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Jean Pierre Seclen-Luna
Pontifical Catholic University of Peru

René I. Castro Vergara
Pontifical Catholic University of Peru

Hellen Lopez Valladares
Pontifical Catholic University of Peru

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Seclen-Luna Jean Pierre
Department of Management, Pontifical Catholic University of Peru
Universitaria Avenue 1801, San Miguel, Lima Peru
jseclen@pucp.pe

René I. Castro Vergara
Innovation Management Research Group, Pontifical Catholic University of Peru
Universitaria Avenue 1801, San Miguel, Lima Peru
r.castrov@pucp.edu.pe

Lopez Valladares Hellen
Department of Management, Pontifical Catholic University of Peru
Universitaria Avenue 1801, San Miguel, Lima Peru
hellen.lopez@pucp.edu.pe

Abstract:
This paper aims to analyse the effects of the use of digital technologies on firms' net sales and productivity. The technology adoption approach is applied in empirical research using data from the National Enterprise Survey in Peru. Using the OLS method on a sample of 2,970 firms from creative and manufacturing industries in Peru, the effects of digital technologies on net sales and productivity are determined. Findings indicate that there is a positive relationship. However, these relationships can be different depending on the type of digital technology, the size of the firm and the manager's gender proportion. We found that most of these technologies are more commonly related to creative industries than manufacturing firms. These relationships have greater statistical significance to net sales in large companies within both types of industry. However, SMEs have greater statistical significance with respect to productivity in both types of industries. Lastly, given the positive effect on these relationships, we conclude by highlighting the importance of managers crafting their technology portfolio and digital capabilities properly and the need for further research to determine the performance of companies in the context of developing countries.

Keywords:
information technology; performance; productivity; manufacturing industries; creative industries; developing country.

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1. Introduction

In the era of digitalization, companies review how to build competitive advantage by drawing on their capabilities and using technology. It is recognized that Information and Communication Technologies (ICT), and especially digital technologies (DT) are fundamentally transforming business strategies, business processes, firm capabilities, products and services, and are even key interfirm relationships in extended business networks. In this context, a "digital business strategy" is required [1]. In fact, empirical evidence has highlighted the positive role of DT in increasing the productivity [2] and sales [3] of companies.

The technology adoption approach aims to understand which specific DT is used by firms or industrial sectors and what the effects are. Most of this stream of research has been addressed in developed economies, characterized by favourable environments for competitiveness. Thus, studies on this topic are almost exclusively based on studies from North American and European firms [4]. However, since the beginning of the past decade, there has been a growing interest in literature dealing with DT in Latin American countries on an aggregate level [5,6]. Despite this, the empirical literature still needs further developments to understand how DT affects the performance of firms in emerging economies.

Based on these arguments, this research poses a central research question: Do digital technologies have a positive effect on a firm's performance? Thus, to address this issue, our article aims to empirically evaluate the effect of the use of DT on the net sales and productivity of 2,970 Peruvian firms through a sample of 979 firms from the creative industries and 1,991 manufacturing firms, using data from the National Enterprises Survey in Peru [7].

From a contextual perspective, in 2015, while the GDP of Latin America and the Caribbean presented a fall of 1% (reaching 0.3%) compared to 2014, the GDP of Peru experienced a growth of 0.9%, reaching 3.3%. At an industrial level, while manufacturing experienced a percentage variation in GDP of -1.5%, services showed a growth of 4.1% [8]. Within services, the creative industries have acquired special relevance since they have been able to articulate various sectors. One of the main promoters has been the Ministry of Culture of Peru. In this way, the creative industries have been positioned in the Peruvian scene [9]. Therefore, the current context of acceleration of the digital transformation of companies offers an opportunity to explore with greater attention which sectors have comparatively greater vocation for the adoption of DT, which can lead to an organization's better performance. Nevertheless, the Economic Commission for Latin America and the Caribbean reported that in Peru the cost of technologies is higher compared to other countries in the region, and about 55% of population have access to social media [10]. In addition, according to the Digital Adoption Index, in 2014, Peruvian businesses were ranked 80th out of 183 countries [11]. So, our contribution aims to understand this phenomenon from the point of view of DT use.

Our research uses OLS regressions in the analysis and considers two subsamples according to the industries compared. The results show that there is a positive relationship between digital technologies and net sales and productivity in the Peruvian firms. However, these relationships can be different depending on the type of digital technologies, firm size, manager's gender and the industry. Thus, we find that most of these technologies are more commonly related to creative industries than manufacturing firms. Specifically, these relationships have the greatest statistical significance in SMEs rather than in large companies, in relation to productivity. By contrast, large companies have the greatest statistical significance with net sales. In addition, manager gender shows positive statistical significance in these relationships for creative industries, while for manufacturing firms there are negative statistical significance. Therefore, our study contributes to the understanding of these relationships in the context of Peruvian creatives and manufacturing firms.

The paper is structured as follows: The second section introduces the literature review and leads to the research hypotheses. The third section details the datasets and tests the hypotheses. The empirical results are discussed in the fourth section. Lastly, the fifth section provides some brief conclusions, limitations, and suggestions for future research.

2. Literature Review and Hypotheses

Many researchers have considered that in adoption and diffusion theory, there are several factors that influence a person choosing a technology. Previous studies have highlighted the difference between the technologies adopted by consumers and that of firms [12]. However, technology adoption models change quickly because of the complex nature of modern information technology, so scholars have acknowledged that resources and new capabilities are necessary to effectively compete in a digital age [13]. Thus, there is a significant body of literature which studies models and determinants of technology adoption. In any case, differences in technology adoption result in divergences of productivity and economic growth [14].

2.1 ICT, Digital Technologies and Firm's Performance.

The strategic management literature recognized that firm performance is the result of multiple factors. For example, ICT adoption has drastically modified communication, sales, and information methods [15], thus enabling firms to achieve strong competitive advantage in production and in other areas of the company. Nowadays, the debate is focused on variables relating to ICT usage and ways of increasing the positive impact of ICT on firm performance. In fact, the degree of ICT adoption varies substantially between countries and even within sectors [16]. The impact of ICT in developing countries is an important issue due to its growth potential. The ICTs convert the systems of organizations and control the productive processes, and even allows for the production of merchandise to be adjusted to the needs of local, regional, and global clients. Therefore, ICTs are allowing the reorganization of the company and the realization of important changes in all functional areas of the company [17]. According to Breard and Yoguel [18], although companies do not follow a trajectory in the incorporation of ICTs, like the evolution of these technologies, companies usually adopt those most consistent with their objectives and strategies.

The impact of ICTs on the performance of companies has been extensively studied using a wide variety of indicators and methodological approaches. Pioneering studies have considered certain indicators, such as investments in hardware, software, and the number of PCs [19]. However, most studies have been concerned with knowing the factors or barriers that affect the adoption of ICT [20], emphasizing the role of the firm's size, age, the skills of the employees, the level of technology used, and productivity [21]. In any case, the literature recognized that one of the most used indicators to measure firm's performance has been the productivity [22]. This perspective suggests that productivity could increase due to the multiple technological configurations that companies adopt [16].

On the other hand, digitization has been increasingly recognized as a complex phenomenon encompassing a variety of different business strategies, ranging from purchasing new software or information technologies (IT) products to redesigning existing processes (e.g., interconnections among products, process and services), and promoting organizational changes [23]. In addition, it is important to note that there is no consensus on the concept of DT, in the literature it is recognized that the adoption of DT is used to carry out e-marketing, e-commerce, and e-business to increase the sales of a company [24]. However, other factors are likely to mediate the effects of DTs on firm's performance, as digital transformation not only involves investing in DTs, but also integrating them into the organizational structure of the company [25]. Recent empirical evidence has highlighted the positive role of DT in increasing the productivity of companies [2,16,25].

According to the previous background literature and given the large number of DT that exist today, we find it convenient to analyse the most representative technologies that positively affect a firm's net sales and productivity, such as broadband and intranet, digital training, digital consulting, websites, online selling, social networking, extranet, and enterprise information systems [3,26,27,28].

2.1.1 Broadband and Intranet

While on a macrolevel the literature supports the notion that broadband positively affects GDP growth and employment [29,30], there is no agreement of the effects on productivity at a firm level. For instance, Bertschek et al. [31] found no effect of broadband adoption on labour productivity, but positive effects on product and process innovation. In the same vein, Haller and Lyons [26] found no statistically significant effect of broadband adoption on firm productivity. Nevertheless, Grimes et al. [32] stated that broadband adoption boosts a firm's productivity by 7–10 percent. On the other hand, Intranet, as a standard internet technology, is a personalized interface where users can access information resources and services in a secure, consistent, and customizable manner. Several authors state that intranet facilitates knowledge sharing because it promotes cooperation among employees who are in various locations, making that information flow and improving overall business performance [33]. Moreover, intranet adoption enhances work productivity since it enables individual commitment, empowerment, and a personal sense of accomplishment. It enables a sense of empowerment because more work can be done whilst multitasking; one login can give access to all organizational data with a 24/7 availability of information [33]. Based on this evidence, we propose the following hypotheses:

Hypothesis 1a: There is a positive relationship between a firm's net sales and the use of broadband.

Hypothesis 1b: There is a positive relationship between a firm's labour productivity and the use of broadband.

Hypothesis 2a: There is a positive relationship between a firm's net sales and the use of intranet.

Hypothesis 2b: There is a positive relationship between a firm's labour productivity and the use of intranet.

2.1.2 Digital Training and Consulting

ICT applications need not only the implementation of technology infrastructure but the use of technical skills. To improve information system integrated results, user involvement and user training are key to ensuring better outcomes. By including and stimulating employees in the process of co-creation and the adoption of new technology, the organization can stimulate innovations both horizontally and vertically. The digital skills that contribute to ICT productivity, i.e., digital information evaluation, critical thinking, creativity and problem-solving, are considered 21st-century digital skills [34]. Gillard [35] suggests that training courses and initiatives should accommodate the more wide-ranging needs of those targeted for inclusion, especially older workers and women who are sometimes left out in organizations, which creates digital inequality. On the other hand, IT consulting firms play a new and major role in supporting the adoption of technologies because they switch from just giving advice to participating in the implementation of ideas and the technology of firms [36]. These authors noted that digital consulting also implies being a developer of hardware and software related to meeting the business objectives of organizations. Through projects in companies, IT consulting firms can increase productivity through the transfer of knowledge from one part of the business to another. This makes the learning process quicker and easier, mainly because it reduces the training time and can lead to the development of innovations [37]. IT consultants also facilitate communication between firms and clients because they give assistance in solving problems related to services and products [38]. As Liao and Cheung [39] claim, IT consulting increases client efficiency by using integrated information-based solutions in business process development, customization, and enhancement, therefore maximizing the client's resources. Based on this evidence, we propose the following hypotheses:

Hypothesis 3a: There is a positive relationship between a firm's net sales and investment in digital training.

Hypothesis 3b: There is a positive relationship between a firm's labour productivity and investment in digital training.

Hypothesis 4a: There is a positive relationship between a firm's net sales and hiring a digital consultant.

Hypothesis 4b: There is a positive relationship between a firm's labour productivity and hiring a digital consultant.

2.1.3 Website, Online Selling and Social Networks

The empirical literature has paid great attention to DTs related to e-commerce and e-marketing applications, such as websites [40], online selling [41], and social networks [42]. The overall aim of these studies is to investigate how and to what extent DTs directly contribute to increasing sales. Websites are perhaps one of the first ICT adoptions by firms around the world since this technology enables the inclusion of information which is easy to understand and useful to clients [43]. Moreover, the website is a medium for interactive communication, not only between clients, as a tool for customer relationship management and sales, but also from business-to-business and with other stakeholders [44]. Thus, a website aims to raise visibility and attract new customers [3]. According to these authors, workers can upload information easily, gather information without moving, and target multiple segments with the design selected. However, Teo and Pian [45] have found that cost saving is not the main benefit of a website, but rather differentiation and growth. In addition, Nurmilaakso [46] found that websites do not result in a significant influence on labour productivity, since a fancy website alone does not ensure business performance, however, this is more the case in B2B e-commerce. In this line, Tarafdar and Zhang [43] pointed out that to attract and retain traffic that allows more business transactions, characteristics such as usability, ease-of-navigation and security are significant. In any case, website design and development software should be available to IT employees and programmers to get better rates of productivity [47]. According to this evidence, we propose the following hypotheses:

Hypothesis 5a: There is a positive relationship between a firm's net sales and the use of website.

Hypothesis 5b: There is a positive relationship between a firm's labour productivity and the use of website.

Online selling refers to transactions along the value chain but using the internet platform together with the existing IT infrastructure. Several studies argue that e-businesses are efficient reducers of distance-related trade costs because firms can reach and expand to the global economy, being able to sell in places where distance or political systems made them previously unreachable [48]. For these reasons, its capacity to reduce trade barriers can lead to big cost savings. Along with cost reduction, earlier studies found benefits such as sales increases and new market penetration [49]. Xia and Zhang [28] discovered that the online channels have more repercussions on sales volumes over the long-term. To adopt online selling there is a process where organizations adapt their routines and even uses internal and external collaboration [50]. The author claims that business can present technical, economic, and legal barriers, preventing them from creating value added e-commerce operations. The use of e-commerce also shows a positive effect on the labour productivity of firms at a national level [51]; the highest growth happens in developing countries because they start from a much lower economic base. At the organizational level Nurmilaakso [46:10] found that "the importance of the ICT-integrated business processes, within and between firms, is evident in e-commerce" and it has positive effects on labour productivity. Thus, we propose the following hypotheses:

Hypothesis 6a: There is a positive relationship between a firm's net sales and the use of online selling.

Hypothesis 6b: There is a positive relationship between a firm's labour productivity and the use of online selling.

Social networks are a group of internet-based applications, mainly using foundations of web 2.0 for the creation and exchange of user generated content [52]. The most used social networks by firms are Facebook, Instagram, Twitter, and LinkedIn. Although there are exponential applications and adjustments organizations have made, there are different understandings about the outcomes and impact of social networks on business performance [27]. Some studies show that social networks positively affect the performance of the new product in the marketplace, because speed-time-to-market of these new products [53] allows sharing knowledge from outside and inside in real-time and reduces barriers between clients and intermediate costs. Other researches states that information from social networks is inaccurate and distorted because sources are unreliable and that, although it helps innovation, it did not translate into financial benefits [54]. Kurnia and Er [55] explain that successful social media usage depends on the interest and condition of the company planning to implement usable platforms. Despite these differences, there is some agreement about the effects on the organization. To begin with, social networks enable better engagement between employees and designers with clients because they receive information about preferences, allowing for demand forecasting and follow-up purchasing

activities. As a result, the areas of marketing, sales and customer management reduce their costs and cut down on physical transportation [56]. Thus, the information from external actors can be used with big data and analytics to improve the current products. In addition, the labour productivity generated is explained by the quality of knowledge acquired from social networks [57], that is, more creativity emerges in the workplace. According to this evidence, we propose the following hypotheses:

Hypothesis 7a: There is a positive relationship between a firm's net sales and the use of social networks.

Hypothesis 7b: There is a positive relationship between a firm's labour productivity and the use of social networks.

2.1.4 Extranet and Enterprise Information Systems

To date, little evidence has been collected for e-business and DTs, such as Extranet, ERP, CRM, and other basic information-sharing services [58]. While intranet is created for internal use, extranets connect to other actors outside the company. Vlosky et al. [59] explain that an extranet is a network that links business partners to another over the internet. Suppliers, customers, or other trading partners are linked to exchange various types of information. A study by Paswan et al. [60] suggests that the standardized data exchange with trading partners has a positive influence on labour productivity because firms integrate their business processes, especially in B2B and e-commerce. With suppliers, for instance, extranet gives the ability to place and secure orders in a transparent system where inventory levels and forecasts are transparent and accessible, creating online partnerships. With customers, extranet increases loyalty, commitment, and confidence [61], which in the long-term gives competitive advantage. Based on this evidence, we propose the following hypotheses:

Hypothesis 8a: There is a positive relationship between a firm's net sales and the use of extranet.

Hypothesis 8b: There is a positive relationship between a firm's labour productivity and the use of extranet.

Enterprise Information Systems (EIS) is essential for companies. For instance, enterprise resource planning (ERP) and customer relationship management (CRM), two of the most widely implemented business software platforms, allows this integration. Both support core corporate activities by incorporating best practices and information to facilitate rapid decision-making, cost reduction and greater material control [62]. A tangible benefit of these systems includes results in business process, mainly by increasing productivity. Karimi et al. [58] found that successful ERP implementation helps business efficiency, effectiveness, and flexibility because it reduces cost and cycle time, improves decision making and planning, and enables external linkages to customers and suppliers. The operational efficiency of an individual worker is related to the amount of time it takes to do a job. With ERP they can access data simultaneously, using less time to do a job. However, a successful ERP implementation requires sufficient and appropriate training, reliable internet connection, involvement of end-users, change management, as well as sufficient demonstration of the prospective ERP system [63]. CRM is more related to the evidence that confirms an increase in market shares and sale growth rates because the systems lead to a quick reaction to market opportunities [64] and enables the creation of opportunities and managing relationships. Based on this evidence, we propose the following hypotheses:

Hypothesis 9a: There is a positive relationship between a firm's net sales and the use of enterprise information systems.

Hypothesis 9b: There is a positive relationship between a firm's labour productivity and the use of enterprise information systems.

2.2 Other Characteristics of the Firm

In general terms, other characteristics of the firm, such as age, size, industry, and even gender of the managers, are useful in understanding the relationships between ICT adoptions and a firm's net sales and productivity. For instance, if we consider the age of the company as a proxy for experience, it could be argued that old companies are more likely to adopt ICTs than younger companies. In fact, formalization in the context of ICT is considered a technological strategy

within the company, which includes organizational planning and preparation [65]. This means determining how, why, and what improvements and benefits those technologies will bring to the company and then analysing needs and objectives in computing and conceiving a strategy for the long-term. It is a very essential factor in leading to the success and rapid spread of ICT adoption [66]. However, there is no consensus in these respects [3]. Accordingly, we present the following hypotheses:

Hypothesis 10a: The age of the firm has a positive relationship with the firm's net sales.

Hypothesis 10b: The age of the firm has a positive relationship with the firm's labour productivity.

In relative terms, the larger sized company has similar positive relationships due to it being related to the capabilities and resources available for ICT adoptions. In this regard, size is a fundamental factor directly influencing ICT; for example, SMEs are mostly dependent on external interactions for ICT adoption because of their critical size [67]. Previous research has emphasized that business size is the most important discriminant for the adoption or non-adoption of ICT [68]. In any case, literature has not reached a consensus about this relationship [3]. However, there is stronger evidence for a positive relationship between firm size, ICT adoption and firm performance. Accordingly, we present the following hypotheses:

Hypothesis 11a: The size of the firm has a positive relationship with the firm's net sales.

Hypothesis 11b: the size of the firm has a positive relationship with the firm's labour productivity.

Gender diversity literature acknowledges that firms with greater gender diversity in top management teams show lower risk and deliver better performance [69]. Specifically, the proportion of women in top management tends to have positive effects on a firms' performance [70]. Furthermore, recent empirical research on digital transformation has shown the role of top management and their experience and skills in promoting and executing digital transformation [71]. Thus, the level of technological awareness at decision-making levels also affects the incorporation of ICTs [72]. In any case, it was decided to incorporate this variable since, at the regional level, creative and cultural industries are one of the sectors with the highest numbers of working women. Accordingly, we present the following hypotheses:

Hypothesis 12a: Higher proportion of female manager's has a positive relationship with a firm's net sales.

Hypothesis 12b: Higher proportion of female manager's has a positive relationship with a firm's labour productivity.

Finally, several studies in different countries have considered that business type and sector of activity are among the factors influencing ICT adoption and performance. For many years, business type has also played a large part in deciding the structure and architecture of ICT, that is, barriers influencing ICT adoption in production companies are different from those of service companies. In this respect, Thong and Yap [73] have noted that the sectors with the greatest intensity of information activities tend to adopt ICT more than those which are less intense. Therefore, the particularities related to the sector or branch of activity can affect both the process of incorporating ICTs and the firm's performance [18]. Accordingly, we present the following hypotheses:

Hypothesis 13a: Creative firms have a greater positive effect on the relationship between the use of digital technologies and net sales than manufacturing firms.

Hypothesis 13b: Creative firms have a greater positive effect on the relationship between the use of digital technologies and labour productivity than manufacturing firms.

Figure 1 presents the hypotheses formulated in a research model.

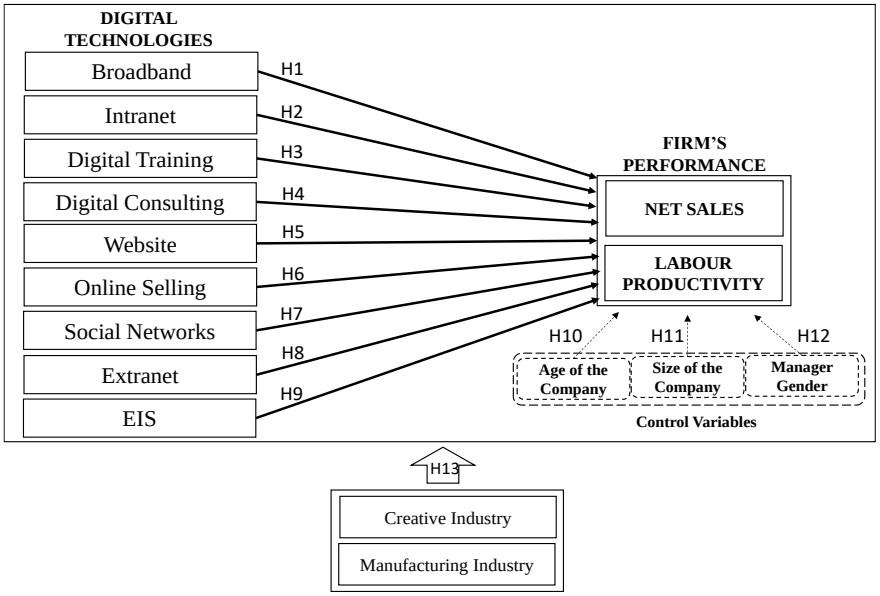

Fig. 1. Research model

3. Data Collection and Methodology

3.1 Data Description

The data is obtained from the National Enterprises Survey in Peru (ENE, by its acronym in Spanish) in 2015. For its part, the ENE data is collected by the Institute of Statistics and Informatics of Peru every three years. The survey consists of an exhaustive questionnaire oriented to obtain information on the business environment of the firms through direct face-to-face surveys with firm managers and owners who participate in the company's decision-making. The population of the survey is made up of large, medium, and small Peruvian companies totalling 13,592 companies from all industries except for the education and health industries. The ENE uses stratified random sampling by location, size, industry, and other country-specific information. In accordance with our research objectives (to know whether there is a relationship between the use of digital technologies and the firms' net sales and productivity), the final sample used consists of 979 firms from the creative industry and 1,991 manufacturing firms.

Table 1. Sample composition

Characteristics of the firm	Creative Industries		Manufacturing	
	#	%	#	%
Firm size by worker number[1]				
Micro	433	44.24	426	21.41
Small	372	38.00	669	33.6
Medium	110	11.22	687	34.47
Large	64	6.54	209	10.52
Total	979	100.00	1991	100.00

Note: 1/ Include managers and employees (permanents and temporary)
Source: Own elaboration from ENE (2015).

3.2 Description of Variables

There are two dependent variables: net sales and labour productivity. The first is calculated as the total net sales of products and services of the companies, and the second is calculated as the ratio of net sales per worker considering only the permanent staff of the company. This measure aims to proxy firm efficiency in using production inputs, thereby providing a basis to compare performance across firms [74]. The independent variables are nine types of DT that approximate the degree of digitization achieved by the company in the back office (intranet, digital training, and digital consulting), in the front office (websites, online selling and social networks), as well as for both types (broadband, extranet and enterprise information systems). To control heterogeneity across the sample, we include age, size, and gender. Table 2 provides a definition of the variables used in the study, whilst Tables 3 and 4 present the summary statistics of those variables and the results of the differences in means tests for creative and manufacturing firms.

Table 2. Definition of variables

Variable	Definition	Scales
Net Sales	Net sales of products/services	Logarithm
Labour Productivity	Net sales per total workers (only managers and permanent)	Logarithm
Broadband	A value of 1 indicates that the firm reported that they have internet with broadband; 0 otherwise	Dichotomous
Intranet	A value of 1 indicates that the firm reported that they have intranet; 0 otherwise	Dichotomous
Digital Training	A value of 1 indicates that the firm reported that they invest in digital training for their workers or owners; 0 otherwise	Dichotomous
Digital Consulting	A value of 1 indicates that the firm reported that they invest in digital consulting; 0 otherwise	Dichotomous
Website	A value of 1 indicates that the firm reported that they have a website; 0 otherwise	Dichotomous
Online Selling	A value of 1 indicates that the firm reported that they sell products or services online; 0 otherwise	Dichotomous
Social Networks	A value of 1 indicates that the firm reported that they have a social network account on Facebook or Twitter; 0 otherwise	Dichotomous
Extranet	A value of 1 indicates that the firm reported that they have extranet; 0 otherwise	Dichotomous
Enterprise Information Systems	A value of 1 indicates that the firm reported that they have enterprise information systems; 0 otherwise	Dichotomous
Firm's Age	Time from foundation of the firm, except firms with three or less years	Logarithm
Firm's Size	Number of total workers (only managers and permanent workers)	Logarithm
Manager's Gender	Percentage of executive women	Logarithm

Table 3. Summary statistics

Variables	(1) Manufacturing Industry		(2) Creative Industry		(3) Difference in Means		
	Mean	SD	Mean	SD	Diff.	t-test	p-value
Broadband	0.914	0.28	0.87	0.337	0.044	1.858	*
Intranet	0.362	0.481	0.375	0.485	-0.012	-0.309	
Digital Training	0.302	0.459	0.41	0.493	-0.107	-2.846	***
Digital Consulting	0.274	0.446	0.23	0.421	0.044	1.236	
Website	0.721	0.448	0.745	0.436	-0.023	-0.659	
Online Selling	0.247	0.431	0.365	0.482	-0.117	-3.259	***
Social Networks	0.389	0.487	0.615	0.487	-0.225	-5.709	***
Extranet	0.129	0.335	0.115	0.319	0.014	0.531	
Enterprise Information Systems	0.9	0.299	0.84	0.367	0.06	2.348	**

Note: The CIIU 3211 is excluded because it is common in both industries. P-value significant at 99%***, 95%**, and 90%*
SD: standard deviation.

Table 4. Summary statistics in Levels

Variables	(1) Manufacturing Industry		(2) Creative Industry		(3) Difference in Means		
	Mean	SD	Mean	SD	Diff.	t-test	p-value
Net Sales	1.46e+08	7.93e+08	3.26e+07	7.25e+07	1.13e+08	2.008	**
Labour Productivity	881258.4	5354798	466528	1847175	414730.4	1.0752	**
Firm's Size	242.915	520.642	95.005	196.655	147.910	3.929	***
Firm's Age	23.023	17.574	17.675	15.397	5.348	3.866	***
Manager's Gender	.438	.260	.507	.290	-.068	-3.148	***

Note: The CIIU 3211 is excluded because it is common in both industries. P-value significant at 99%***, 95%**, and 90%*
SD: standard deviation.

3.3 Method and Regression Model

In accordance with our research objectives, we estimate the effects of DT adoption on two firm performance proxies through the OLS method. Thus, the models took the following form in the case of firm productivity:

$$\text{Productivity}_i = \beta_0 + \beta_1 * DT_i + \beta_2 * \theta_i + \varepsilon_i \quad (1)$$

where the sub-index *i* refers to the firm. DT is a vector that grouped the nine proxy variables of digital technologies that were presented in Figure 1 (broadband, intranet, digital training, digital consulting, website, online selling, social networks, extranet, enterprise information systems). ϑ1 is a vector of control variables, such as firm age, size, and gender. ε1 is the error term. To support the hypotheses, β1 and β2 need to be positive. An alternative model is estimated considering the net sales of the company as a dependent variable.

4. Result and Discussion

The results indicate that some DTs are important determinants for the net sales and performance of the companies. Table 5 shows the results of the models estimated through the OLS method, both for creative and manufacturing industries. In columns 1 and 2 the effects of the use of DTs are estimated with respect to the net sales of the companies, and columns 3 and 4 with respect to labour productivity. First, if we analyse column 1, we can see that the use of almost all DTs analysed (broadband, intranet, digital consulting, websites, extranet, and enterprise information systems) has a positive relationship on the net sales of companies in the creative industry. Therefore, these results support hypotheses 1a, 2a, 4a, 5a, 8a, 9a, respectively and are consistent with previous studies [3,33,39,61,64]. However, we found that digital training, online selling, and social networks have negative relationships. One possible explanation could be not only the low adoption of these technologies (41% and 37%), but probably also scarce digital capabilities [34] and companies do not effectively manage their social networks, as evidenced in previous studies [54]. Furthermore, it is important to note that the firm's age, size, and manager's gender also have a positive relationship. Therefore, these results support hypotheses 10a, 11a and 12a, respectively. Thus, these results suggests that large firm in the creative industry with experience in the market and with some proportion of female managers position can affect positively on their net sales, in addition to the use of DT. In this way, our results are consistent with previous studies [65,68,70,71].

Second, if we look at column 2, we can see that the use of almost all DTs analysed (broadband, digital consulting, websites, extranet, and enterprise information systems) has a positive relationship on the net sales of manufacturing companies. Therefore, these results support hypotheses 1a, 4a, 5a, 8a, 9a, respectively and are consistent with previous studies [3,39,61,64]. However, we found that online selling and social networks have negative relationships. One possible explanation could be not only the low adoption of these technologies (25% and 39%), but probably also scarce digital capabilities [34] and companies that do not effectively manage their social networks, as evidenced in previous

studies [54]. This argument can also be used in the case of the use of intranet and digital training (36% and 30%), since they do not present statistical significance. Furthermore, it is important to note that both age and size of the firms also have positive relationships. Thus, these results support hypotheses 10a and 11a, respectively. Therefore, these results suggest that large manufacturing firms with experience in the market can affect positively their net sales, in addition to the use of DT. However, the low proportion of female manager position has a negative relationship. In this way, these results concur with previous studies [65,68,70,71]. At this point, it is important to mention that the RMSE in both models (1 and 2) according to net sales shows satisfactory significance (0.998 and 1.157) and the R square (0.68 and 0.72) is considerably strong [75], respectively.

Table 5. Regression Models

Variables	**Net Sales**		**Labour Productivity**	
	Creatives Industries	Manufacturing	Creatives Industries	Manufacturing
	(1)	(2)	(3)	(4)
Broadband	0.30***	1.16***	0.30***	1.16***
	(0.10)	(0.09)	(0.10)	(0.09)
Intranet	0.51***	0.10	0.51***	0.10
	(0.09)	(0.07)	(0.09)	(0.07)
Digital Training	-0.22**	-0.10	-0.22**	-0.10
	(0.09)	(0.07)	(0.09)	(0.07)
Digital Consulting	0.34***	0.24***	0.34***	0.24***
	(0.10)	(0.07)	(0.10)	(0.07)
Website	0.28***	0.24***	0.28***	0.24***
	(0.11)	(0.06)	(0.11)	(0.06)
Online Selling	-0.19**	-0.24***	-0.19**	-0.24***
	(0.09)	(0.06)	(0.09)	(0.06)
Social Networks	-0.48***	-0.29***	-0.48***	-0.29***
	(0.08)	(0.06)	(0.08)	(0.06)
Extranet	0.99***	1.11***	0.99***	1.11***
	(0.17)	(0.13)	(0.17)	(0.13)
Enterprise Information Systems	0.35***	0.37***	0.35***	0.37***
	(0.10)	(0.08)	(0.10)	(0.08)
Firm's Age	0.32***	0.55***	0.32***	0.55***
	(0.06)	(0.04)	(0.06)	(0.04)
Firm's Size	0.94***	0.74***	-0.06*	-0.26***
	(0.03)	(0.03)	(0.03)	(0.03)
Manager's Gender	0.29***	-0.51***	0.29***	-0.51***
	(0.07)	(0.06)	(0.07)	(0.06)
Constant	10.55***	9.31***	10.55***	9.31***
	(0.17)	(0.13)	(0.17)	(0.13)
N	979	1,991	979	1,991
R-squared	0.68	0.72	0.27	0.27
Adj. R-squared	0.679	0.719	0.265	0.268
Root MSE	0.998	1.157	0.998	1.157
Wald chi2	173.5	425	30.39	61.65

Note: Coefficients estimated to be significant at 99%***, 95%**, and 90%*, SD in parentheses.

Third, if we focus on column 3, we can see that the use of almost all DTs analysed (broadband, intranet, digital consulting, website, extranet, and enterprise information systems), have a positive relationship with the labour productivity of companies in the creative industries. Therefore, these results support hypotheses 1b, 2b, 4b, 5b, 8b, 9b, respectively and are consistent with previous studies [32,33,36,47,58,60,62]. However, we found that certain DTs have negative relationships, such as digital training, online selling, and social networks. Perhaps one reason could be the low adoption of these technologies (41% and 37%), or maybe scarce digital capabilities [34] or training courses should accommodate the more wide-ranging needs of those targeted for inclusion, especially older workers and women who are sometimes left out in organizations, which creates digital inequality [35], and companies who do not effectively manage their social networks, as evidenced in previous studies where it was found that this technologies did not

translate into financial benefits [54]. Furthermore, it is important to note that both firm age and manager's gender also have a positive relationship. Thus, these results support hypotheses 10b and 12b, respectively. However, firm's size has a negative relationship. So, it seems that creative SMEs with at least one woman as managers can affect positively on their productivity, in addition to the use of DTs. Thus, our results are consistent with previous studies [3,66, 70,71,72].

Fourth, if we focus on column 4, we can see that the use of almost all DTs (broadband, digital consulting, websites, extranet, and enterprise information systems) have a positive relationship with the labour productivity of manufacturing companies. Therefore, these results support hypotheses 1b, 4b, 5b, 8b and 9b, respectively and are in line with previous studies [32,36,47,58,60,62]. However, we found that certain DTs have a negative relationship, such as online selling and social networks. Regarding online selling, probably there are still several technical and non-technical limitations that prevent organizations getting all the benefits [50]. In this study, only 25% of the companies use this sales channel. In addition, like in recent studies, manufacturing companies show that social networks mainly effect creativity, job satisfaction and motivation, but not productivity [54]. Moreover, we found that both the use of the intranet and investments in digital training do not present statistical significance. Perhaps, among other things, this is because their use is also scarce, only 36% and 30% of manufacturing companies carried out these activities, respectively. Furthermore, it is important to note that the firm's age also has a positive relationship, thus, this result supports hypotheses 10b. Nevertheless, both the size of the firm and the manager's gender have negative relationships. These results suggest that manufacturing firms with experience in the market can affect positively on their productivity, in addition to the use of DTs. Furthermore, it seems that large manufacturing firms with low proportion of female managerial position may be prone to not adopting these DTs. Thus, our results are consistent with previous studies [3,65,70,72]. At this point, it is important to mention that the RMSE in both models (3 and 4) according to labour productivity shows satisfactory significance (0.998 and 1.157) and the R square (0.27) is slightly moderate [75], respectively.

Fifth, if we make a comparative analysis between the creative and manufacturing industries, with respect to net sales (columns 1 and 2), we can see some differences. For example, large creative firms with experience in the market, some proportion of female managerial position and those that adopt DTs (broadband, intranet, digital consulting, websites, extranet and enterprise information systems), have positive relationships with a firms' net sales, while large manufacturers with experience in the market, with low proportion of female manager position and adopt DTs (broadband, digital consulting, websites, extranet and enterprise information systems), have positive relationships with a firms' net sales. Despite this, creative firms use a greater number of DTs that have positive and significant relationships with net sales compared to manufacturing firms. Therefore, the results support hypothesis 13a. In addition, if we focus on labour productivity (columns 3 and 4), the results show that there are slight differences. For example, creative SMEs with experience in the market, some proportion of female managerial position and those that adopt DTs (broadband, intranet, digital consulting, websites, extranet and enterprise information systems), have positive relationships with their labour productivity, while SME manufacturers with experience in the market, a low proportion of female managerial position and those who adopt DTs (broadband, digital consulting, website, extranet and enterprise information systems), have positive relationships with their labour productivity. Despite this, creative firms use a greater number of DT and have positive and significant relationships with labour productivity compared to manufacturing firms. Thus, these results support hypothesis 13b. In any case, we can affirm that the particularities related to the activities of the company can affect the adoption of DTs [20,73] and in turn, these influence on the performance of the companies [18].

Lastly, it's important to mention that the mere existence of a technology may not secure the outcomes or performance desired, thus, digital capabilities are necessary to effectively compete in a digital age [13]. Although recent empirical research has suggested which dynamic capabilities are necessary to compete in a digital economy [77,78] and has identified a range of sub-capabilities of those capabilities; it remains unexplored in the academic literature [13]. Unfortunately, our research could not measure these capabilities due to a lack of available data in the survey.

5. Conclusions

From a theoretical perspective, this article not only contributes to the technology adoption approach by reinforcing the arguments that digital technologies can affect the firm's performance [2,14,22,25] but also that this relationship may be different depending on the manager's gender [70,71,72], the size of the firm [3,66,67] and the industry [18,73]. In that sense, our study contributes empirically to showing that there is a positive relationship between the use of digital technologies and the net sales and productivity of the companies. Our results tested these theories originating in developed countries in the Peruvian context. The empirical analysis is based on a sample of 2,970 Peruvian companies from creative and manufacturing industries. We found that there are differences in adoption of DTs between both industries, where most of the digital technologies are positively related to net sales and productivity in creative industries rather than manufacturing firms. Furthermore, a more detailed analysis of these relationships shows that the greater the number of DTs used, the more positive significative with firms' performance. Despite this, we found that there are some DTs (online selling and social networks) that have negative significance on a firms' performance. This is, probably due to the fact that Peruvian companies can present technical, economic and legal barriers, preventing the successful implementation of these DTs, as other literature has recognized [50,55]. Such controversial evidence shows the ongoing debate between the use of DTs and firm performance, due to some dynamic capabilities being necessary to compete in a digital economy [77,78] and the use of DTs perhaps being insufficient.

On the other hand, when we factor in the sample considering the age of the company, the results suggest that firms with experience in the market can positively affect their performance, in addition to the use of DTs. However, the size of the company and the manager's gender shows controversial results that encourage debate. For instance, our results show that large firms are prone to positively affect firms' net sales, while SMEs are prone to affect firms' productivity in both industries. Instead, in the manager's gender, some proportion of female managerial position have positive relationships with a firms' performance in creative industries, in addition to the use of DTs, while the low proportion of female managerial position have negative relationships with performance in manufacturing firms. Thus, it would be relevant for future research to try to clarify these arguments and identify what practices or strategies are carried out by these companies in these respects, especially, when top management support in digital transformation may have positive or negative effects [79].

In practical implication terms, our results suggest that almost all DTs have a positive effect on net sales and productivity. However, these relationships can be different depending on the manager's gender, the size of the firm and the industry, as we mentioned above. Therefore, companies in both industries should improve their implementation of DTs, especially in the use of online selling and social networks, by proper management of the technology portfolio and capabilities [80]. Thus, the alignment between the functionality of digital technologies and organizational strategies is needed in order to take advantage of digital technologies [1], which requires suitable strengthening of workers' digital capabilities [13,80]. Additionally, more policy efforts should be put into making promoting gender diversity in top management positions. Similarly, the adoption of DTs may also require ad hoc policies, to the extent that they strongly associate with innovation processes within the company [81]. In that sense, the creation of advanced services should be encouraged to link innovation in manufacturing firms, especially to foster the servitization strategy [82], digital transformation [83] and industry 4.0 [84].

Lastly, this study has limitations that should be highlighted. First, despite the ENE survey being used, the low number of key variable observations limits the analysis at the intra-industry level, allowing only interpretations of the industry as a whole. Second, due to the timeline of the survey, which is cross-sectional in nature, our study does not assess digitalization dynamics, so future studies should focus on this issue. Lastly, because there may be other factors that have not been included in our models (especially digital capabilities), future research should corroborate our results in specific contexts in emerging countries.

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Biographical notes

Jean Pierre Seclen-Luna
is PhD in Economics from the University of the Basque Country, an institution where he was researcher at the Economics and Business Faculty. Currently he is Full Professor Associate at the Department of Management and Coordinator of the Research Group on Innovation Management at the Pontifical Catholic University of Peru (PUCP). Furthermore, he is member of the Latin-Ibero-American Association for Technological Management and Innovation (ALTEC) and is a member of the International Advisory Board of the Basque Economic Review. His research activity is focused on issues about innovation management, servitization and KIBS. His main publications have been in the Journal Sustainability; Technology Analysis & Strategic Management; Competitiveness Review: An International Business Journal; International Journal of Business Environment, among others. He has numerous participations in international conferences.

René I. Castro Vergara
is Economist and Master in Management and Policy of Innovation and Technology from the Pontifical Catholic University of Peru (PUCP). He has been a consultant for more than ten years in the areas of Productive Development, Innovation and Technology Management, Digital Transformation, and Economic and Social Development for many organizations, most of them from the public sector. He also has a specialization in Management of Companies and Cultural Initiatives and is a member of both the Innovation Management Research Group, belonging to the Management Sciences Academic Department of PUCP, and the Latin-IberoAmerican Association of Technology Management and Innovation (ALTEC). His publications are related to innovation processes in creative and cultural industries. He currently works as a specialist in evaluation of public interventions in the Public Expenditure Quality Directorate of the Ministry of Economy and Finance.

Hellen López Valladares
is MSc. in International Development from the University of Manchester, United Kingdom. Social Manager by the Pontifical Catholic University of Peru (PUCP). With postgraduate studies in Strategic Management of Corporate Social Responsibility and Inclusive Businesses and in Design, Execution and Evaluation of Public Investment Projects. She is currently an Associate professor and researcher at the Department of Management Sciences, Coordinator of the Social Mention of the School of Management, Coordinator of Working Papers Publications and founder and member of the Research Group on Business Growth. She has conducted research and consulting on business growth, social entrepreneurship, female entrepreneurship, and social innovation, publishing in conferences, journals, class materials and for the development of private and public organizations.