow for the collecting, processing, and transmitting of information (Setiowati *et al*., 2015). Nowadays, technology and computers have a significant impact on the society, and information is carried all over the world at the speed of light through ICT, benefitting both individuals and enterprises (Malaquias *et al*., 2016). Within companies, ICT has altered the market-oriented characteristics of goods and services as well as production procedures, employee workflow, and management techniques (Ritchie &

Brindley, 2005). Particularly, the Internet has changed the way people do business (Setiowati *et al*., 2015; Tan *et al*., 2009).

Regardless of ICT adoption by SMEs, their flexibility in structures, processes and systems makes them better equipped to adapt to changes in ICT (Ritchie & Brindley, 2005). As a result, the literature proposes a wide variety of positive effects in companies, such as, reducing effort, improving communication with stakeholders and shareholders, improving internal processes and efficiency, increasing revenues and reducing cost, among others (Kannabiran & Dharmalingam, 2012; Ongori & Migiro, 2010).

Nonetheless, the impact of ICT use and adoption in the firms has effects beyond merely economic (Malaquias *et al*., 2016). The use of ICT also reduces the effort in certain kinds of tasks (Thapa *et al*., 2012), which enhances employee satisfaction and motivation (Gimeno-Arias *et al*., 2021). This contributes to improving the work environment (Bernal-Conesa *et al*., 2017); one of the goals of CSR. Elsewhere, ICT also plays an important role in sharing information. ICT is now a potent tool for monitoring, promoting, communicating, and measuring businesses' social and financial goals. How a company addresses social issues, sustainable production, and safer products can be communicated via the Internet (Brennan & Johnson, 2004) at a lower cost (Tan *et al.*, 2009), strengthening ties and collaborations (Qosasi *et al*., 2019). The capacity of ICT to implement and drive CSR is as limitless as the advances in technology (Kennedy *et al*., 2020).

Few studies analyze the effects of ICTs on CSR. For example, Charumathi and Padmaja (2018) conclude that ICTs positively affect CSR disclosure. However, Avotra *et al.* (2021) found that the application of ICT in business has a negative effect on CSR.

In spite of the lack of the empirical studies that show the effect of ICT adoption on CSR (Malaquias et al., 2016), from the above perspective, the following hypothesis is developed:

H1: *In the case of Spanish SMEs, ICT adoption positively impacts Corporate Social Responsibility.*

*ICT adoption and innovation*

Innovation is a critical factor for economic growth, it is one of its main catalysts and it is inevitable for companies, not only for their expansion but also for their mere survival in today's global and demanding markets (Donbesuur *et al*., 2020). From a theoretical approach, innovation can be described as the application of new knowledge to develop new processes, services, and goods (Ode & Ayavoo, 2020). Karakara and Osabuohien

(2020) assert that discovering new markets for sales, creating new products, utilizing novel business strategies, or building a reputation all fall under the category of innovation and have an effect on a company's growth. Therefore, in the current global and dynamic environment, innovation must be a fundamental factor in improving the competitiveness of companies (Berasategi *et al*., 2011).

The majority of SMEs do not have sufficient resources to stimulate innovation by themselves (Bertello *et al*., 2022; Pellegrino & Savona, 2017). Consequently, ICT could provide the platform to help enable SEM innovation. Bresnahan *et al.* (2002), state that ICTs play an essential role in enabling companies to innovate in the sense of general-purpose technology. In the same line, Tan *et al.* (2009) believe that ICT is the most cost-efficient tool to help SMEs to compete with larger organizations, using the Internet as an innovation in conducting business. The synergies between ICT and innovation facilitate innovation due to the spread of information; favouring knowledge flows, information networks and reducing transaction costs (Billon *et al.*, 2017). The latter, particularly, benefits SMEs by having cost strategies (Zaridis *et al*., 2021).

Many studies have evaluated how ICT tools have a impact on innovation (Michaelides *et al*., 2013). All companies, and SMEs in particular, have documented the benefits of ICT for innovation. So, the results found in a large number of previous studies about the ICT adoption in companies reveal that in SMEs, an increase in ICT, such as investment in hardware, software, and a budget for its operation, increases the effect of innovation (Ebrahimi *et al*., 2018; Karakara & Osabuohien, 2020; Valdez-Juárez *et al*., 2018). For these reasons, the following hypothesis is developed:

H2: *In the case of Spanish SMEs, ICT adoption impacts innovation.*

CSR and innovation

Taking into account the capacity of innovation to create new products, services, and processes and according to the strategic CSR framework, there is a very strong link between CSR and technological innovation (Bocquet *et al*., 2019). Although this relationship has been shown to be dual in much research (Bocquet *et al*., 2019; García-Piqueres & García-Ramos, 2020), in line with (Santos-Jaén *et al*., 2021), in this research a unidirectional relationship between CSR and innovation is deemed.

Due to the pressure of their stakeholders, responsible and sustainable companies must embrace innovation in processes, services, and products in order to boost energy efficiency and lessen the negative effects of their

actions on the environment (García-Piqueres & García-Ramos, 2020; Ikram *et al*., 2019). In this sense, CSR is a catalyst for companies' innovation activities (Ben Hassen & Talbi, 2022). In SMEs, a virtuous circle is developed between innovation and CSR. The more CSR, the more innovative the SME (Zastempowski & Cyfert, 2021). Based on this idea, a great deal of research has shown CSR's impact on company innovation, in any type of company (Pan *et al*., 2021), in Spanish companies (García-Piqueres & García-Ramos, 2020) and especially in Spanish SMEs (Bocquet *et al*., 2019; Palacios-Manzano *et al*., 2021; Santos-Jaén *et al*., 2021; Zastempowski & Cyfert, 2021).

From this argument, the following hypothesis is developed:

H3: *In the case of Spanish SMEs, CSR impacts innovation.*

*The mediating role of CSR*

The effective use of ICTs allows for more effective CSR initiatives, facilitating their implementation by contributing to their understanding and common use (Charumathi & Rahman, 2019). People, the planet, and profit are the three fundamental pillars of sustainability (Ranjbari *et al*., 2021). As a result, many organizations have started sustainable development by incorporating ICTs into their operations in a sustainable strategy (Losa-Jonczyk, 2020). Therefore, this impact of innovation in firms modifies the corporate business models and strategies (Martinez-Conesa *et al*., 2017).

Implementing ICTs in SMEs will provide them with greater resources to carry out innovative activities (Bertello *et al*., 2022) and indirectly increase this innovation by promoting CSR. Furthermore, by facilitating the implementation and dissemination of CSR practices, ICTs will also lead to an increase in the innovative activity of SMEs, as these companies will have greater possibilities of satisfying stakeholders' interests in terms of obtaining more sustainable products, services, and processes.

Thus, a mediation of CSR in the link between ICT adoption and innovation is possible, leading us to develop this hypothesis:

H4: *In the case of Spanish SMEs, CSR mediates the relationship between ICT adoption and innovation.*

*CSR and Firm Performance*

Firm performance means the effectiveness of the enterprise in achieving financial and operational performance (Saraf *et al*., 2007). Previous studies suggest that innovation is linked to firm performance (Canil *et al*., 2021). According to Zakaria *et al.* (2019), innovative organizations are more likely to start an organizational change that could have an impact on their performance.

From a theoretical perspective, as stated by the Stakeholder Theory, beyond shareholders a company's relationships with a wider range of stakeholders, including customers, governments, employees, environmentalists, and others, serve as a guide to comprehend the firm's range of obligations (Lv *et al*., 2020). In this line of thought, a contractual relationship is supposed to exist between the company and all its stakeholders, which makes it possible for businesses to be managed for the benefit of all stakeholders, in the financial and non-financial areas (Jain *et al.*, 2016).

Through the implementation of CSR practices, companies can achieve improved employee satisfaction (Dobele *et al.*, 2014; Nyeadi *et al*., 2018) while developing more sustainable and innovative products and services (Schaltegger *et al*., 2012; Szekely & Strebel, 2013), which will give them interesting competitive advantages (Rhou *et al*., 2016). This will lead in the mid-term to an increase in the demand for products and services and even allow their prices to rise, thereby increasing their profitability (Wang & Choi, 2013). So, companies can improve their performance through CSR practices (Chen *et al*., 2018). In turn, returns will be even higher if the CSR practices implemented are linked to the preferences of their stakeholders (Michelon *et al*., 2013).

The analysis of the relationship between CSR and performance has generated enormous interest among academics lately (Beck *et al*., 2018; Lv *et al*., 2020; Partalidou *et al*., 2020; Úbeda-García *et al*., 2021). Although in most cases, the previous research demonstrates a direct and positive link (Beck *et al*., 2018; Busch & Friede, 2018; Jang *et al*., 2019; Nyeadi *et al*., 2018; Partalidou *et al*., 2020; Úbeda-García *et al*., 2021). Some authors, such as Gimeno-Arias *et al.* (2021), establish that CSR has no direct effect on performance. Even SME scholars have shown interest in how CSR impacts firm performance, and arrived at the same conclusion (Martinez-Conesa *et al*., 2017; Palacios-Manzano *et al*., 2021; Sinha *et al*., 2018). For these reason, the following hypothesis is developed:

H5: *In the case of Spanish SMEs, CSR impacts firm performance*.

*The mediating role of innovation*

Due to disparities in their technological capacities, enterprises competing in the same market experience unequal production costs. So, the disparity in their capabilities the levels results in a different performance. As a result of the capacity of innovation to generate new ideas in the organization through products, processes and services, applying the latest and most advanced knowledge, companies gain from a premium for innovation that increases their longevity, regardless of their features (size, ages, …) (Cefis, 2005). Indeed, if companies can innovate more, they will be better able to adapt to their environment (Zakaria *et al*., 2019). Hence, according to Dana *et al*. (2022) innovation is essential for "rapid growth" in companies.

In line with the above, Gorączkowska (2020) states that nowadays, the application of innovation brings quantifiable benefits to companies. As a result, the literature has shown a positive relationship between a company's innovation project and its performance, as innovation is the main driver of economic growth, contributing to the long-term profitability and continuity of the company (Guerrero-Villegas *et al*., 2018; Ruiz-Palomo *et al.*, 2022). Moreover, this relationship is considered to be strong in SMEs (Carrasco-Carvajal & García-Pérez-de-Lema, 2021; Donbesuur *et al*., 2020; Roach *et al*., 2016; Zhu *et al*., 2019). We, therefore, formulate the following hypothesis as follows:

H6: *In the case of Spanish SMEs, innovation impacts firm performance*.

On the basis of the above, in the relationship between CSR and performance, the mediating role of innovation is obvious. The links between CSR and company performance are explained by intangible resources, which include innovation (Ahmad *et al.*, 2022). For companies to increase their performance, they need the capabilities that innovation brings to them (El-Gammal *et al.*, 2018). With this in mind, innovation is considered essential for CSR to enhance company performance (Briones Peñalver *et al*., 2018). Moreover, this conclusion has been reached by several scholars in the field (Hull & Rothenberg, 2008; Martinez-Conesa *et al*., 2017; Zhu *et al*., 2019).

By orienting their management towards CSR, SMEs will increase their performance by increasing their corporate reputation and stakeholder satisfaction. Consequently, CSR will turn SMEs into more innovative companies searching for more productive products, services, and processes. This increase in their innovative character will bring them more profits. As

a result, an indirect effect of innovation on the performance of SMEs through CSR is expected.

In this sense, we assume that:

H7: *In the case of Spanish SMEs, innovation mediates the effect of CSR on SMEs performance*.

In short, our hypotheses suggest that the adoption of ICT might positively impact innovation and CSR; simultaneously, the effect of CSR on Innovation has been described as a virtuous circle in prior literature. Similarly, CSR and innovation impact SME performance, conforming a sequential path from ICT adoption to firm performance. Path analyses typically use multiple indicators for measuring unobserved variables, where the use of Structural Equations Modeling (SEM) is usual. Moreover, such sequential relationships conform a model with two nested mediating effects, as shown in Figure 1. At this point, composite-based SEM methods, such as PLS-SEM, overcome the limitations of both Hayes' Process regressions and factor-based SEM techniques in mediation analysis (Sarstedt *et al.*, 2020). In addition, unobserved variables, especially composites, are widely used in business management research, where PLS-SEM is one of the most valuable methods (Becker *et al*., 2022). Measurement scales were then taken following a composite approach and the data was collected to carry out our research following a suitable methodology.

## Methods

### *Sample and data collection*

To conduct the empirical analysis, the data have been obtained from telephone surveys conducted by a company specialized in this type of work. This survey was developed through a self-administered questionnaire applying to the CEO of companies from several sectors, such as manufacturing and service sectors in Spain (See Table 1). CEOs of SMEs have been chosen because, in this type of company, they usually make the majority of decisions (Van Gils, 2005), and therefore, their perceptions highly influence the company's strategy.

The questionnaire consists of twenty-seven questions divided into four blocks. The initial fifteen questions, included in the first block called "General Data," sought to obtain information on the characteristics of each company surveyed. To this end, we collected several information such as age, industry and number of employees of the firms. The remaining questions

were used to carry out this research, corresponding to each of the variables created, as seen in Table 2.

The sample has been divided into two segments, according to the business activity carried out and the size of the companies. Table 1 illustrates the sample composition, made up of 2,825 companies, with a response rate of 7.25% and a sampling error of 1.82%. Moreover, Appendix A shows the sample size and the total population by strata, and Appendix B shows sampling error for each sector. For this purpose, the composition of the firms in the population has been extracted from the data contained in the INE (Spanish National Statistics Institute). The INE prepares and distributes statistics regarding Spanish companies tabulated by size, industry, and other indicators. Then, the SABI database (Bureau Van Dijk) was used for a stratified random selection of the sample. SABI is a database that includes contact information on more than 2.9 million Spanish companies. Fieldwork was conducted during the first four months of 2018.

To ensure the unambiguousness of the survey, a preliminary test was applied on 25 firms. The survey was administered anonymously to minimize the social acceptance bias (Fisher, 1993).

Finally, common method bias and nonresponse bias have been analysed. To verify that nonresponse bias was not a concern we proxied nonresponses by using 20% of late respondants. Then, we compared them with 80% of the earlier responses. The ANOVA test showed no differences among the two groups created. In line with Hair *et al*. (2019b), the common variance bias has been assessed applying a single factor test (Podsakoff *et al*., 2003). The results show that four factors account for 59.29% of the total variance, and the principal latent factor accounts for 30.28%. On the basis of these results, it can be stated that the common method bias is not a concern in this research.

To check the appropriate sample size, we performed a post hoc test using the G*Power (v. 3.1.9.4) software (Mayr *et al*., 2007). Starting from the effect size (f2) and the number of predictors, and assuming a standard error of 0.05, we estimated the power for the sample, which is greater than 0.80 (the shortcut value). Based on the results obtained, we can be sure that, taking into account the magnitude of the effects found, we are working with a sufficient sample size (Cohen, 2013).

*Measurement of variables*

The variables used in the research have been created from the survey conducted. In turn, the questions that make up the survey have originated

from previous literature. The description and makeup of the variables utilized in the study are displayed in Table 2.

ICT adoption: ICT adoption has been created based on five indicators, adapted from previous research (Karakara & Osabuohien, 2020; Malaquias *et al*., 2016), which contain questions involving the use of ICT in companies.

Corporate Social Responsibility: There is no unified and general way to conceptualize CSR (Galbreath, 2018); a broad spectrum of ways to measure CSR can be identified in the previous literature (García-Piqueres & García-Ramos, 2020). In this study, and to design a variable that could measure CSR in the companies under study, a 5-point Likert scale has been applied to obtain the CSR data. So, we have created a latent variable oriented to knowing how CSR in the company is implemented, using seven indicators in the survey that were chosen based on a carefully selected review of CSR literature (Adinata, 2019; Devie *et al*., 2018; Esparza-Aguilar & Reyes-Fong, 2019; Ikram *et al*., 2019).

Innovation: Innovation was measured following previous research (Martínez-Ros & Labeaga, 2009). A scale that distinguishes between products and innovation processes has been used for this purpose (Madrid-Guijarro et al., 2009). Moreover, in line with Hughes *et al*. (2001), this option has proved to be more suitable for SMEs. So, in this paper, innovation is a construct made up of seven items that utilize a 5-point Likert scale to measure the degree of innovation implemented in companies in the last few years.

Firm Performance: On the basis of previous research (Martinez-Conesa *et al*., 2017; Ruiz-Palomo *et al*., 2019; Úbeda-García *et al*., 2021), both financial and operational performance were measured through a latent variable constructed. Hence, eight items were used to capture the perception that managers have of their companies in comparison with competitors. In contrast, from accounting information, comparing a company with its competitors has been proven as a the key indicator of corporate success (Ruiz-Palomo *et al*., 2019).

*Statistical procedure*

The model contains four first-order composite type A. This is because, by studying the items and the constructs, we think there is a defining relationship between them, that is, the items define the constructs (Cepeda-Carrion *et al*., 2019). Consequently, we examined our research model applying partial least squares path modeling, which is widely supported as a variance-based structural equation model (PLS-PM or PLS-SEM) (Reinartz *et al*., 2009). PLS-PM is applied in many different areas and is

regarded as one of the most sophisticated and all-encompassing methods for modeling structural equations. Moreover, PLS-SEM is considered a modeling method for structural equations in its most recent iteration for creating various composite models, such as reflective and formative (Henseler, 2017). Besides, PLS-PM allows the estimation of multiple relationships between latent variables simultaneously, making it ideal for testing the proposed model (Hair *et al*., 2017). Furthermore, PLS-SEM has a series of additional advantages (Hair *et al*. 2019a): it is not necessary to assume that the sample follows a normal distribution, it is very valid when analyzing secondary data from the perspective of measurement theory, and it is a method with a high degree of statistical power.

All these advantages of PLS-PM have led us to choose this method rather than others, such as CB-SEM (Covariance-based Structural Equation Modeling). However, we know that PLS has some shortcomings; for example, the comparison of models is poorer than if GSCA (Generalized Structured Component Analysis) is used since the latter technique allows us to obtain better model fits (Lovaglio, 2011), whereas unweighted summed scales appear to be an easier technique (Rönkkö & Evermann, 2013). Nevertheless, we have opted for PLS as this technique is currently the most widely used in business research for composite-based models (Hair *et al*., 2019a), and typically, it might be better understood than the more complex GSCA, while substantially improving the results obtained by the unweighted model (Hubona *et al*., 2021).

Three approaches were pursued in this research: confirmatory, explanatory and predictive. (Cepeda-Carrion *et al*., 2019). SmartPLS version 3.3.2 software was used to estimate the proposed model. In addition, a bootstrap method based on 10,000 sub-samples was tackled to test the hypotheses.

As is common in practice, the PLS-PM analysis encompasses the evaluation of the measurement model and the evaluation of the structural model (Yáñez-Araque *et al.*, 2020).

## Results

### *Measurement model evaluation*

The reliability and convergent validity of the constructs was verified through measurement loads, Dijstra-Henseler rho ratio (Dijkstraand & Henseler, 2015), and the average variance extracted (AVE) (Hair *et al.*, 2019a). Moreover, Cronbach's Alpha and composite reliability (Chin, 1998) were also checked. These results and the descriptive statistics of the

observed variables are displayed in Table 3. They confirm that the measurement model has a good fit, because all values exceeded their respective thresholds (Cepeda-Carrion *et al*., 2019). These findings thus support the convergent validity of the reflective scales under study.

Discriminant validity was verified by using the Fornell-Larcker criterion, since none of the latent variables squared correlations exceed the AVE of each construct. Furthermore, all the Heterotrait-monotrait (HTMT) ratios ranged from 0.179 to 0.547, which are under the level recommended of 0.85 (Henseler *et al*., 2016). The results shown in Table 4 demonstrate the existence of discriminant validity.

The standardized root mean square residual (SRMR), which was used to evaluate the good fit of this study, was also checked, in both saturated and estimated models, to ensure that it did not surpass a value of 0.08. These findings imply that the model's requirements suit the data well (Hu & Bentler, 1998).

*Structural model evaluation*

Firstly, we can state that no collinearity problems are present in this model since all the variance inflation factor (VIF) values are near 1, which is below the generally accepted cut-off value of 3 (Hair *et al*., 2019a). To continue, we have used a bootstrap (10,000 resamples and one-tailed test) to assess the statistical significance of the path coefficients (Streukens & Leroi-Werelds, 2016).

Regarding the hypotheses proposed, Table 5 and Figure 2 show the results that allow us to accept the proposed hypotheses. The effect of ICT adoption on CSR is positive and significant (β=0.169***), verifying H1. Similarly, the effect of ICT adoption on innovation is also positive and significant (β=0.308***), supporting H2. Moreover, as can be seen, CSR's impacts on innovation and performance are positive and significant (β=0.249*** and β=0.423***, respectively), so H3 and H5 are supported. Finally, the effect of innovation on performance is positive and significant (β=0.198***), and therefore H6 is supported. As will be discussed below, all these results agree with those obtained in previous studies.

Following Chin (2010), we also checked R2 and Cohen's effect size (f2) (Cohen, 1988). Cohen's f2 effects show that CSR has an important effect on companies' performance.

This study also examined the indirect effects and the variance accounted for (VAF) (Hair *et al*., 2014), which determines the proportion of the indirect effect in relation to the total effect (Hair *et al*., 2017). Likewise, the results also demonstrate the mediating role of CSR in the relationship be-

tween ICT adoption and innovation. The indirect effect amounts to 0.042*** (VAF=12%). Hence, the proportion mediated is not prominent, while the direct and indirect effects are both significant, so partial mediation is proposed, accepting H4. Similarly, the indirect effect of CSR on performance via innovation is positive and significant (value=0.049***, VAF=10.4%), suggesting a partial mediation since the direct effect is also significant, supporting H7.

Regarding the impact of ICT on performance, our results show both global indirect effect and total effect are positive and significant (β=0.141*** and β=0.150*** respectively).

As established by Valls Martínez *et al*. (2021), we have conducted the analysis of the predictive relevance in this section. Since the Q2 values are more than 0, we also conducted a confirmatory composite analysis test after a blinding method to ascertain the model's overall predictive significance as the first stage in the quality assessment (Tenenhaus *et al*., 2005).

Finally, we also measure predictive power through the analysis of out-of-sample predictive validity (Sharma *et al*., 2018; Shmueli, 2010). We could determine that our model could accurately predict new case values by ensuring that all PLS Q2 prediction values were positive and that RMSE and MAEPLS values were lower than comparable LM values. PLS prediction was used to assess predictive ability with k-folds of 10 and 10 replicates (Shmueli *et al*., 2016). We obtained positive Q2 predict values for all indicators, which are shown in Table 3. Additionally, the PLS-SEM model's error in predicting results is lower than its error in predicting results based solely on the average of the values. Thus, these findings validate predictive validity and provide more evidence favoring the theories investigated in this work.

## Discussion

The findings of the empirical research show, consistent with previously conducted research, the positive impact of ICT adoption on corporate performance and other aspects related to business management. So, starting with regard to the effect on innovation, our results demonstrate as ICT adoption provides SMEs with the necessary resources to implement and improve innovative actions. Therefore, ICT has become a key element in the innovation of SMEs in Spain. Thus, the greater the implementation of ICTs, the greater the innovative activity of SMEs. These results coincide with those found in previous studies (Karakara & Osabuohien, 2020; Valdez-Juárez *et al*., 2018; Yunis *et al*., 2017).

Likewise, according to Bernal-Conesa *et al.* (2017), in this paper it has been proved how the ICT adoption has a positive effect on CSR by enhancing employee motivation and improving corporate transparency. This result also coincides with that provided by Charumathi and Padmaja (2018), who shows that the greater the application of ICTs in companies, the more they facilitate and increase the disclosure of information related to CSR. However, the results obtained contradict the thesis defended by Avotra *et al.* (2021). In their study development during the Covid-19 era, these researchers demonstrated that the application of ICTs in the business world negatively affects CSR, due to asymmetric information problems.

Similarly, it is interesting to highlight the impact of CSR on innovation due to the stakeholders' pressure to create new products, services, and processes according to the strategic CSR framework, leading companies to be more and more innovative. As a result, SMEs need a higher degree of innovation to be able to implement CSR in their business processes. In this vein, our results have shown that those SMEs that have a CSR orientation carry out more innovative activities than SMEs that do not carry out CSR activities. Our findings are consistent with previous studies that consider CSR in SMEs as a factor driving corporate innovation activities (Bocquet *et al*., 2019; Palacios-Manzano *et al*., 2021; Santos-Jaén *et al.*, 2021; Zastempowski & Cyfert, 2021).

Regarding the above, this study fills a related gap in the indirect effect of ICT through CSR on innovation. By facilitating the implementation and dissemination of CSR practices, ICT will increase the capacity of SMEs to develop products, services, and processes that are more responsive to the demands of their stakeholders in terms of sustainability. Therefore, ICTs will also have an indirect impact on SME innovation.This finding is in agreement with those reported in the previous literature. Thus, according to Martinez-Conesa *et al.* (2017), CSR-oriented ICT impacts innovation by changing strategies and business models in companies. Furthermore, as our findings suggest, in SME the implementation of CSR practices will give them competitive advantages which will improve their performance (Martinez-Conesa *et al*., 2017; Sinha *et al*., 2018). Through appropriate CSR practices, SMEs can increase their stakeholders' satisfaction. This positively and directly impacts the company's reputation and provides it with interesting competitive advantages that allow it to stand out from its competitors and improve its performance. Our results are fully in line with those obtained by other researchers previously, such as Beck *et al.* (2018), Busch and Friede (2018), Jang *et al*. (2019), Nyeadi *et al.* (2018), Partalidou *et al.* (2020) and Ubeda-García *et al.* (2021). However, these results do not coincide with those who believe there is no direct effect. They believe that CSR

needs something else to impact performance, such as an increase in employee motivation or customer satisfaction. Therefore, its effect would be indirect (Gimeno-Arias *et al*., 2021).

The findings regarding the impact of innovation on performance are consistent with those reported in the literature (Guerrero-Villegas *et al*., 2018; Ruiz-Palomo *et al*., 2022). The results confirm how innovation gives companies greater performance and capacity to respond to changes in their environment. This is because innovation enhances the ability of companies to generate new ideas in the organization through products, processes and services, applying the latest and most advanced knowledge, which translates into important benefits for the companies (Gorączkowska, 2020). Continuing with innovation, our second major contribution is established; the indirect effect of innovation on performance through CSR. Based on existing theory, our results have shown how innovation positively affects the impact of CSR on performance (Hull & Rothenberg, 2008) by providing the necessary capabilities to drive the effect of CSR on business (Briones Peñalver *et al*., 2018). When SMEs orient their management towards CSR, this leads to an increase in performance as the company becomes a more innovative organization. In addition, the predictive power shown in the model supports the proposed research model (Straub & Gefen, 2004).

## Conclusions

Using a sample of 2825 Spanish SMEs and using a PLS approach, this paper focuses on the effect of ICT adoption on their performance while examining the mediating effects of CSR and innovation on this relationship, taking a further step forward with respect to the literature.

Previous studies have demonstrated the effects of ICTs on performance (Chege *et al*., 2020) and now this paper highlights the reasons why CSR and innovation increase the positive impact of ICT on SMEs performance. The findings demonstrate that firms which are the most proactive in CSR practices have the greatest impact on their innovation activities, achieving interesting competitive advantages. Hence, by using CSR as a strategy for differentiation, the impact of ICT adoption on companies' performance will be much greater.

From a theoretical perspective, this study makes a valuable contribution to the managerial literature on the role of CSR practices and innovation as enablers of the connection between ICT and SME performance. This research makes two significant contributions to the literature by incorporating two sequential mediating effects into the model. On the one hand, the indi-

rect effect of ICT on innovation through CSR. On the other hand, the indirect effect of CSR on SME performance through innovation, providing a path that allows us to disentangle the effect of ICT adoption on performance in Spanish SMEs. In today's business environment, CSR and innovation have become essential drivers of growth. CSR enhances firms' reputation (Waheed *et al*., 2020) and innovations are crucial for a companies' growth (Coad & Rao, 2008).

This research also has some practical implications for SMEs managers, policymakers and SMEs associations. Our research shows that CSR practices in SMEs improve their value and competitiveness in the marketplace. Consequently, these responsible practices will increase the performance of these companies. Quite the contrary, the findings encourage managers to establish a CSR strategy in their firms, since in this way, through innovation, this strategy will contribute to develop important sustainable competitive advantages that will encourage them not only to increase their response to improve changes in the environment, but also to optimize their performance, directly and indirectly through CSR and innovation. In relation to public policy, our results are related to the 2030 Agenda for Sustainable Development Goals, which are intended to address the major economic, social, and environmental concerns facing our planet (Yáñez-Araque *et al.*, 2020). This research demonstrates the relevance and need to promote policies, through incentives or subsidies, aimed at promoting CSR practices in SMEs so that SMEs with fewer resources could have more opportunities to survive in this difficult moment brought about by the effect of the Covid-19 pandemic in the economy, Russia-Ukranie conflict and economic-financial crisis. These circumstances have transformed the business environment in EU countries.

This research has limitations that may serve as future lines of research. Our research uses a sample formed by Spanish SMEs only. For this reason the findings may not be transferable to third countries (García-Piqueres & García-Ramos, 2020). For research in the next few years, it would be interesting to expand the study to larger companies and companies from other countries. In the same way, it could be interesting to carry out this study at the sectoral level, analyzing sectors of vital importance for a country's economy, such as tourism. Additionally, in future studies, it would be interesting to investigate SMEs to show whether industry-related contingency factors like growth, dynamism, and/or competition may moderate the links between CSR, innovation, and performance (Martinez-Conesa *et al*., 2017). Similarly, it might also be interesting to analyze aspects which impact ICT, such as digitalization. Moreover, our research did not distinguish the different dimension of CSR. Regarding this issue, this study suggests that future

research could identify each specific dimensions of CSR (economic, legal, ethical, and philanthropic), to see whether their impacts on innovation and performance are different. It would also be interesting to update this research due to the extraordinary worldwide circumstances that ensued since the date of data collection. During this time, the business environment in European countries has changed as indicated in the previous paragraph. Concerning the statistical technique employed, future studies could provide more scientific evidence by replicating this model in different contexts, using factor-based measurements and SEM techniques, or applying the GSCA inferential statistical method, since this technique maintains all the advantages of PLS (unique solutions and no normality assumptions) and avoids the major drawback of PLS (lack of global optimization procedure and overall fit measure) (Lovaglio, 2011), which allows for better comparisons between models.

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## Annex

**Table 1.** Sample distribution

| Industry | Total | | Micro size | | Small size | | Medium size | |
|---|---|---|---|---|---|---|---|---|
| | N | % | N | % | N | % | N | % |
| Food and beverage | 166 | 5.9 | 60 | 5.3 | 72 | 5.3 | 34 | 9.9 |
| Textiles | 45 | 1.6 | 14 | 1.2 | 27 | 2.0 | 4 | 1.2 |
| Wood and cork | 45 | 1.6 | 11 | 1.0 | 28 | 2.1 | 6 | 1.8 |
| Paper, publishing, and printing | 62 | 2.2 | 24 | 2.1 | 29 | 2.1 | 9 | 2.6 |
| Chemicals | 19 | 0.7 | 2 | 0.2 | 11 | 0.8 | 6 | 1.8 |
| Rubber and plastic products | 49 | 1.7 | 10 | 0.9 | 26 | 1.9 | 13 | 3.8 |
| Other non-metallic minerals | 60 | 2.1 | 16 | 1.4 | 38 | 2.8 | 6 | 1.8 |
| Basic and fabricated metals | 142 | 5.0 | 45 | 4.0 | 80 | 5.9 | 17 | 5.0 |
| Machinery and equipment | 101 | 3.6 | 34 | 3.0 | 57 | 4.2 | 10 | 2.9 |
| Electrical, electronic, optical | 14 | 0.5 | 3 | 0.3 | 7 | 0.5 | 4 | 1.2 |
| Manufacture of motor vehicles | 28 | 1.0 | 7 | 0.6 | 6 | 0.4 | 15 | 4.4 |
| Furniture | 38 | 1.3 | 13 | 1.2 | 20 | 1.5 | 5 | 1.5 |
| Construction | 503 | 17.8 | 218 | 19.3 | 254 | 18.7 | 31 | 9.1 |
| Wholesale business | 574 | 20.3 | 280 | 24.8 | 235 | 17.3 | 59 | 17.3 |
| Hotel industry | 117 | 4.1 | 30 | 2.7 | 72 | 5.3 | 15 | 4.4 |
| Transport and telecommunications | 295 | 10.4 | 107 | 9.5 | 152 | 11.2 | 36 | 10.5 |
| Computer services | 95 | 3.4 | 38 | 3.4 | 41 | 3.0 | 16 | 4.7 |
| Others | 472 | 16.7 | 216 | 19.1 | 200 | 14.8 | 56 | 16.4 |
| **Total** | **2,825** | **100.0** | **1,128** | **100.0** | **1,355** | **100.0** | **342** | **100.0** |

**Table 2.** Constructs, dimensions and scale items used in the questionnarie

| **ICT adoption** (Chege *et al*., 2020; Karakara & Osabuohien, 2020; Malaquias *et al.*, 2016) | |
|---|---|
| Indicate if your company uses the following technologies or processes and, if so, indicate their degree of importance from 1 (minimum importance) to 5 (greatest importance) | |
| ict1 | Own website |
| ict2[a] | E-commerce platform (sale/e-commerce) |
| ict3 | Active presence in social networks |
| ict4 | CRM programs for customer management |
| ict5 | ERP applications for integrated production management |

**Table 2.** Continued

| | |
|---|---|
| **CSR** (Adinata, 2019; Agyemang & Ansong, 2017; Devie *et al*., 2018; Esparza-Aguilar & Reyes-Fong, 2019; Ikram *et al*., 2019; Lee *et al*., 2012) | |
| Please evaluate from 1 (absolutely disagree) to 5 (absolutely agree) the following questions | |
| csr1 | Is widely known by management and applied in company management |
| csr2 | Means achieving social value as well as economic value |
| csr3 | The company carries out its activities consuming less energy and other resources |
| csr4 | Effective recycling measures exist |
| csr5 | The image and reputation of the company has improved in the last three years |
| csr6 | Transparency when dealing with clients and suppliers has improved in recent years |
| csr7 [a] | Priority to working with local suppliers and raw materials is given |
| **Innovation** (Madrid-Guijarro *et al*., 2009; Martínez-Ros & Labeaga, 2009) | |
| Indicate if your company has made the following innovations in the last two years and, if so, indicate the degree of importance of each from 1 (minimum importance) to 5 (greatest importance) | |
| inn1 | Changes or improvements in existing products/services |
| inn2 | The launching of new products/services in the market |
| inn3 | Changes or improvements in production processes |
| inn4 | Acquisition of new property or equipment |
| inn5 | New changes or improvements in organization and/or management |
| inn6 | New changes or improvements in purchasing and/or procurement |
| inn7 | New changes or improvements in commercial and/or sales |
| **Performance** (Martinez-Conesa *et al*., 2017; Ruiz-Palomo *et al*., 2019; Úbeda-García *et al*., 2021) | |
| In comparison with your competitors, please indicate your level of agreement with the following performance indicators of your company, from 1 (absolutely disagree) to 5 (absolutely agree) | |
| per1 | Your company offers higher quality products |
| per2 | You company has more efficient internal processes |
| per3 | Your company has more satisfied customers |
| per4 | Your company adapts earlier to changes in the market |
| per5 | Your company is growing more |
| per6 | Your company is more profitable |
| per7 | Your company has more satisfied/motivated employees |
| per8 | Your company has a lower absenteeism |

[a] These indicators were not included in latent variables due to convergent and discriminant criteria of consistent PLS path modeling. All the measures were Likert-type scales.

**Table 3.** Outer model validation and confirmatory composite analysis

| | Mean | SD | Loading | t*** | $Q_B^2$ | $Q_{PLS}^2$ | α | $\rho_A$ | $\rho_C$ | AVE |
|---|---|---|---|---|---|---|---|---|---|---|
| ICT adoption | | | | | | | 0.70 | 0.70 | 0.81 | 0.52 |
| ict1 | 3.29 | 1.84 | 0.71 | 43.28 | | | | | | |
| ict3 | 1.76 | 2.15 | 0.74 | 49.23 | | | | | | |
| ict4 | 1.62 | 2.18 | 0.72 | 34.00 | | | | | | |
| ict5 | 1.55 | 2.19 | 0.72 | 35.19 | | | | | | |
| CSR | | | | | 0.02 | 0.03 | 0.85 | 0.86 | 0.89 | 0.57 |
| csr1 | 3.79 | 0.96 | 0.74 | 56.62 | 0.01 | 0.01 | | | | |
| csr2 | 3.73 | 0.93 | 0.78 | 71.72 | 0.01 | 0.01 | | | | |
| csr3 | 3.72 | 0.96 | 0.72 | 54.81 | 0.01 | 0.01 | | | | |
| csr4 | 3.88 | 1.00 | 0.69 | 42.07 | 0.01 | 0.01 | | | | |
| csr5 | 3.96 | 0.84 | 0.79 | 84.29 | 0.02 | 0.02 | | | | |
| csr6 | 3.98 | 0.84 | 0.81 | 86.74 | 0.02 | 0.02 | | | | |
| Innovation | | | | | 0.12 | 0.12 | 0.91 | 0.91 | 0.93 | 0.64 |
| inn1 | 3.09 | 2.02 | 0.78 | 81.65 | 0.12 | 0.07 | | | | |
| inn2 | 2.58 | 2.17 | 0.71 | 57.69 | 0.10 | 0.08 | | | | |
| inn3 | 2.82 | 2.12 | 0.80 | 85.93 | 0.11 | 0.07 | | | | |
| inn4 | 3.03 | 2.06 | 0.79 | 80.46 | 0.09 | 0.06 | | | | |
| inn5 | 2.85 | 2.12 | 0.82 | 98.53 | 0.13 | 0.09 | | | | |
| inn6 | 2.68 | 2.16 | 0.86 | 131.93 | 0.12 | 0.09 | | | | |
| inn7 | 2.56 | 2.19 | 0.85 | 127.80 | 0.13 | 0.10 | | | | |
| Performance | | | | | 0.16 | 0.02 | 0.90 | 0.90 | 0.92 | 0.59 |
| per1 | 4.02 | 0.84 | 0.71 | 49.07 | 0.14 | 0.01 | | | | |
| per2 | 3.84 | 0.84 | 0.76 | 62.45 | 0.13 | 0.02 | | | | |
| per3 | 4.05 | 0.77 | 0.80 | 82.27 | 0.17 | 0.01 | | | | |
| per4 | 3.97 | 0.81 | 0.81 | 29.26 | 0.18 | 0.02 | | | | |
| per5 | 3.80 | 0.86 | 0.77 | 70.97 | 0.14 | 0.02 | | | | |
| per6 | 3.73 | 0.87 | 0.78 | 75.45 | 0.17 | 0.02 | | | | |
| per7 | 3.90 | 0.85 | 0.79 | 79.91 | 0.17 | 0.01 | | | | |
| per8 | 4.01 | 0.88 | 0.70 | 48.08 | 0.15 | 0.00 | | | | |

Note: Significance and standard deviations (SD) performed by 10,000 repetitions Bootstrapping procedure. $Q_B^2$: cross-validated redundancies index performed by a 9-step distance-blindfolding procedure. $Q_{PLS}^2$: PLS-predict index performed with 10 k-fold and 10 repetitions. α: Chronbach's alpha; $\rho_A$: Dijkstra–Henseler's composite reliability; $\rho_C$: Jöreskog's composite reliability; AVE: Average Variance Extracted; ***: All loadings are significant at a 0.001 level.

**Table 4.** Discriminant validity

| | CSR | ICT adoption | Innovation | Performance |
|---|---|---|---|---|
| CSR | **0.756** | *0.207* | *0.334* | *0.547* |
| ICT adoption | 0.169 | **0.722** | *0.435* | *0.179* |
| Innovation | 0.301 | 0.350 | **0.801** | *0.360* |
| Performance | 0.482 | 0.148 | 0.325 | **0.765** |

Note: HTMT ratio over the diagonal (italics). Fornell–Lacker criterion: square root of AVE in diagonal (bold) and construct correlations below the diagonal.

**Table 5.** Structural model and hypotheses testing

| | Path | t | $f^2$ | 95CI | | H | Supported |
|---|---|---|---|---|---|---|---|
| **Direct effects** | | | | | VIF | | |
| ICT adoption -> CSR | 0.169 | 8.851*** | 0.029 | [0.138-0.201] | 1.000 | $H_1$ | Yes |
| ICT adoption -> Innovation | 0.308 | 18.649*** | 0.113 | [0.281-0.335] | 1.029 | $H_2$ | Yes |
| CSR -> Innovation | 0.249 | 14.505*** | 0.074 | [0.221-0.227] | 1.029 | $H_3$ | Yes |
| CSR -> Performance | 0.423 | 22.520*** | 0.222 | [0.392-0.454] | 1.100 | $H_5$ | Yes |
| Innovation -> Performance | 0.198 | 10.934*** | 0.049 | [0.168-0.228] | 1.100 | $H_6$ | Yes |
| **Indirect effects** | | | | | VAF | | |
| *Individual indirect effects* | | | | | | | |
| ICT adoption -> CSR -> Innovation | 0.042 | 7.524*** | | [0.033-0.052] | 12.000 | $H_4$ | Yes |
| CSR -> Innovation -> Performance | 0.049 | 9.008*** | | [0.138-0.201] | 10.380 | $H_7$ | Yes |
| *Global indirect effects* | | | | | | | |
| ICT adoption -> Innovation | 0.042 | 7.672*** | | [0.033-0.052] | 12.000 | | |
| ICT adoption -> Performance | 0.141 | 12.709*** | | [0.123-0.160] | 94.000 | | |
| CSR -> Performance | 0.048 | 8.842*** | | [0.040-0.058] | 10.160 | | |
| **Total effect** | | | | | | | |
| ICT adoption -> Innovation | 0.350 | 21.365*** | | [0.324-0.378] | | | |
| ICT adoption -> Performance | 0.150 | 12.716*** | | [0.123-0.160] | | | |
| CSR -> Performance | 0.472 | 26.585*** | | [0.443-0.501] | | | |

Note: $R^2$ adjusted [95% CI in brackets]: CSR: 0.029 [0.019; 0.041]; Innovation: 0.183 [0.162; 0.206]; Performance: 0.268 [0.242; 0.298]. Blindfolding $Q^2$ index as shown in Table 3; Standardized path values reported; $f^2$: size effect index; 95CI: 95% Percentile Confidence Interval; VIF: Inner model Variance Inflation Factors; VAF: Variance Accounted Formula x 100 represents the proportion mediated. Significance, t-Student, and 95% bias-corrected CIs were performed by 10,000 repetitions Bootstrapping procedure; ***: $p < 0.001$. Only total effects that differ from direct effects are shown.

**Figure 1.** Conceptual model and hypotheses

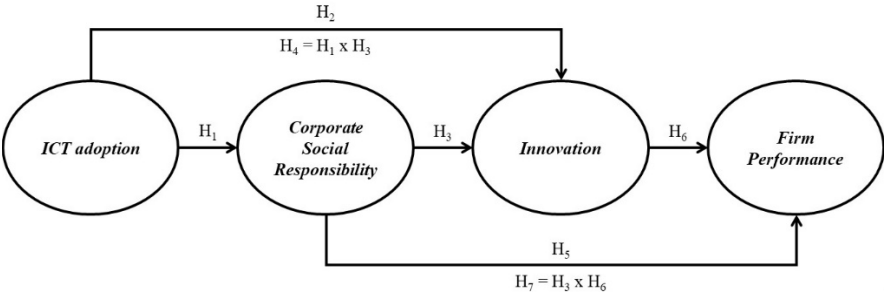
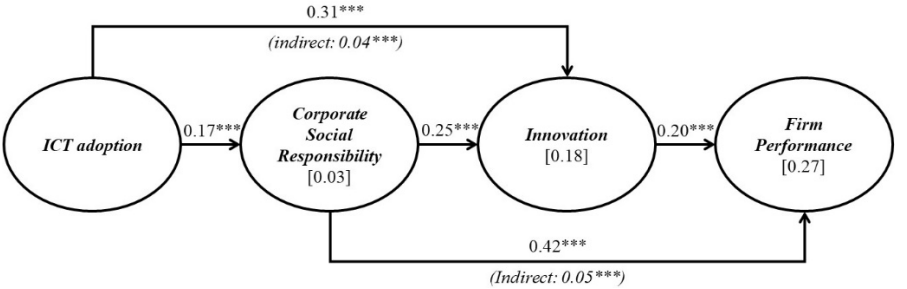



**Figure 2.** Results




Note: Standardized Paths reported ($R^2$-adjusted in brackets). ***: p<0.001.

**Appendix A.** Sample size and total population by strata

| Economic activity | Total | | Micro size | | Small size | | Medium size | |
|---|---|---|---|---|---|---|---|---|
| | N | P | N | P | N | P | N | P |
| Food and beverage | 166 | 9,418 | 60 | 3,330 | 72 | 5,233 | 34 | 855 |
| Textiles | 45 | 1,436 | 14 | 507 | 27 | 824 | 4 | 105 |
| Wood and cork | 45 | 1,818 | 11 | 769 | 28 | 957 | 6 | 92 |
| Paper, publishing, and printing | 62 | 770 | 24 | 179 | 29 | 440 | 9 | 151 |
| Chemicals | 19 | 1,553 | 2 | 389 | 11 | 863 | 6 | 301 |
| Rubber and plastic products | 49 | 1,963 | 10 | 504 | 26 | 1,140 | 13 | 319 |
| Other non-metallic minerals | 60 | 2,268 | 16 | 768 | 38 | 1,263 | 6 | 237 |
| Basic and fabricated metals | 142 | 663 | 45 | 189 | 80 | 340 | 17 | 134 |
| Machinery and equipment | 101 | 7,821 | 34 | 2,914 | 57 | 4,395 | 10 | 512 |
| Electrical, electronic, optical | 14 | 630 | 3 | 178 | 7 | 366 | 4 | 86 |
| Manufacture of motor vehicles | 28 | 759 | 7 | 179 | 6 | 383 | 15 | 197 |
| Furniture | 38 | 1,959 | 13 | 751 | 20 | 1,084 | 5 | 124 |
| Construction | 503 | 12,350 | 218 | 6,017 | 254 | 5,870 | 31 | 463 |
| Wholesale business | 574 | 21,121 | 280 | 14,640 | 235 | 4,544 | 59 | 1,937 |
| Hotel industry | 117 | 23,667 | 30 | 14,377 | 72 | 8,568 | 15 | 722 |
| Transport and telecommunications | 295 | 761 | 107 | 278 | 152 | 412 | 36 | 71 |
| Computer services | 95 | 3,628 | 38 | 1,260 | 41 | 1,939 | 16 | 429 |
| Others | 472 | 4,499 | 216 | 3,168 | 200 | 1,177 | 56 | 154 |
| **Total** | **2,825** | **97,084** | **1,128** | **50,397** | **1,355** | **39,798** | **342** | **6,889** |

Note: N: Sample; P: Population.

**Appendix B.** Sample estimation errors

| Sample estimation errors | | | |
|---|---|---|---|
| | **p=50%** | **p=70%** | **p=90%** |
| **Industry (95% confidence level)** | | | |
| Manufacturing | 3.49 | 3.2 | 2.09 |
| Construction | 4.28 | 3.92 | 2.57 |
| Commerce | 4.03 | 3.70 | 2.42 |
| Services | 3.08 | 2.83 | 1.85 |
| **Size (95% confidence level)** | | | |
| Micro sized firms | 2.89 | 2.64 | 1.73 |
| Small sized firms | 2.62 | 2.40 | 1.57 |
| Medium sized firms | 5.17 | 4.74 | 3.10 |
| **Total (95% confidence level)** | **1.82** | **1.67** | **1.09** |