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# The role of innovation in the relationship between digitalisation and economic and financial performance. A company-level research

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ABSTRACT

This paper analyses how innovation affects the relationship between the digitalisation of the company and its economic and financial performance, reviewing the cause-effect situation of this relationship. As some scientific literature suggests, the impact of ICT technologies on business performance is not homogenous amongst firms. The answer to this issue is probably to be found in innovation. In order to further develop this statement, this study examines the role of innovation in the relationship between business performance and business digitalisation. This research framework has been built based on the Innovation Theory of Rogers. Companies from all over Spain have been surveyed and the data has been contrasted with Partial Least Squares-Structural Equation modelling (PLS-SEM) and Moderation Analysis. The results show that in effect, innovation acts as a moderator variable in the relationship between business digitalisation and performance. These results allow us to conclude that it is not only important to digitalise the company to improve its performance, but that this digitalisation should also be aligned with a clear innovation strategy that allows for improving the company's performance. The aim of this study is to contribute with greater knowledge to how the digitalisation of the company affects its economic/financial performance and manifest the role innovation plays in this relationship.



## 1. Introduction

Scholarly research has shown that there is a positive link between Information and Communication Technologies (hereinafter ICT) and economics. As the mainstream scientific literature suggests (Vu, Hanafizadeh & Bohlin, 2020), causality runs from ICT to economic growth. In fact, this relationship is well documented at the macroeconomic level (Fernández-Portillo, Almodóvar-González, Coca-Pérez, and Jiménez-Naranjo, 2019) pushing the economic development, as well at the microeconomic level (Eze, Chinedu-Eze & Bello, 2018; Fernández-Portillo, Sánchez-Escobedo & Almodóvar-González, 2020b; Gërguri-Rashiti, Ramadani, Abazi-Alili, Dana & Ratten, 2017) for example, in order to improve your processes, products, sales and finally your profits.

Despite the evidence presented by these scholars, there is a lack of consensus about this issue. In this sense, various studies have pointed out that the impact of ICT on economics could be different (Fernández-Portillo, Almodóvar-González & Hernández-Mogollón, 2020a). For example, some papers suggest either little or no relationship between these subjects at country level (Pradhan, Arvin, Nair, Bennett & Bahmani, 2019; Thompson & Garbacz, 2011; Yazdan & Hossein, 2013). Similarly, at firm level, there is evidence calling into question the positive impact of ICT on business performance (Bertschek, Cerquera & Klein, 2013; Haller & Lyons, 2015).

Despite this ongoing discussion and based on the assumption that such a positive relationship exists, we can state that at firm level the Internet has opened many possibilities for companies by offering less expensive access to markets and information on competition, the economy and its environment. In this regard, Porter talked in 2001 about the tangible changes that could be seen in business models and the transformations that these new ICT would bring to the design of processes. At present, the impact this technology is having on the economic environment (Kumar, Stauvermann & Samitas, 2016; Sánchez-Bayón, 2014; Vu, 2011) is mainly driven by its massive adoption by companies.

Digitalisation has spread to all productive sectors, presumably because there is strong evidence that the digitalisation of a company has a positive influence on its performance (Albiman & Sulong, 2017; Bouwman, Nikou, Molina-Castillo & de Reuver, 2018; Bruno, Elaine & Ney, 2018; Kumar et al., 2016; Skorupinska & Torrent-Sellens, 2017; Venturini, 2015; Vu, 2011). However, in this point, we have to clarify

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that this relationship does not behave in the same way in all companies. In fact, it has been clearly proved that improvements in productivity can only be achieved as long as there are qualified workers with the 'expertise' required for it (Kumar et al., 2016; Skorupinska & Torrent-Sellens, 2017). In addition, we can observe a certain degree of difference in their competitive opportunities (Bouwman et al., 2018), with one very notable variable appearing at this point: innovation (Kumar et al., 2016).

As we can see, this subject arouses interests in the scientific community and, therefore, has led us to carry out this research. We understand that this investigation is framed within the Dissemination of Innovation Theory (Rogers, 2003), since if we consider that digitalisation is an innovation and its application in the company improves its performance, we find ourselves with a major dilemma: why does this improvement in performance not take place in all companies? This question can cause large financial losses, due to the economic investment and resources needed to digitalise a company. We suspect that the answer to this issue has to do with the way in which the application of this innovation is managed in the company.

At this point, the following research question seems relevant: what role does innovation play in the relationship between the digitalisation of a business and its economic and financial performance? To respond to this, the aim of this paper is to see whether innovation interfere in the relationship between the level of digitalisation of a company and its financial performance, in order to improve the return on the investment made by companies to become digital. The results show that innovation does indeed act as a moderating variable in this relationship, which allow us to conclude that it is not only important to digitalise the company to improve its performance, but that this digitalisation should also be aligned with a clear innovation strategy.

To arrive at these results, this research has been structured as follows. After this introduction, Section 2 presents the literature review of the scientific background of the research, as well as the conceptual model and our hypotheses. A description of our research methodology is presented in Section 3. Subsequently, Section 4 focus on the development of our empirical study, while Section 5 discusses the results obtained. Finally, conclusions, limitations and further research lines are exposed in Section 6.

## 2. Literature background, model and hypotheses

The first studies focused on the digitalisation and its influence in companies began in the late 1990s. During this period, several researches linked the Internet and company's operations (Zimmerman & Koerner, 1999). At the same time, the first paper discussing digital business as useful factor to boost sales through electronic commerce was published (Slywotzky, 1999). However, it was the study of Navas and Breeze (1999) the first to investigate the digitalisation of the administrative and financial systems of the company.

We can state that the digitalisation of business is also progressing thanks to the development of sensors and the large number of internal and external data sources, which allow continuous access to large amounts of data on what is happening, both within the company and in its environment. To take advantage of it, it is necessary to apply statistical techniques and Big Data algorithms, which provide useful and valuable information for the company, resulting in greater efficiency, productivity and performance (Davenport, 2014; Fosso-Wamba, Akter, Edwards, Chopin & Gnanzou, 2015; Jin et al., 2015).

In addition, the digitalisation of companies helps to generate new business models (Bouwman et al., 2018) and, if these are aligned with innovation, they boost companies' economic and financial performance (Bouwman et al., 2018; Chesbrough, 2006; Giesen, Riddleberger, Christner & Bell, 2010, 2007; Pohle & Chapman, 2006).

In other words, digitalisation drives companies to be better connected, to manage information more efficiently and to access more knowledge, as well as to improve efficiency, flexibility, personal communication tools and digital physical infrastructures. In this regard, they increase productivity and improve performance (Albiman & Sulong, 2017; Gide & Wu, 2007; Premkumar, 2003; Prier & McCue, 2007; Ramdani & Kawaiek, 2007; Skorupinska & Torrent-Sellens, 2017; Venturini, 2015; Zhu, Kraemer, Xu & Dedrick, 2004). On the contrary, it must be taken into account that different studies agree that performance improvements do not occur until the company and its human resources have the necessary 'expertise' (Chau & Hui, 2001; Hernández-Ortega, Jiménez-Martínez & Martín-De Hoyos, 2009; Hollenstein & Wörter, 2004; Kumar et al., 2016; Lin & Lin, 2008; Premkumar, 2003; Ramdani & Kawaiek, 2007; Skorupinska & Torrent-Sellens, 2017; Soares-Aguiar & Palma-dos-Reis, 2008; Zhu, Kraemer & Xu, 2003).

Different studies point out the possibility that the progress of business digitalisation and the improvement of their economic results may have some relation with innovation and its management (Kumar et al., 2016; Vu, 2011). Moreover, the innovations that emerge as a result of these ICT developments have a positive impact on economic performance (Albiman & Sulong, 2017).

In addition, the literature indicates that the production of innovation will affect the overall performance of a company, and that this innovation can also have a positive effect on business performance, as it can enable companies to develop a competitive advantage (Chesbrough, 2006; Hult, Hurley & Knight, 2004; Hurley & Hult, 1998). This approach encourages companies to continuously improve to better adapt to changes in markets, so that if their competitors cannot keep up with the pace of innovation, they can gain a competitive advantage and a better performance (Bouwman et al., 2018; Hult et al., 2004; Hurley & Hult, 1998).

Furthermore, although there have been innovations in companies throughout their history, currently their adoption has not undergone significant changes (Dann and Dann, 2003). Therefore, we understand that to this day, the classic theories of dissemination of innovations are still valid to study and predict the digitalisation process of the company.

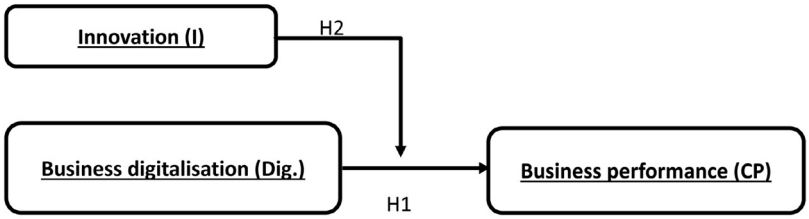
For this reason, to understand this digitalisation, we resort to the Diffusion of Innovation Theory, developed by Everett Rogers (1962, 1971, 1983, 1995, 2003, 2008), as it shows a fundamental approach from a sociological perspective. This author explains the process of adoption of innovation by the organisation and describes the factors that influence it, as well as the phases that it comprises.

Rogers (2003) defines innovation as an idea, practice or object that is perceived as new by an individual or an adoption unit, and in the same way, technology as a design of instrumental actions that reduces the uncertainty of the cause-effect relationships involved in achieving a desired result (Rogers, 2003).

The adoption of innovations in companies is a dynamic and multidimensional process which is affected not only by external factors, but also by the very condition of the innovation to be carried out. In the particular case of innovations derived from the business digitalisation, decision-making is affected by several factors, including the nature of the ICTs to be adopted. Thus, while some are moved by the novelty of technology, others are probably looking for technologies that will bring about a real transformation of their business processes (Rogers, 2003).

In terms of how a new technological idea is adopted and used in the company, the Diffusion of Innovation Theory describes the adoption patterns, explains the diffusion mechanism and helps predict whether a new invention will be successful (Rogers, 2008; Schilling, 2008). In the case study, it will help the company's digitalisation process to increase its economic and financial performance.

The literature shows that Diffusion of Innovation Theory has a solid theoretical basis and constant empirical support, and it is a useful approach to the study of business digitalisation because it can be considered an innovation (Premkumar et al., 2003, Premkumar,




*Source*: compiled by the authors.

**Fig. 1.** Conceptual model*Source*: compiled by the authors.

Ramamurthy & Crum, 1997; Beatty, Shim & Jones, 2001; Zhu, Kraemer & Xu, 2006).

Many studies rely on this theory to study business digitalisation (Chau & Tam, 1997; Chwelos, Benbasat & Dexter, 2001; Kuan & Chau, 2001; Premkumar, Ramamurthy & Crum, 1997; Rai & Bajwa, 1997; Thong, 1999; Zhu & Kraemer, 2002), while Hsu, Kraemer and Dunkle (2006) investigated the use of innovation after the adoption stage.

Consequently, we are in a position to confirm the importance of this theory to better understand the digitalisation process in companies that want to improve their performance. Once we have reached this point, we will proceed to present the conceptual framework that we propose, and to do so we will describe our hypotheses with the aim of verifying how innovation acts in the relationship between business digitalisation and economic performance.

When we consider the impact of digitalisation on enterprises performance, there are several investigations that show a positive influence. However, there is not consensus on the importance of this impact, nor whether all levels of digitalisation/ICT implementation provide the same performance. Hence, the timely completion of this study (Brynjolfsson & Hitt, 2003; Hitt & Brynjolfsson, 1996; Loveman, 1994; Lucas Jr., 2000; Powell & Dent-Micallef, 1997; Strassmann, 1985; Weill & Aral, 2006).

The valid **Hypothesis 1** that we propose is written as follows: 'The digitalisation of business is positively and directly related to business performance'.

That said, it seems appropriate for innovation to play a fundamental role in the above-mentioned relationship and therefore to moderate the connection between the two. We hereby propose the second valid hypothesis, which is mainly based on the studies of Bouwman et al. (2018), Despas and Mao (2014), Fernández-Portillo, Sánchez-Escobedo, Jiménez-Naranjo and Hernández-Mogollón (2015), Hult et al. (2004), Hurley and Hult (1998), Rogers (2003, 2008) and Schilling (2008) and is worded as follows:

**Hypothesis 2**: 'Innovation moderates the relationship between the business digitalisation and its economic and financial performance'.

After establishing the working hypotheses (see Fig. 1), the next step is to describe the research methodology used in the empirical study.

## 3. Research methodology

The empirical tests of our working hypothesis were carried out using a Multivariate Analysis based on Structural Equation Models (SEM) with Partial Least Square (PLS). The software SmartPLS, version 3.2.7, was used.

### 3.1. Field study design

In our research, the sample fulfils the requirement of 'homogeneous space' to avoid problems of non-controllable variables (Fernández-Portillo, 2016); that is why mercantile companies located in Spain in May 2016 were analysed. The entrepreneurs, who were located thanks to the data obtained from the SABI database, were surveyed through an online questionnaire. The target population was 805,588 mercantile companies, of which only 4041 had their mail available (see Table 1). It is important to highlight the difficulty of collecting the data, as it was necessary to contact the directors of the companies to carry out the survey.

To ensure the validity of our study, the questionnaire and the survey were designed on the basis of validated questionnaires (Podsakoff, MacKenzie & Podsakoff, 2012). In their development we used the proposals of Bonnet (2011), García-Moreno, García Moreno, Nájera-Sanchez and de Pablos Heredero (2018), and Serasols and Urbano (2007). To measure business performance, data was obtained from SABI (Iberian Balance Sheet Analysis System).

### 3.2. Multivariate analysis

We will now proceed to discuss the statistical relationship between the variables in the model. In this sense, SEM-PLS seemed appropriate due to the possibility of different links between our selected variables. Therefore, we are in line with previous studies based on this technique because this technique is the more adequate at the characteristics of the study (Jiménez-Naranjo et al., 2016; Kazakov, Ruiz-Alba & Muñoz, 2020; Robina-Ramírez, Fernández-Portillo & Díaz-Casero, 2019). In addition, in our case, we have followed the recommendations of Edwards (2001) to discuss the 'Business Digitalisation' construct. We will address the two-steps approach through the latent variables scores.

## 4. Results

Firstly, we will deal with the multidimensional variable. Afterwards, following Henseler, Hubona and Ray (2016) and Henseler (2018), as the latter is a confirmatory research, we will study the goodness of the global adjustment of the model. Thirdly, we will proceed to check the measurement instrument and we will analyse the proposed model, for which we will test the hypotheses. Finally, we will study the predictive capacity of the model, as required by the statistical technique used.

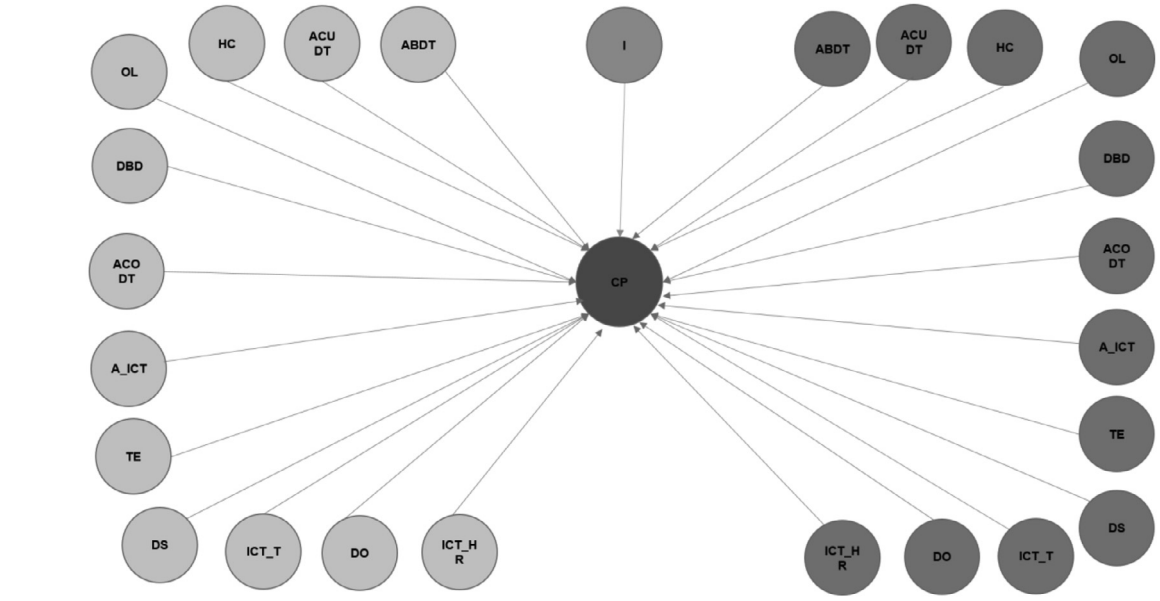
To start, we present the model in stage 1 (see Fig. 2), where these first-order factors will act in the model as the second-order construct they represent.

In the next step, we proceed to validate the global model. To do so, in SmartPLS it is necessary to validate the complete model with all the indicators, and generate a model called FIT, in the case of working with Type A composites (see Fig. 3).

**Table 1**
Population and sample data.

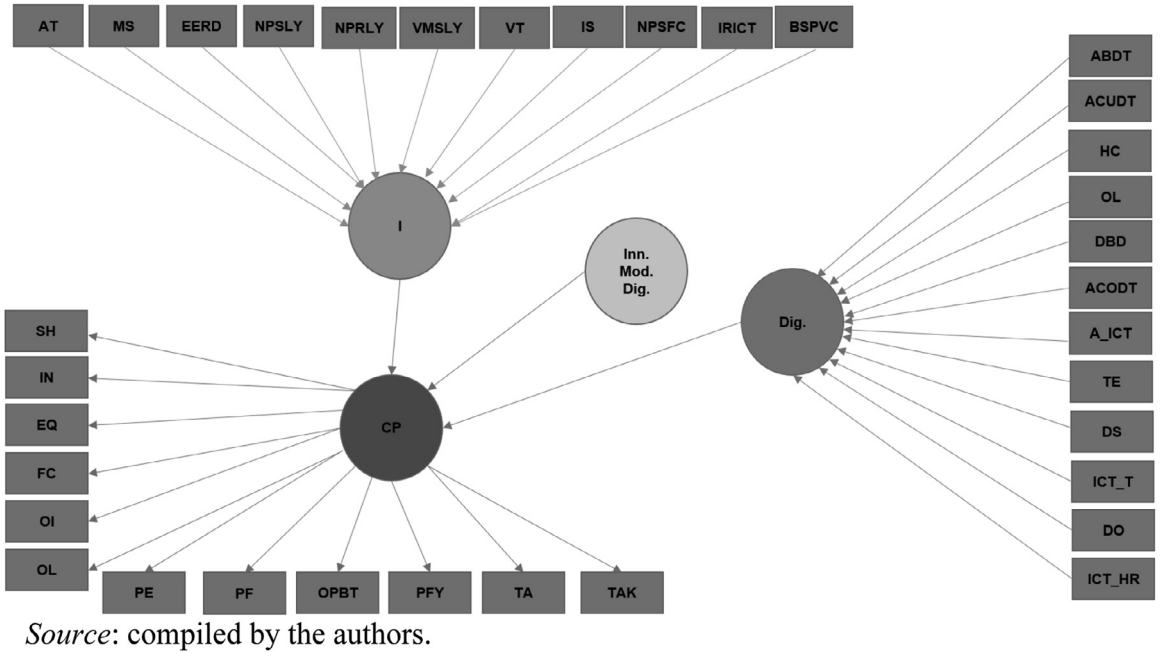
| Living Business | Significance of the sample | | |
|---|---|---|---|
| Sample | Population | Confidence level | Confidence interval |
| 150 | 805,588 | 95% | 8% |

*Source*: compiled by the authors.




*Source*: compiled by the authors.

**Fig. 2.** Model approach in stage 1*Source*: compiled by the authors.




*Source*: compiled by the authors.

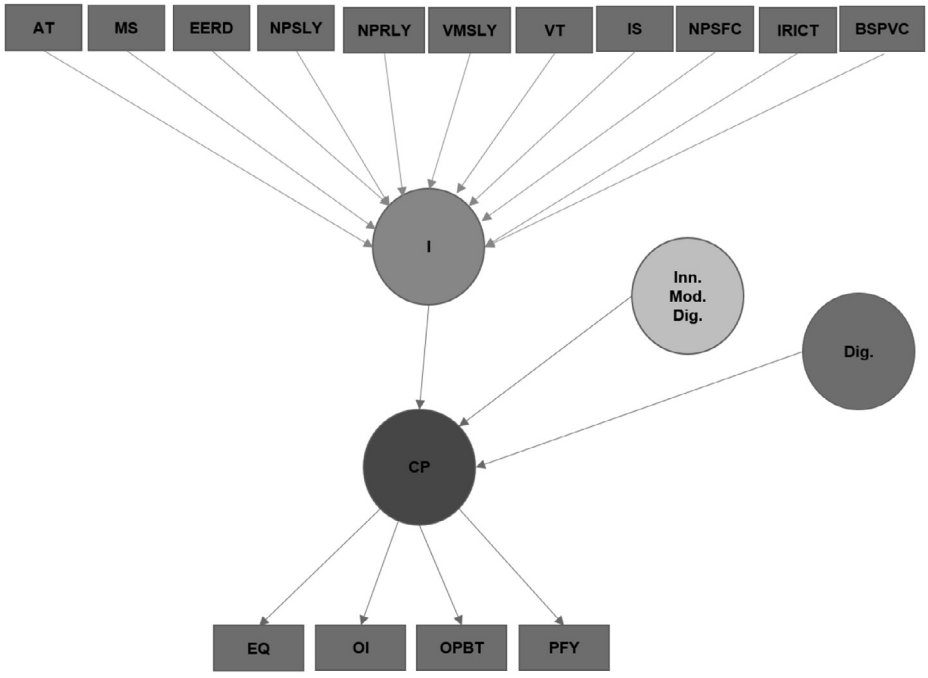
**Fig. 3.** Approach of the FIT model*Source*: compiled by the authors.

As for the results obtained, according to Williams, Vandenberg and Edwards (2009): 585) a model has a good fit if the standardised root mean square residual (SRMS) of the saturated model has a value lower than 0.10. In our case it is 0.088, so it is within the required limits. In addition, we performed bootstrap-based exact adjustment tests for the estimated model (Dijkstra & Henseler, 2015), in which the results of the original SRMR sample, d_ULS and d_G2, must be less than 95% and 99% (Henseler et al., 2016). Once again, we can confirm that all the requirements are met (see Table 2).

**Table 2**
Validation of the global model.

| Estimated model | SRMR | d_ULS | d_G2 |
|---|---|---|---|
| Original sample | 0.088 | 4.834 | 1.208 |
| 95% | 0.090 | 5.081 | 6.493 |
| 99% | 0.097 | 5.945 | 15.066 |

*Source*: compiled by the authors.




*Source*: compiled by the authors.

**Fig. 4.** Latent variable scores with refined indicators*Source*: compiled by the authors.

In the next stage of the PLS analysis, the model is estimated using the latent variable scores obtained by the programme for each of the first-order components. Then, we represent the model including the second-order variable (see Fig. 4).

### 4.1. Evaluation of the measurement instrument

In the first place, we conduct the analysis of the validity and reliability of the instruments used to measure the reflective variables. Then, we carry out each one of the evaluations. The required values are presented in summary table 3.

To verify the individual reliability, we examine the loads ($\lambda$) of the indicators with their respective construct, and eliminate those items that do not meet the requirements (Hair, Sarstedt, Hopkins & Kuppelwieser, 2014). In this sense, we should know than to keep an indicator of a construct, we must keep the one with a load equal to or higher than 0.707. This implies that the shared variance between the construct and its indicators is higher than the error variance (Carmines & Zeller, 1979). Some researchers suggest that this heuristic rule should not be so rigid (Barclay, Higgins & Thompson, 1995; Chin, 1998). Based on this, an indicator can be deleted if its load is between 0.4 and 0.7 and this leads to an increase in the AVE, or in the composite reliability (CR), above the threshold suggested for these parameters (Hair, Ringle & Sarstedt, 2011). We can maintain these indicators because of their major contribution to the content validity (see Tables 4 and 5). Very weak indicators with values equal to or less than 0.4 must always be eliminated (Hair et al., 2011).

The next step is to analyse the validity and reliability of the indicators of the formative constructs, which are 'Innovation' and 'Level of business digitalisation'.

The first goal to be analysed is the multicollinearity of the indicators of the formative construct. For this analysis we have used the VIF (Variance Inflation Factor), which indicates that values less than 3.3 will be valid (Diamantopoulos & Siguaw, 2006).

Finally, once the multicollinearity analysis has been carried out, we start the bootstrapping algorithm to obtain the significance of the load and weight (Hair et al., 2014).

Once the indicators for the reflective and formative variables have been refined, the model is shown in the Fig. 5, where only those indicators that exceed the values established for the initial stages of scale development are shown.

After finalising the analysis of the estimated model, we proceed to evaluate the structural model.

### 4.2. Analysis of the structural model

First, we test the multicollinearity between the antecedents of endogenous constructs (Cassel, Hackl & Westlund, 1999), and we verify that VIF is less than 5 (see Table 6) (Hair et al., 2014: 170).

**Table 3**
Parametric values justification.

| Analysis | Parameter | Values higher than | Justification |
|---|---|---|---|
| Individual reliability | Loads ($\lambda$) | 0.4 | Hair et al. (2014) |
| Composite reliability | Cronbach's Alpha ($\alpha$) | 0.7 | Nunnally and Bernstein (1994) |
| | Composite reliability (Cr) | 0.6 | Bagozzi and Yi (1988) and Nunnally and Bernstein (1994) |
| Convergent validity | Average variance extracted (AVE) | 0.5 | Fornell and Larcker (1981) |
| Discriminant validity | Comparison of the AVE and correlations between constructs | AVE > Correlations | Barclay et al. (1995), Hair et al. (2011), Henseler et al. (2009) |

*Source*: Fernández-Portillo et al. (2020):7).

**Table 4**
Individual reliability.

| | Cronbach's Alpha | Rho_A | Composite reliability | Average variance extracted (AVE) |
|---|---|---|---|---|
| Business Performance | 0.811 | 0.813 | 0.877 | 0.643 |

*Source*: compiled by the authors.

**Table 5**
Discriminant validity.

| | Business Performance | Innovation | Mod. Innovation | Business digitalisation |
|---|---|---|---|---|
| Business Performance | 0.802 | | | |
| Innovation | 0.427 | | | |
| Mod. Innovation | 0.505 | 0.257 | 1.000 | |
| Business digitalisation | 0.498 | 0.441 | 0.292 | |

*Source*: compiled by the authors.

Secondly, we evaluate the 'Path coefficient' of the hypotheses (-1 < Path Coefficient < 1). The higher its absolute value, the more relevant this hypothesis is (see Table 7).

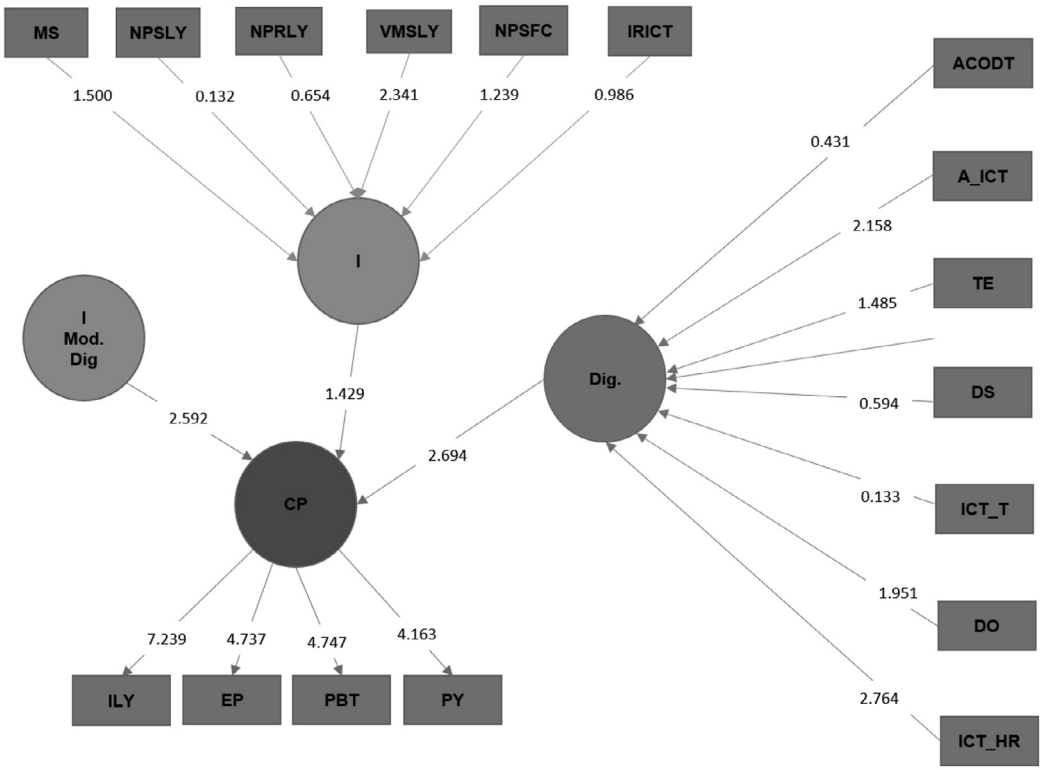
To continue, we carry out the significance of the hypothesis through bootstrapping (10,000 subsamples), and we use the values of the t-statistic with a one-tailed test (Hair et al., 2014) (see Table 8).

An important step in the analysis is to report the confidence intervals because it is a non-parametric approach and is not based on any type of distribution (Henseler, Ringle & Sinkovics, 2009). 'If a confidence interval for an estimated path coefficient does not include the value zero, then the hypothesis that is equal to zero is rejected' (Henseler et al., 2009:306) (see Table 9).

From the results obtained when analysing the proposed hypothesis, we must comment on the following:

H1. Accepted. In this case, it is shown that the level of business digitalisation has a direct and positive influence on business performance. When evaluating this hypothesis, we must indicate that it obtains the maximum level of significance. This result confirms the theory defended by many authors that talks about the advantages that ICT provide to companies. In addition, the ICT human resources are the more important in this relation, for this reason, is very important than business have this type of the person.

H2. Accepted. Its results establish that innovation acts as a moderating variable of the relationship between business digitalisation and its performance. In this case, the new products are very important for




*Source*: compiled by the authors.

**Fig. 5.** Final model with refined indicators*Source*: compiled by the authors.

**Table 6**
Evaluation of the collinearity of the constructs.

| | Business Perf. |
|---|---|
| Innovation | 1.290 |
| Mod. Innovation | 1.115 |
| Dig. | 1.257 |

*Source*: compiled by the authors.

**Table 7**
Contrast of hypotheses according to their 'Path Coefficient'.

| Hypothesis | Path coefficient | Acceptance of hypothesis |
|---|---|---|
| H1. Dig. -> Business Perf. | 0.349 | YES |
| H2. Mod. Innov. → Dig. →Bus. Perf. | 0.252 | YES |

*** p(0.01); ** p(0.05); *p(0.1). 1-Tailed T-Student.
*Source*: compiled by the authors.

**Table 8**
Contrast of hypotheses based on their level of significance.

| Hypothesis | T-statistic | Significance |
|---|---|---|
| H1. Dig. -> Business Perf. | 2.655 | *** |
| H2. Mod. Innovation | 2.644 | *** |

*Source*: compiled by the authors.

**Table 9**
Contrast of hypotheses with confidence levels.

| Hypothesis | 5.0% | 95.0% | Acceptance of hypothesis |
|---|---|---|---|
| H1. Dig. -> Business Perf. | 0.158 | 0.585 | YES |
| H2. Mod. Innovation | 0.143 | 0.377 | YES |

*Source*: compiled by the authors.

**Table 10**
Evaluation of the effect of the model.

| Study relationships | $R^2$ | $Q^2$ | Path | Correlation | Explained variance |
|---|---|---|---|---|---|
| H1. Dig. -> Business Performance | | | 0.349 | 0.498 | 17.38% |
| H2. Moderator Innovation | | | 0.252 | 0.495 | 12.47% |
| Innovation -> Business Performance | | | 0.134 | 0.393 | 5.26% |
| **Business Performance** | **0.409** | **0.164** | | | 40.9% |

*Source*: compiled by the authors.

this construct, for this reason, the companies should know the importance of this point.

Next, we examine the explained variance of the latent dependent variables, through the latent variables that precedent them ($R^2$). Usually, $R^2$ has to be higher than 0.1 (Falk & Miller, 1992), but this depends on the context (Sanz, Ruiz & Aldás, 2008). Finally, we do an analysis of the predictive relevance of the model ($Q^2$) using the 'blindfolding' algorithm. To validate our model $Q^2$ must be positive (Hair et al., 2014). The results are shown in Table 10.

Regarding the data obtained, it should be noted that the $R^2$ of 'business performance' takes a value of 0.409, which according to Chin (1998) is a moderate level as it is higher than 0.33 and lower than 0.67. In addition, the level of business performance explains 17.38% of its performance variance, which is in line with the high significance of hypothesis 1.

Once we have reflected the significance of the value provided by $R^2$, we must emphasise the importance that the predictive capacity of the model acquires through the $Q^2$ value, noting that in relation to this parameter for the 'business performance' construct it produces a value ($Q^2$) of 0.164, which indicates that the model has predictive relevance (Hair et al., 2014).

In conclusion, we can argue that innovation plays a very important role in the economic and financial performance of companies, and also moderates the relationship between their digitalisation and their performance.

Based on the proposed model and the hypotheses analysed, Table 11 shows the results of the contrast of hypotheses. In view of these data, we can affirm that the proposed model is validated, which is a contribution to the research under consideration.

## 5. Discussion

At this point, we can say that we have been able to respond to the proposed objectives and, in addition, we have obtained a series of interesting data, which will be discuss below.

With regard to the contrast of hypotheses, it shows information that will be critical in the decision making of the managers of the companies and public administration.

Business digitalisation has a direct and positive influence on business performance. In addition, it is accepted with the highest value of significance, the result of which allows us to affirm that the higher the level of business digitalisation, the better the company's performance. This is a way of checking its progress in performance, as already stated in the theoretical framework (Albiman & Sulong, 2017; Gide & Wu, 2007; Premkumar, 2003; Prier & McCue, 2007; Ramdani & Kawaiek, 2007; Skorupinska & Torrent-Sellens, 2017; Venturini, 2015; Zhu et al., 2004).

Regarding the level of digitalisation, the company's ICT human resources and their technological experience are included as the most important indicators, which coincides with what was proposed in the scientific literature (Cano & Baena, 2015; Chau & Hui, 2001; Hernández-Ortega et al., 2009; Hollenstein & Wörter, 2004; Kumar et al., 2016; Lin & Lin, 2008; Premkumar, 2003; Ramdani & Kawaiek, 2007; Skorupinska & Torrent-Sellens, 2017; Soares-Aguiar & Palma-dos-Reis, 2008; Zhu et al., 2003).

**Table 11**
Results of the hypotheses proposed in the model.

| Hypothesis | Evaluation of the hypothesis | Confidence levels | T-statistic | Path Coefficient |
|---|---|---|---|---|
| Hypothesis 1 | ACCEPTED | YES | $^{***}p < 0.01$ | YES |
| Hypothesis 2 | ACCEPTED | YES | $^{***}p < 0.01$ | YES |

*Source*: compiled by the authors.

**Annex 1**
Detail of the sample.

| No. of employees | Sector | | |
|---|---|---|---|
| 0 | 2% | Commerce | 25.3% |
| 1–9 | 12% | Services | 26% |
| 10–49 | 43.3% | Construction | 24.7% |
| 50–249 | 34.0% | Industry | 24% |
| More of 250 | 6.7% | Age of technology | |
| Studies carried out by the employer | Les at 1 year | 2.7% | |
| University leve | 73.3% | 1 to 5 years | 64.7% |
| Bachiller | 21.3% | More to 5 years | 32.6% |
| Other | 5.4% | Experience in the sector | |
| Market focus | 0 years | 10.0% | |
| Regional | 30.7% | 0 to 1 year | 1.3% |
| National | 39.3% | 1 to 3 years | 6.7% |
| International | 30.0% | 3 to 5 years | 3.3% |
| % clients outside of Spain | More to 5 years | 78.7% | |
| | 0% | 28% | Specific training in ICT |
| 1–100% | 72% | Yes | 32.7% |
| | No | 67.3% | |

However, we find 'the accessibility of technology' and 'digitalised operations' as the second and the third most important indicators, respectively, which means that they are extremely significant in our model.

In relation to the way in which innovation moderates the relationship between business digitalisation and performance, we must say that, as suspected from what we had extracted from the literature review (Albiman & Sulong, 2017; Bouwman et al., 2018; Chesbrough, 2006; Hult et al., 2004; Hurley & Hult, 1998; Kumar et al., 2016; Rogers, 2003, 2008; Schilling, 2008; Vu, 2011), it has a direct and positive influence.

Therefore, we can refute that the digitalisation level of the companies should be part of business performance programmes, since the model has been validated through the proposed analysis, and the explained variance of this variable also enables us to understand 17.3% ($R^2$ = 0.173) of the company's performance. The results can be considered low level, but an explained variance of 40.9% is achieved by including innovation in the model, which means reaching a moderate level (0,67> $R^2$> 0,33) (Chin, 1998).

## 6. Conclusions

In conclusion, we can confirm that innovation moderates the relationship between business digitalisation and performance. As has been shown, if we go deeper into the study it is necessary to highlight that if we want to enhance the company's performance, it is absolutely necessary to invest in improving its level of digitalisation, since it has a significant weight. Furthermore, if we want to obtain a greater guarantee of this enhancement, we must include adequate innovation management, since again a significant improvement is observed, which in turn is clearly reflected in the explained variance. In addition, we must also point out the importance of having human resources with the adequate training and experience, so that they can obtain all the available return from the company's new digital resources. Ideally, these ICT resources should be as accessible and complete as possible.

It should be noted that the main limitation found in this study has been the compilation of the primary data used in the empirical study, so it might be interesting to increase the sample in future research. As regard of future lines, we propose to conduct this study with secondary variables at European and global level, which will allow the different behaviours of the study in different countries, sectors, and different degrees of internationalization to be analysed.

## References


Albiman, M. M., & Sulong, Z. (2017). The linear and non-linear impacts of ICT on economic growth, of disaggregate income groups within SSA region. *Telecommunications Policy*, *41*, 555–572.

Bagozzi, R. P., & Yi, Y. (1988). On the evaluation of structural equation models. *Journal of the Academy of Marketing Science*, *16*(1), 74–94.

Barclay, D., Higgins, C., & Thompson, R. (1995). The partial least squares (PLS) approach to casual modeling: Personal computer adoption and use as an illustration. *Technology Studies*, *2*(2), 285–309 Special Issue on Research Methodology.

Beatty, R. C., Shim, J. P., & Jones, C. J. (2001). Factors influencing corporate web site adoption: A time-based assessment. *Information & Management*, *38*, 337–354.

Bertschek, I., Cerquera, D., & Klein, G. J. (2013). More bits - more bucks? Measuring the impact of broadband internet on firm performance. *Information Economics and Policy*, *25*, 190–203.

Bonnet, D., & Ferraris, P. (2011). Transform to the power of digital: Digital transformation as a driver of corporate performance. *Digital Transformation Review*, *1*, 14–29.

Bouwman, H., Nikou, S., Molina-Castillo, F. J., & de Reuver, M. (2018). The impact of digitalization on business models. *Digital Policy, Regulation and Governance,*, *20*(2), 105–124.

Bruno, F., Elaine, T., & Ney, C. (2018). Critical success factors for big data adoption in the virtual retail: Magazine Luiza case study. *Revista Brasileira de Gestão de Negócios*, *20*(1), 112–126. doi:10.7819/rbgn.v20i1.3627.

Brynjolfsson, E., & Hitt, L. M. (2003). Computing productivity: Firm-level evidence. *Review of Economics and Statistics*, *85*(4), 793–808.

Cano, J. A., & Baena, J. J. (2015). Impacto de las tecnologías de información y comunicación en el desempeño de la negociación internacional. *Revista Brasileira de Gestão de Negócios*, *17*(54), 751–768. doi:10.7819/rbgn.v17i54.1901.

Carmines, E.G., .& Zeller, R.A. (.1979). Reliability and validity assessment. N. 07-017, Sage University Paper Series on Quantitative Applications in the Social Sciences. Beverly Hills: Sage.

Cassel, C., Hackl, P., & Westlund, A. H. (1999). Robustness of partial least-scuares method for estimating latent variable quality structures. *Journal of Applied Statistcs*, *26*(4), 435–446.

Chau, P. Y., & Hui, K. L. (2001). Determinants of small business EDI adoption: An empirical investigation. *Journal of Organizational Computing and Electronic Commerce*, *11*(4), 229–252.

Chau, P. Y. K., & Tam, K. Y. (1997). Factors affecting the adoption of open systems: An exploratory study. *MIS Quarterly*, *21*(1), 1–24.

Chesbrough, H. (2006). *Open business models: How to thrive in the new innovation landscape*. Boston: Harvard Business Press.

Chin, W. W. (1998). The partial least squares approach to structural equation modelling. In G. A. Marcoulides (Ed.), *Modern methods for business research* (pp. 295–336). Mahwah: Lawrence Erlbaum Associates.

Chwelos, P., Benbasat, I., & Dexter, A. S. (2001). Research report: Empirical test of an EDI adoption model. *Information Systems Research*, *12*(3), 304–321.

Dann, S, & Dann, S (2003). *Strategic Internet Marketing 2.0,* (2a). Queensland, Australia: John Wiley and Sons.

Davenport, P. (2014). *The attention economy: Understanding the new currency of business*. Boston: Harvard Business School Press.

Despas, N., & Mao, N. (2014). Análisis paralelo entre e-turismo y e-gobierno: Evolución y tendencias. *Investigaciones Turísticas*, *7*, 1–22.

Diamantopoulos, A., & Siguaw, J. A. (2006). Formative versus reflective indicators in organizational measure development: A comparison and empirical illustration. *British Journal of Management*, *17*(4), 263–282.

Dijkstra, T. K., & Henseler, J. (2015). Consistent partial least squares path modeling. *MIS Quarterly,*, *39*(2), 297–316.

Edwards, J. R. (2001). Multidimensional constructs in organizational behavior research: An integrative analytical framework. *Organizational research Methods*, *4*(2), 144–192.

Eze, S. C., Chinedu-Eze, V. C., & Bello, A. O. (2018). Actors and emerging information, communications and technology (EICT) adoption: A study of UK small and medium services enterprises. *Cogent Business & Management*, *5*, 1480188. doi:10.1080/23311975.2018.1480188.

Falk, R. F., & Miller, N. B. (1992). *A primer for soft modeling*. Ohio: University of Akron Press.

Fernández-Portillo, A. (2016). *Factores determinantes para la elaboración de un modelo de éxito de la empresa en el medio digital*. Tesis Doctoral. Universidad de Extremadura. Departamento de Economía Financiera y Contabilidad. Cáceres. España.

Fernández-Portillo, A., Almodóvar-González, M., & Hernández-Mogollón, R. (2020a). Impact of ICT development on economic growth. A study of OECD European union countries. *Technology in Society*, *63*, 101420. doi:10.1016/j.techsoc.2020.101420.

Fernández-Portillo, A., Sánchez-Escobedo, M. C., & Almodóvar-González, M. (2020b). Análisis del impacto de la innovación, las TIC y el clima empresarial sobre los ingresos de las PYMES. *Revista Internacional de Organizaciones*, *24*, 183–209.

Fernández-Portillo, A., Sánchez-Escobedo, M. C., Jiménez-Naranjo, H. V., & Hernández-Mogollón, R. (2015). La importancia de la innovación en el comercio electrónico. *Universia Business Review*, *47*(3), 106–125.

Fernández-Portillo, A., Almodóvar-González, M., Coca-Perez, J. L., & Jiménez-Naranjo, H. V. (2019). Is sustainable economic development possible thanks to the deployment of ICT? *Sustainability*, *11*(22), 6307.

Fornell, C., & Larcker, D. F. (1981). Structure equation models: LISREL and PLS applied to customer exist-voice theory. *Journal of Marketing Research*, *18*(2), 39–50.

Fosso-Wamba, S., Akter, S., Edwards, A., Chopin, G., & Gnanzou, D. (2015). How 'big data' can make big impact: Findings from a systematic review and a longitudinal case study. *International Journal of Production Economics*, *165*, 234–246.

García-Moreno, M. B., García Moreno, S. M., Nájera-Sanchez, J. J., & de Pablos Heredero, C. (2018). The impact of organizational factors on-business adoption: An empirical analysis. *Journal of Industrial Engineering and Management (JIEM)*, *11*(3), 466–496.

Gërguri-Rashiti, S., Ramadani, V., Abazi-Alili, H., Dana, L., & Ratten, V. (2017). ICT, innovation and firm performance: The transition economies context. *Thunderbird International Business Review*, *59*, 93–102.

Gide, E., & Wu, M. X. (2007). A study for establishing E-commerce business satisfaction model to measure e-commerce success in SMEs. *International Journal of Electronic Customer Relationship Management*, *1*(3), 307–325.

Giesen, E., Riddleberger, E., Christner, R., & Bell, R. (2010). When and how to innovate your business model. *Strategy & Leadership*, *38*(4), 17–26.

Hair, J. F., Ringle, C. M., & Sarstedt, M. (2011). PLS-SEM: Indeed a silver bullet. *The Journal of Marketing Theory and Practice*, *19*(2), 139–152.

Hair, J. F., Sarstedt, M., Hopkins, L., & Kuppelwieser, V. G. (2014). Partial least squares structural equation modeling (PLS-SEM). An emerging tool in business research. *European Business Review*, *26*(2), 106–121.

Haller, S. A., & Lyons, S. (2015). Broadband adoption and firm productivity: Evidence from Irish manufacturing firms. *Telecommunications Policy*, *39*, 1–13.

Henseler, J. (2018). Partial least squares path modeling: Quo Vadis. *Quality & Quantity*, *52*, 1–8.

Henseler, J., Hubona, G., & Ray, P. A. (2016). Using PLS path modeling in new technology research: Updated guidelines. *Industrial Management & Data Systems*, *116*(1), 2–20.

Henseler, J., Ringle, C. M., & Sinkovics, R. R. (2009). The use of partial least squares path modeling in international marketing. *Advances in International Marketing*, *20*, 277–320.

Hernández-Ortega, B., Jiménez-Martínez, J., & Martín-De Hoyos, M. J. (2009). The effect of experience on web procurement. An intersectorial analysis of small firms. *International Journal of Entrepreneurial Behaviour & Research*, *15*(1), 7–24.

Hitt, L. M., & Brynjolfsson, E. (1996). Productivity, business profitability, and consumer surplus: Three different measures of information technology value. *MIS Quarterly*, *20*(2), 121–142.

Hollenstein, H., & Wörter, M. (2004,. September). The decision to adopt internet-based e-commerce: An empirical analysis based on Swiss firm-level data, Berlin: Paper presented at theProceedings of the 15th Biennial Conference of the International Telecommunications Society (ITS).

Hsu, P., Kraemer, K. L., & Dunkle, D. (2006). Determinants of e-business use in U.S firms. *International Journal of Electronic Commerce*, *10*(4), 945.

Hult, G. T. M., Hurley, R. F.&, & Knight, G. A. (2004). Innovativeness: Its antecedents and impact on business performance. *Industrial Marketing Management*, *33*(5), 429–438.

Hurley, R. F., & Hult, G. T. M. (1998). Innovation, market orientation, and organizational learning: An integration and empirical examination. *Journal of Marketing*, *62*(3), 42–54.

Jiménez-Naranjo, H. V., Coca-Pérez, J. L., Gutiérrez-Fernández, M., & Fernández-Portillo, A. (2016). Determinants of the expenditure done by attendees at a sporting event: The case of world padel tour. *European Journal of Management and Business Economics*, *25*(3), 133–141.

Jin, S., Lin, W., Yin, H., Yang, S., Li, A., & Deng, B. (2015). Community structure mining in big data social media networks with MapReduce. *Cluster Computing*, *18*(3), 999–1010.

Kazakov, S., Ruiz-Alba, J. L., & Muñoz, M. M. (2020). The impact of information and communication technology and internal market orientation blending on organisational performance in small and medium enterprises. *European Journal of Management and Business Economics*, *30*(2), 129–151.

Kuan, K. K. Y., & Chau, P. Y. K. (2001). A perception-based model for EDI adoption in small businesses using a technology-organization-environment framework. *Information & Management*, *38*, 507–512.

Kumar, R. R., Stauvermann, P. J., & Samitas, A. (2016). The effects of ICT on output per worker: A study of the Chinese economy. *Telecommunications Policy*, *40*, 102–115.

Lin, H. F., & Lin, S. M. (2008). Determinants of e-business diffusion: A test of the technology diffusion perspective. *Technovation*, *28*, 135–145.

Loveman, G. W. (1994). An assessment of the productivity impact of information technologies. *Information technology and the corporation of the 1990s: Research studies* (pp. 84–110). Oxford University Press.

Lucas, H. (2000). *La tecnología de la información y la paradoja de la productividad*. Oxford: Oxford University Press.

Navas, D., & Breeze, B. (1999). Scientific-Atlanta integrates its global supply chain and ensures accurate shipments. *ID SYSTEMS*, *19*, 34–39.

Nunnally, J. C., & Bernstein, I. H. (1994). *Psychometric theory* (3rd Edition). New York: McGraw-Hill.

Podsakoff, P. M., MacKenzie, S. B., & Podsakoff, N. P. (2012). Sources of method bias in social science research and recommendations on how to control it. *The Annual Review of Psychology*, *63*, 539–569.

Pohle, G., & Chapman, M. (2006). IBM's global CEO report 2006: Business model innovation matters. *Strategy & Leadership*, *34*(5), 34–40.

Powell, T. C., & Dent-Micallef, A. (1997). Information technology as competitive advantage: The role of human, business and technology resources. *Strategic Management Journal*, *18*(5), 375–405.

Pradhan, R. P., Arvin, M. B., Nair, M., Bennett, S. E., & Bahmani, S. (2019). Short-term and long-term dynamics of venture capital and economic growth in a digital economy: A study of European countries. *Technology in Society*, *57*, 125–134.

Premkumar, G. (2003). A meta-analysis of research on information technology implementation in small business. *Journal of Organizational Computing and Electronic Commerce*, *13*(2), 91–121.

Premkumar, G., Ramamurthy, K., & Crum, M. R. (1997). Determinants of EDI adoption in the transportation industry. *European Journal of Information Systems*, *6*(2), 107–121.

Prier, E., & McCue, C. (2007). E-procurement adoption in local governments of the United States. *Government Procurement*, *15*(1), 12–31.

Rai, A., & Bajwa, D. S. (1997). An empirical investigation into factors relating to the adoption of executive information systems: An analysis of EIS for collaboration and decision support. *Decision Sciences*, *28*(4), 939–974.

Ramdani, B., & Kawalek, P. (2007). SME adoption of enterprise systems in the Northwest of England. In McMasterT. , WastellD. , FerneleyE. , DeGrossJ. I. (Eds.), *Organizational dynamics of technology-based innovation: Diversifying the research agenda* (pp. 409–429). Boston: Springer.

Robina-Ramírez, R., Fernández-Portillo, A., & Díaz-Casero, J. C. (2019). Green start-ups' attitudes towards nature when complying with the corporate law. *Complexity*. doi:10.1155/2019/4164853.

Rogers, E. M. (1962). *Diffusion of innovations*. New York: Free Press.

Rogers, E. M. (1971). *Diffusion of innovations* (2nd Edition). New York: Free Press.

Rogers, E. M. (1983). *Diffusion of innovations* (3rd Edition). London: Collier McMillan.

Rogers, E. M. (1995). *Diffusion of innovations* (4th Edition). New York: Free Press.

Rogers, E. M. (2003). *Diffusion of innovations* (5th Edition). New York: Free Press.

Rogers, E. M. (2008). Diffusion of innovations. In D. Stacks, & M. Salwen (Eds.), *An integrated approach to communication theory and research* (pp. 409–420). New York: Routledge.

Sánchez-Bayón, A. (2014). Global system in a changing social reality: How to rethink and to study it. *Beijing Law Review*, *5*, 196–209.

Sanz, S., Ruiz, C., & Aldás, J. (2008). *La influencia de la dependencia del medio en el comercio electrónico B2C. Propuesta para un modelo integrador aplicado a la intención de compra futura en internet: 36* (pp. 45–75). Cuadernos de Economía y Dirección de la empresa.

Schilling, M. A. (2008). *Dirección estratégica de la innovación tecnológica*. Madrid: McGraw-Hill.

Serarols, C., & Urbano, D. (2007). El empresario y los factores de éxito. Estudio de casos de empresas tradicionales y digitales. *Revista de Contabilidad y Dirección*, *5*, 139–167.

Skorupinska, A., & Torrent-Sellens, J. (2017). ICT, innovation and productivity: Evidence based on eastern European manufacturing companies. *Journal of the Knowledge Economy*, *8*, 768–788.

Slywotzky, A. J. (1999). La empresa digital. *Gestión*, *4*(3), 14–15.

Soares-Aguiar, A., & Palma-dos-Reis, A. (2008). Why do firms adopt e-procurement systems? Using logistic regression to empirically test a conceptual model. *IEEE Transactions on Engineering Management*, *55*(1), 120–133.

Strassmann, P. A. (1985). *Information payoff: The transformation of work in the electronic age*. New York: Free Press.

Thompson, H. G., & Garbacz, C. (2011). Economic impacts of mobile versus fixed broadband. *Telecommunications Policy*, *35*, 999–1009.

Thong, J. Y. L. (1999). An integrated model of information systems adoption in small businesses. *Journal of Management Information Systems*, *4*(15), 187–214.

Venturini, F. (2015). The modern drivers of productivity. *Research Policy*, *44*, 357–369.

Vu, K. M. (2011). ICT as a source of economic growth in the information age: Empirical evidence from the 1996-2005 period. *Telecommunications Policy*, *35*, 357–372.

Vu, K., Hanafizadeh, P., & Bohlin, E. (2020). ICT as a driver of economic growth: A survey of the literature and directions for future research. *Telecommunications Policy*, *44*, 101922. doi:10.1016/j.telpol.2020.101922.

Weill, P., & Aral, S. (2006). Generating premium returns on your IT investments. *MIT Sloan Management Review*, *47*(2), 39–48.

Williams, L., Vandenberg, R. J., & Edwards, R. J. (2009). Structural equation modeling in management research: A guide for improved analysis. *The Academy of Management Annals*, *3*(1), 543–604.

Yazdan, G. F., & Hossein, S. S. M. (2013). FDI and ICT effects on productivity growth. *Procedia-Social and Behavioral Sciences*, *93*, 1710–1715.

Zhu, K., & Kraemer, K. (2002). E-commerce metrics for net-enhanced organizations: Assessing the value of e-commerce to firm performance in the manufacturing sector. *Information Systems Research*, *13*(3), 275–295.

Zhu, K., Kraemer, K. L., Xu, S., & Dedrick, J. (2004). Information technology payoff in e-business environments: An international perspective on value creation of e-business in the financial services industry. *Information Resources Management Journal*, *7*(1), 6–18.

Zhu, K., Kraemer, K., & Xu, S. (2003). Electronic business adoption by European firms: A cross-country assessment of the facilitators and inhibitors. *European Journal of Information Systems*, *12*(4), 25–268.

Zhu, K., Kraemer, K. L., & Xu, S. (2006). The process of innovation assimilation by firms in different countries: A technology diffusion perspective on e-business. *Management Science*, *52*(10), 1557–1576.

Zimmerman, H. D., & Koerner, V. (1999). New emerging industrial structures in the digital economy-the case of the financial industry. Presented at the 1999, In *Proceedings of the Americas Conference on Information Systems (AMCIS99)* Presented at the 1999. Milwaukee.