



# WORKING PAPER

## Digitalisation and Firm Performance: Evidence from Tunisian SMEs

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EMNES Working Paper No 36 / July, 2020

### Abstract

Existing studies suggest that the level of digitalisation amongst Tunisian Small and Medium-sized Enterprises (SMEs) is low. Tunisian SMEs lack the resources and capabilities needed to implement digital technologies. Furthermore, the literature argues that digitalisation offers unprecedented opportunities for SMEs, making digitalisation more than fundamental for their survival and growth. The purpose of this paper is to shed light on the relationship between digitalisation and performance, in the context of Tunisian SMEs. Based on a firm-level dataset of 466 SMEs in Tunisia, the results indicate that digitalisation is positively related to firms' performance, allowing them to develop their activities, boost their sales, and to have a greater presence within foreign markets. This positive relationship is linked with the firm's engagement within a global digitalisation strategy, where it considers digitalisation as being an integral part of its business and activities. Thus, the paper gives several policy recommendations to support the digital transformation of SMEs in Tunisia.

**Keywords:** Firm performance, digitalisation, internationalisation, SMEs, digital strategy

**JEL classifications:** L25; O14; O33; C21

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## Introduction

The Tunisian economy is dominated by small and medium-sized enterprises (SMEs), accounting for more than 99% of all firms in the private sector. Tunisian SMEs are confined to low-technology and low-productivity activities leading, to a low value added and limited integration to the global value chains. SMEs are also characterised by low upward mobility and a low contribution to job creation, since they do not have the appropriate financial, human, and logistical resources to innovate (Mouelhi and Ghazali2018).

In a context of strong and tough competition from the world market, digitalisation proves to be an important driver of SME competitiveness and growth. In order to achieve higher growth rates, more job creation, and more integration into global value chains, urgent actions are needed to switch to an investment, innovation, and export-led growth system. Technology, digitalisation, and automation offer new opportunities for firms and new instruments for governments to improve the business environment and competitiveness.

In today's world, SME involvement in the technological transformation and digital economy is essential within the context of digital revolution, trade openness, and intensive exposure to international competition. According to a study carried out in 2017 by BPI France, 20% of French companies that refuse to follow the digital shift will be unable to stand up to competition and are projected to disappear by 2020. In fact, firms that are not able to adapt to these changes will be less attractive to an increasing number of connected consumers (Verhoef et al. 2019). Thus, digitalisation has become a strategic priority for an increasing number of SMEs (Chan et al. 2019).

Several studies suggest that digitalisation is a key factor and challenge for a firm's growth and performance; innovative firms are more likely to grow (Cassetta et al. 2019; OECD 2017; Martín-Peña et al. 2020). The adoption of new technologies and processes allows the emergence of high-value added products with new market perspectives (Mouelhi and Ghazali2018; Martín-Peña et al. 2020). In fact, digitalisation is expected to exert a positive impact on productivity and competitiveness through a more efficient use of these factors. It also offers easier access to international investment funds and to new finance instruments capable of supporting the firm's growth.

SMEs, mostly with limited resources and capabilities, should consider digitalisation as an opportunity to develop locally and internationally (Hagsten and Kotnik 2017). Firms should embrace digitalisation to meet their customers' new requirements in terms of quality, transparency, communication, information and delivery.

Autio (2017) and Bughin and van Zeebroeck (2017) use the term “digital disruption” to describe the transformative impact produced by digital technologies and infrastructure on how business, economy and society operate. The authors argue that digitalisation is transforming entrepreneurship by creating new entrepreneurial practices. Valenduc and Vendramin (2017) consider that the current wave of digitalisation is assimilated with the third or fourth industrial revolution, or the second machine age.

Despite these benefits, SMEs are lagging behind large firms in terms of digitalisation. In fact, SMEs with their small-scale and limited knowledge of new solutions and their benefits, limited financial resources, and lack of digital skills face many more constraints than large enterprises in adopting digital tools within their operational activities. In fact, digitalisation requires a complementary investment in new machinery, software, solutions, knowledge and technical expertise, especially digital and analytical skills.

Tunisian decision-makers are aware of the digital challenge, so they have initiated several programmes and projects, such as “Digital Tunisia 2018” and “Smart Tunisia 2020”, with the objective of “becoming a digital reference at the international level and make ICT an important lever for socio-economic development” (IACE 2016, p.48). They mobilised resources and funds to support and facilitate the digital transition, in addition to several programmes that are dedicated to promote innovation (PCAM, PASRI etc).

Furthermore, many financial and fiscal incentive tools have been introduced to support the technological transformation of firms, such as the “RIICTIC”, which is an incentive tool for creativity and innovation in the information technology and communication field. RIICTIC supports projects in innovative and high added value activities, based on e-business.

However, despite these initiatives, the digitalisation level of SMEs remains low with regard to some available indicators. For example, Tunisia is lagging far behind leading countries in terms of e-commerce, as indicated by the UNCTAD index (2018). The system is characterised by the presence of many actors and many initiatives but isn’t well coordinated, lacking a national digital vision and an effective strategy.

Several studies have analysed the impact of digitalisation on firm performance. However, they are often oriented to large firms and, to a lesser extent, to SMEs in developed countries (OECD 2017). Thus, the topic of a firm’s digitalisation and performance remains relatively unexplored in the context of MENA and developing countries. The main reason is a lack of detailed data, especially at a firm level. The debate about the impact of digitalisation on performance is new in regards to developing countries.

To fill this gap, this paper aims to study the relationship between digitalisation and firm performance, in the context of Tunisian SMEs. The paper also gives an overview of the stock of digitalisation for SMEs in Tunisia and presents the main constraints to SME digitalisation. In addition, it proposes some policy recommendations to boost the digitalisation process of SMEs in Tunisia. To the best of our knowledge, this is the first study that gives an empirical investigation into the relationship between digitalisation and firm performance in the case of Tunisian SMEs.

Based on a sample of 466 Tunisian SMEs from the manufacturing and service sectors observed in 2013, the empirical results show that digitalisation has a significant and positive effect on firm performance with regards to several indicators of performance. In addition, this positive association is more pronounced when the firm is engaged in a global digitalisation strategy, where digitalisation is considered to be an integral part of a firm's business and activities. The results highlight the role of complementarities amongst digital tools, as a source of sustained competitive advantage and, thereby, the firm's performance.

The remainder of this paper is structured as follows: Section 2 gives an overview of the state of SME digitalisation in Tunisia, as well as the main constraints. Section 3 provides the theoretical background. In Section 4, we present the empirical strategy and some descriptive statistics. Section 5 shows and discusses the results. Finally, we present the conclusion and propose certain recommendations to support the digital transition of SMEs in Tunisia.

## SMEs and digitalisation in Tunisia: overview and main constraints

In this section, we try to give an overview of the state of SME digitalisation in Tunisia and study the main related constraints. For this, we make an inventory of the information and studies available for Tunisia.

According to recent reports (ESCWA 2018; UNCTAD 2018; WEF 2016), Tunisia and more broadly, MENA countries, are not well equipped to use new technologies for further development. Fig. 1 shows that Tunisia's economy is in a poor position to utilise e-commerce.<sup>6</sup> In particular, the use of the internet and digital tools in Business-to-Consumer (B2C) transactions is low.

### **Insert Fig.1 here**

Furthermore, according to the WEF ranking, the business and innovation environments in Tunisia are limited. As shown in Fig.2, Tunisia is lagging far behind

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<sup>6</sup> The E-commerce Index is calculated as the average of four indicators, which are: account ownership at a financial institution or with a mobile-money-service provider (% of population aged 15+), individuals using the Internet (% of population), Postal Reliability Index and secure internet servers (per 1 million people) (UNCTAD B2C E-Commerce index 2018, Focus on Africa).

the leading countries (amongst which are small countries such as Singapore, Estonia, and Malta) in terms of the Network Readiness Index.<sup>7</sup>

**Insert Fig.2 here**

Focussing on the firm level, the Business Usage Index, which is a firm level measure of technology absorption and capacity to innovate, is particularly low in Tunisia (Fig. 3). Whilst Tunisia has a better ranking in terms of individual usage of ICT, its ranking in terms of overall ICT business usage is very low. The social impact of ICT use (in terms of basic services access: internet use in education, and healthcare) is higher than the economic impact of ICT use (new business models and a new organisational model in firms). In Tunisia, it seems that individuals are more prepared for digitalisation and more integrated than firms.

**Insert Fig.3 here**

In this context, Tunisian MSEs should capture a larger share of online demand, given the strong presence of Tunisian consumers on social networks. The “Network Readiness Index” evolutions indicates that MENA countries are improving their ranking slightly, but more remains to be done in order to close the digitalisation gap and encourage firms to adopt digital technologies. Within a context of intensive exposure to international competition and a digital world, Tunisian SMEs should find new ways to innovate in products, processes and organisation in order to survive and grow.

According to a qualitative survey of 350 Tunisian firms, conducted by Ernst and Young (EY) in 2018,<sup>9</sup> 71% of the contacted enterprises believe that the digital impact is important and 55% report having a plan for digital transformation (mainly in the financial sector). In addition, 67% of managers express their intention to invest in analytics and big data.

The survey results also highlight that 53% of contacted firms think that the lack of internal expertise is the main obstacle to the implementation of digital projects. The shortage of digital technical skills and the lack of familiarity with digital tools are one of the main obstacles to the implementation of digital projects. 47% think that the enterprise culture and resistance to change are hampering the digital transformation process. 37% refer to their information systems as being another obstacle to digitalisation. Regulatory barriers and financial barriers are also considered as main barriers to digitalisation. Funding digitalisation is very limited and the traditional financial actors and instruments are not adapted to projects with

<sup>7</sup> The “Network Readiness Index” is calculated for more than 140 countries to assess a country’s preparedness to reap the benefits of emerging technologies. The index is based on 4 main categories, 10 pillars (sub-categories) and 53 indicators. One of the pillars is dedicated to business usage (WEF, The global information technology report, innovating in the digital economy, 2016).

<sup>8</sup> WEF, The global information technology report, innovating in the digital economy, 2016.

<sup>9</sup> Ernst and Young, Baromètre 2018 des entreprises en Tunisie.

a high degree of digital and technological components. In addition, weak digital infrastructure, poor development of electronic payment solutions, and digital security problems are also hindering SME digitalisation. All of these factors put SMEs at a disadvantage in terms of digital maturity and competitiveness.

In order to assess the “readiness” of Tunisian firms to transition to the digital age, in 2016 the Arab Institute of Business Leaders (IACE) generated a «*Readiness Digitalisation Index*» for 270 Tunisian enterprises from the manufacturing and services sectors. The results suggest there has been a timid approach to the digitalisation process amongst Tunisian firms and a low level of digital maturity, despite full awareness of its importance and its challenges. Furthermore, this awareness is not accompanied by digitalisation strategies and the implementation of digitalisation plans. Few firms are using new technologies, such as cloud computing, mobile applications and e-commerce. The health services, as well as the financial and informatics services are the most prepared for and integrated into the digital transformation. The manufacturing sector, tourism and commerce lag behind.

According to the survey, the main constraints faced by Tunisian firms are: the lack of a digital strategy, the lack of digital skills, and the problem of cyber-security. Moreover, many of the contacted firms think that digital transformation is expensive in the short-term (equipment, training, and restructuring) whereas its benefits are only visible in the longer term. That’s why SMEs, with few resources and limited access to finance, are reluctant to adopt and engage in the digitalisation process. Digitalisation requires massive financial investment, human resources and time. It could involve a replacement of machinery and equipment (new equipment, new skills, new organisation and new technologies). Therefore, many SMEs think that the costs of digital transformation are greater than the profits it will generate.

In this context, the government needs to support the growth and modernisation of Tunisian SMEs, in order to create a critical mass of stronger, more resilient and competitive firms. By enhancing firm performance, digitalisation could generate important economic and social benefits.

## Theoretical background

The relationship between digitalisation and firm performance has been studied recently in the empirical literature. Indeed, digitalisation represents an emerging field that is challenging the fundamentals of firm performance. Many authors have shown that digitalisation is a key factor in SME performance. Digitalisation provides new value-creating and revenue-generating opportunities (Sklyar et al. 2019). It also provides new opportunities for internationalisation (Cassetta et al. 2019).

Several studies have investigated the benefits resulting from the adoption of digital tools. Based on a sample of 391 large companies around the world, Westerman et al. (2012) show that firms categorised as “Digirati” have the highest performance, in terms of revenue generation, profitability and market valuation. These firms have, on average, 9 percent higher revenue compared to the average

firm. By using advanced technologies, they are able to use physical assets more optimally.

Weill and Woerner (2015) conducted a survey of large U.S corporations across a variety of industries and found that firms with a deep engagement in digital ecosystems outperform their industry peers. The authors highlight an increase of around 30 percent in revenue growth and a 27 percent increase in profit margins for companies that are engaged in the digital ecosystem, compared to their direct competitors.

In a recent study, Bughin et al. (2017) prove that digitalisation is positively correlated with financial performance. The authors split firms into three groups according to their digitalisation ranking. They found a significant association between the level of digitalisation and revenue growth. Bughin and van Zeebroeck (2017) further argue that, today, digitalisation acts as a major “disruptor” with far-reaching consequences. Studying the magnitude of the digital disruption impact on companies, they estimate that new digital entrants take up to 20 percent of market shares but, more importantly, they also change customer behaviour.

Based on a sample of 193 SMEs in Austria, Eller et al. (2020) prove that a digital strategy has a positive effect on a firm’s financial performance, suggesting that digitalisation acts as a driver for further growth. This result is in line with Barua et al. (2004) and Albano et al. (2015), showing that digitalisation positively relates to financial performance.

Furthermore, several studies have emphasised the role of digital technologies in accessing international markets (Olejnik and Swoboda 2012; Sinkovics et al. 2013), with most of them focussing on multinationals and large firms (Bennett 1997; Bianchi and Mathews 2013). Exploring the role of e-business digital technologies in explaining the export propensity of Italian SMEs, Cassetta et al. (2019) prove that digital technologies have a positive impact on internationalisation, particularly when they are associated with investments in digital skills. Compared to larger firms, the potential benefits of digitalisation may be even greater for SMEs, because they mitigate the classical constraints to internationalisation that are related to firm size and financial issues (Mathews and Healy 2008; Tseng and Johnsen 2011). Digitalisation may, in this case, compensate for a weaker physical presence of SMEs compared to large firms in foreign markets (Cassetta et al. 2019).

The literature has extensively examined the mechanisms through which digitalisation increases performance. Digitalisation affects firm performance through improvements in both product offering and operational process (Kryvinska et al. 2014; Martín-Peña et al. 2020). Digitalisation facilitates commercialisation for SMEs and offers them new forms and ways of marketing and commerce, by diversifying their communication channels (mobile, website, social media) via e-commerce platforms (new digital sales channels) and online transactions. This creates new business opportunities, transforms the business model, permits closer stakeholder relationships, and enhances business processes and service innovation, resulting in an increase in revenue.

In the literature, the value-creation generated by digitalisation is traditionally linked to the use of ICT (Belvedere et al. 2013; Cardona et al. 2013). Great attention has been paid to the consequence of ICT adoption in terms of productivity, performance and export growth. Koc and Bozdag (2009) and Moshiri and Simpson (2011) have shown that ICT positively affects firm performance through variables such as improvements in product offering and standardisation of processes.

Digitalisation allows better connectivity between the company and its customers. It enables the company to meet customer requirements and to attract new clients by collecting data on consumers, practicing personalised marketing and services, and having close relationship with clients. A client's requests could be integrated directly into the production process in order to make better decisions, as well as to adapt and meet the needs and requirements of customers, as a result of informed knowledge about customer expectations.

Furthermore, by transforming entrepreneurship and creating new entrepreneurial practices, digitalisation could offer new perspectives on SME internationalisation, which is one of the most important sources of firm growth and improved performance (Lu and Beamish 2001). The international experience of SMEs is often limited due to their small size and lack of human and financial resources; digital technologies offer facilities and mitigate the barriers and constraints to internationalisation. As highlighted by Cassetta et al. (2019), digital technologies provide an additional channel for commercial relationships, marketing and sales.

Digitalisation offers new opportunities in foreign markets; it enables the identification of and connection to new customers, suppliers, and partners worldwide at a reduced cost. Beyond that, digitalisation offers SMEs new opportunities to develop their network and to enhance their global value chain participation (Jean et al. 2010; Jin et al. 2014; Marchi et al. 2018). Hagsten and Kotnik (2017) show that websites are key factors in the decision of SMEs to export and that online sales have an impact on their export intensity.

Furthermore, Fuentelsaz et al. (2009, 2018) argue that the implementation of new technology directly increases firm efficiency and productivity through changes in the production process, like automating certain tasks, improving the human resource management, and better remote control of different production units. Digital technologies support daily tasks and give teams the opportunity to focus on their core business and strategy.

Digital tools facilitate the communication and the coordination with internal staff and external supply chain partners and improve the networking capability of SMEs (Cenamoret al., 2019). This could improve efficiency by stimulating information and knowledge sharing, upgrading information systems, enabling data analysis, offering better organisation and coordination across teams, maintaining interpersonal links, developing new relationships, and identifying market trends and new opportunities (Eller et al. 2020).

Autio (2017) argues that digitalisation creates opportunities for existing SMEs to proactively rethink both their internal and external interactions with

customers, partners, suppliers and internal stakeholders. Digitalisation offers new opportunities in foreign markets whilst, at the same time, increasing competition in the home market. This requires learning and dynamic capabilities which, in turn, creates fresh demand for skilled and technological jobs.

Bley et al. (2016) show that firm digitalisation reduces costs. In fact, access to business platforms (e-commerce, crowdfunding and cloud platforms) reduces costs by dematerialising a number of services, using innovative solutions for meeting organisations and implementing cloud services. Digitalisation allows for reduced communication and marketing costs via social media. Furthermore, online sales avoid the costs related to physical outlets. Moreover, cloud-computing services limit the cost of ICT investment for SMEs via a “pay-as-you-go model” (paying for each service, each use) (OECD 2017).

Moreover, digitalisation offers faster and less expensive tools for administrative procedures (creation and custom procedures) and more systems for the daily tasks within companies, such as recruiting, electronic invoicing and online payments.

Finally, digitalisation offers easier access to capital networks, extensive access to financing (OCDE 2017), access to various and innovative national and international financing tools via Fin-Tech and alternative instruments (such as crowdfunding). This facilitates the creation of start-ups and innovative enterprises.

## Empirical analysis

### Data

The data used for our empirical analysis comes from the World Bank (WB) Enterprise Surveys (ES). The focus was on the Tunisia ES, which was conducted between March 2013 and July 2014, as part of the joint World Bank, European Bank for Reconstruction and Development (EBRD) and European Investment Bank (EIB) Enterprise Survey.<sup>10</sup> The ES was designed to provide information about the business environment affecting firm-level productivity. It also assesses the constraints to private sector growth and enterprise performance. Whilst the ES is not particularly focused on digitalisation, it includes helpful information on the engagement of firms in the digitalisation and innovation processes.

The dataset is a cross-sectional sample covering a set of active Tunisian firms from the manufacturing and service sectors that employed at least one person.

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<sup>10</sup> World Bank, European Bank for Reconstruction and Development, European Investment Bank. Tunisia Enterprise Survey (ES) 2013. [www.enterprisesurveys.org](http://www.enterprisesurveys.org)

Consistent with the aim of this research, which focusses on SMEs, a sample of 466 firms that have less than 199 employees<sup>11</sup> has been selected for the estimation.

## Variables

Following the question being studied in this paper, we use variables that are related to firm performance and digitalisation. We also include other variables to allow for some covariates, including a set of firm characteristics. The variables are described in Table 1 and presented, in turn, below.

The dependant variable refers to the firm performance, which we approximate by three alternative measures, often used in the literature. The first and most standard measure of firm performance is the *total sales* (Crozet and Milet 2017; Fang et al. 2008; Martín-Peñaet al. 2020; Patterson et al. 2004). For the estimation, it was operationalised using the logarithm function (Martín-Peñaet al. 2020). The robustness of our findings is then tested by using *sales growth* as an alternative indicator of performance (Parida et al. 2016). As mentioned by Cenamor et al. (2019), SME performance can be well captured by the dynamic of their results. Thus, we have used the average annual sales growth rate for the period 2009 to 2012. The third measure of firm performance is *internationalisation*, which refers to the firm's presence in foreign markets. As developed in the theoretical background, digitalisation could offer new opportunities for firms in foreign markets, making them more efficient. In line with Cassetta et al. (2019), Hagsten and Kotnik (2017) and Pickernell et al. (2016), we use a dummy variable which is equal to 1 if the firm exports, 0 otherwise.

Regarding the independent variables, the digitalisation variable was measured by several indicators, ranking from basic digitalisation tools to more developed digitalisation technologies, such as ICT and new software. In fact, as highlighted by Calvino and Criscuolo (2019), digitalisation represents a multifaceted phenomenon. Verhoef et al. (2019) also argue that digitalisation is a multi-disciplinary mechanism involving changes in strategy, organisation, information technology, supply chains and marketing. As basic digitalisation tools, we introduce dummies for email and website usage (Cassetta et al. 2019 and Hagsten and Kotnik 2017). The developed digitalisation technologies are those closely related to innovation and new technologies (Autio et al. 2018). In line with the literature, we introduce a set of dummy variables taking a value of 1 if the firm uses respectively: *new products or services*, *new technologies for manufacturing or services*, *new technologies for logistics*, *new technologies for marketing*, and *ICT*.<sup>12</sup> Although not fully comprehensive, these items reflect a range of elements in digital technologies

<sup>11</sup> According to the Tunisian National Statistics Institute (INS), SMEs are firms with less than 200 employees (micro firm 0-5 employees, small firm 6-49 employees, medium firm 50-199 employees) (OECD 2018, SME Policy Index. The Mediterranean Middle East and North Africa. DOI: <https://doi.org/10.1787/9789264304161-en>).

<sup>12</sup> By ICT, we mean new or significantly improved techniques, equipment and software. It does not include email and website usage.

including online delivery, automation and online sales (see description in Table 1). In the digitalisation-performance literature, digitalisation items are introduced separately or combined into a composite digitalisation index. Thus, besides being introduced separately, all these items were summed to construct a *digitalisation index* at a firm level (Martín-Peña et al. 2020). The digitalisation index ranges from 0 to 7, with values closer to 7 indicating higher levels of digitalisation by the firm.

To control for firm characteristics, we introduce several covariates commonly used in the literature, such as *age* (Cenamor et al. 2019; Eller et al. 2020; Martín-Peña et al. 2020; Parida and Örtqvist 2015), *size* (Cassetta et al. 2019; Cenamor et al. 2019; D'Angelo 2012; Eller et al. 2020; Kellermanns et al. 2012; Martín-Peña et al. 2020) and *economic sector* (Cassetta et al. 2019; Cavusgil and Zou 1994; López Rodríguez and García Rodríguez 2005; Martín-Peña et al. 2020; Patterson et al. 2004).

Firm age is measured as the number of years between the foundation of the firm and the observation year (Cenamor et al. 2019; Martín-Peña et al. 2020). In line with Cassetta et al (2019), we introduce dummies for size (micro, small, and medium) and a binary variable for sector, where 1 indicates that the firm belongs to the manufacturing sector to control for sector-specific characteristics.

Finally, as a firm's performance may be influenced by other factors, we also control for a firm's legal status and capital participation. Therefore, we introduce two dummy variables: *family ownership* taking a value of 1 if the firm is under family ownership (Chrisman and Patel 2012; Eller et al. 2020), *foreign* taking 1 if the firm is under foreign ownership, and 0 if the firm is domestically owned (Basti et al. 2011; Kimura and Kiyota 2007).

**Insert Table.1 here**

## **Descriptive statistics**

Table 2 provides descriptive statistics for our dataset of 466 SMEs in Tunisia. 60% of our sample is small-sized firms (6-49 employees) with 50% operating in the manufacturing sector. Regarding digitalisation, 95% of firms use e-mail to communicate with clients and suppliers, and 65% have their own website. Although well equipped with basic digital tools, SMEs seem to be less familiar with more advanced digital technologies. Only 26% of SMEs have used new digital technologies (online sales) for their marketing operations in the three last years, whilst 23% have introduced new technologies for manufacturing or services processes (automation and new software). The proportion is even smaller if we consider digital methods for logistics and distribution operations (13%) and ICT (19%). This fact is not specific to Tunisian SMEs. Small firms are often seen to be unfamiliar with a number of digital technologies, with the exception of email, websites, social media and software packages (Cassetta et al. 2019).

The mean value of the digitalisation index shows that, on average, firms only use 2 (amongst 7) of the digital technologies. This reflects that Tunisian SMEs are not yet engaged in a global digital strategy and are far from digital maturity.

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**Insert Table.2 here**

As indicated in Table 2, the SMEs in our sample have, on average, seen an increase in their sales during the last three years, whilst about 46% are exporters. Studying the statistical relationship between performance and the level of digitalisation, we found that firm performance is significantly and positively correlated with the level of the firm's digitalisation. A moderate positive correlation was found between the digitalisation index and sales and the digitalisation index and sales growth, with a higher value for sales ( $r=0.29$ ,  $p\text{-value}<0.01$ ). Regarding internationalisation, Figure 4 also shows that exporting firms have a higher level of digitalisation on average (they are more digitalised) than non-exporting firms.

**Insert Fig.4 here**

This correlation analysis provides a starting point from which to explore the relationship between digitalisation and performance and gives some preliminary support to a positive relationship between the two phenomena. These results will be confirmed by the following regression analysis.

## Regression results

### Estimation strategy

The results of our regression analysis are presented in Tables 3 and 4. In Table 3, we consider  $\ln(\text{sales})$  and  $\text{sales growth}$  as our dependent variables, whilst in Table 4 we study the effect of digitalisation on the probability to export. The Ordinary Least Squares (OLS) method was used in Table 3. The dependent variable in columns (1) and (2) is  $\ln(\text{sales})$ , whilst in columns (3) and (4), sales growth is used as a dependant variable. The control variables were introduced in all the equations to control for firm characteristics. As for digitalisation variables, they were first introduced separately (columns (1) and (3)), then summed on a digitalisation index (columns (2) and (4)).

The results of Table 4 were obtained by estimating a probit model. In this model, the probability that a firm  $i$  exports ( $\Pr(\text{Internationalisation}_i=1)$ ) is explained by several covariates. The estimation method used for this model is the maximum likelihood. The control variables are those introduced in Table 3. We also follow the same strategy for digitalisation variables. In addition, since the estimated coefficients of a probit model are not easily interpreted, we also compute (in columns (2) and (4)) the marginal effects of independent variables on the propensity to export. Marginal effects give the amount of change in the export propensity that will be generated by a 1-unit change in the independent variables (Cassetta et al. 2019).

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## Results and discussion

Various tests were conducted to ensure the validity of our estimates. First, the assumption of normality of the distribution of error terms was confirmed using the Jarque-Bera test. In addition, the reliability of the composite level of digitalisation was verified with Cronbach's- $\alpha$  and composite reliability (CR) measures. Furthermore, we use the robust standard errors to deal with a potential problem of heteroskedasticity.

The estimation results (reported in Tables 3 and 4) first indicate that, from the Fisher and Wald Chi<sup>2</sup> tests, we reject the null hypothesis of non-significance at the 1% level, as a whole, of the coefficients of the explanatory variables.

As for the explanatory variables, the results show that most of the covariates have expected signs and are in line with previous empirical studies. Regarding digitalisation, the results indicate a positive relationship between digitalisation and firm performance. Results of Table 3 show that several digitalisation components have a significant and positive effect on firm sales and sales growth. Firms that use email, websites, digital tools for logistics or marketing operations, have higher annual sales on average than those who do not use them. The increase in firm sales seems rather to be related to the use of digital tools for manufacturing or services operations. According to Cassetta et al. (2019), global and regional value chains are increasingly reliant on digital technologies to improve manufacturing, logistics and marketing activities. Effective deployment of such systems is a way of building a sustainable competitive advantage (Koc and Bozdog 2009) allowing SMEs to occupy new positions in the value chain (Davies 2004). In this case, SMEs should take advantage of the implementation of digital technologies. In addition, with increasingly international and competitive markets, digital technologies offer SMEs new ways to expand.

The results of Table 4 show that having a website has a positive and significant marginal effect at the 10% level of significance on internationalisation. The positive effect of website use on the propensity to export was highlighted by several studies in the literature (Cassetta et al. 2019; Hagsten and Kotnik 2017; Pickernell et al. 2016). Hagsten and Kotnik (2017) have found that websites are key elements in the decision of SMEs to export. Bianchi and Mathews (2013) argue that, by using a website, firms may expand their sales to new international markets and consumers, with little capital investment.

The effect of ICT is not statistically significant in all specifications which, at first glance, appears to be in contrast with the theoretical predictions. However, recent empirical studies have underlined that ICT cannot, on its own, directly generate benefits for firm. The use of ICT needs human capital capability with adequate skills that are able to manage and deploy ICT technologies (Cenamor et al. 2019; Mouelhi 2009; Yunis et al. 2018). Cassetta et al. (2019, p.1) also show that “e-business technologies have a positive impact on internationalisation only when they

are embedded with process and organisational innovations and investments in digital skills have been made". Mouelhi (2009) proves that the greatest benefits from ICT are realised when ICT investment is combined with human capital upgrading.<sup>13</sup>

The most important result in our study is the effect of the digitalisation index, which showed positive effects on SME performance and was statistically significant at the 1% level in all the specifications considered. In comparison with the individual digital items, the composite index of digitalisation reflects an element of a firm's digital maturity and its engagement level in a global digital strategy. The firm performance significantly rises with the level of digitalisation. This result is in line with Martín-Peña et al. (2020) and clearly indicates that firm performance is quite well linked with the capability of a firm to develop a digital strategy for all its activities and operations. Firms should consider digitalisation as an integral part of their organisational and business practices. According to Tilson et al. (2010), digitalisation is a socio-technical process which requires the combination of multiple and complementary tools, so that the lack of some of them may slow down the benefits of digitalisation. Verhoef et al. (2019, p.2) argue that "digital transformation is multi-disciplinary by nature, as it involves changes in strategy, organisation, information technology, supply chains and marketing". Cassetta et al. (2019, p.2) also argued that digital transformation does not only entail investing in digital technologies, but also embedding them in the organisational structure of the firm. As highlighted by Mazzarol (2015), digitalisation is a multi-dimensional, dynamic and gradual transformation process. This ranges from minor changes such as e-marketing and promotional activities, to e-commerce transactions and on to a more general transformation of a business model and processes (production, customer and management processes). Several studies showed that firms that transform their business and activities have a clear and coherent digital strategy. A digital strategy considers digital tools as a whole (Bharadwaj et al. 2013). Eller et al. (2020) show that a digital strategy is positively associated with a firm's financial performance, arguing that "firms require a digital strategy to orchestrate all mandatory resources to achieve and enhance competitiveness. On the other hand, the absence of a digital strategy leads to poor decisions and a waste of resources" (Eller et al., 2020, p.121).

Regarding control variables, the results show significant effects for age, size and sector. In general, as expected from the empirical literature (Cassetta et al. 2019; Pickernell et al. 2016), the most efficient firms are medium-sized, belonging to the manufacturing sector, and are those that have not been recently established. Furthermore, the results show that family ownership has a significant negative effect on firm sales at the 1% level. The results also highlight that foreign SMEs are more likely to grow and to export into foreign markets than their domestic counterparts.

**Insert Table.3 here**

<sup>13</sup> Unfortunately the lack of reliable information on workers' skills in our database does not allow for the testing of this interaction effect.

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**Insert Table.4 here**

Finally, as recent empirical studies have highlighted the potential non-linear relationship between digitalisation and firm performance (Cenamor et al. 2019; Martín-Peña et al. 2020), we run additional estimations including a quadratic term for the digitalisation index. In order to assess the robustness of our results. The results (not included in the paper) show that our data does not provide clear evidence of a non-linear relationship between digitalisation and firm performance. The coefficients of the quadratic term were not significant in all the specifications, thus providing additional credence to the validity of our results.

## Conclusion and policy recommendations

This study contributes to a better understanding of the challenges of digitalisation for SMEs, by exploring the relationship between digitalisation and SME performance in Tunisia. Whilst extensive literature has studied the SME digitalisation issue, our paper is amongst few studies that focus on the MENA region and on Tunisia in particular.

The available data and studies suggest that the digitalisation level of Tunisian SMEs is low with regard to some digital maturity indicators. The main constraints faced by Tunisian firms are the weak digital infrastructure, the problems of cyber-security, the lack of digital skills, attitudes and resistance to change, the costs of digitalisation and limited access to finance for digital transformation.

In line with previous research, our results confirm that digitalisation is positively related to firm performance. Digitalisation has a positive impact on firm sales and firm growth, but also on its propensity to export. Besides confirming the positive role of digitalisation on firm performance, our paper most importantly shows that firms should have a clear and coherent digital strategy in order to increase their business and activities. It stressed the role of the complementarities amongst digital components as a source of sustained competitive advantage and firm performance. SMEs should consider digitalisation as an integral part of their organisational and business practices. Digitalisation should be viewed as a strategy to be developed rather than a tool to be implemented. SMEs should apply digital transformation in all areas, ranging from production, to logistics, manufacturing and marketing operations.

In this context, removing barriers for SME digitalisation is a significant need, particularly in Tunisia, where SMEs constitute more than 99% of all firms and employ 60% of the workforce.<sup>14</sup> In addition, digitalisation could constitute a good

<sup>14</sup> Statistics from INS for 2017.

opportunity for SMEs to develop their activities and boost their performance which, in turn, could generate economic growth and reduce unemployment.

Although this study provides some interesting findings, the results should be interpreted with caution, due to several limitations which could give opportunities for further research in the future. The main issue is the lack of extensive data focusing on digitalisation at the firm level in Tunisia which, if available, could enrich the specification of our model. The second issue is related to the cross-sectional nature of our data, which may only provide insights into statistical associations or correlations between digitalisation and firm performance rather than cause-effect mechanisms. Finally, as this paper uses a sample of manufacturing and service SMEs, the results could not be extended to all Tunisian SMEs. In fact, it is judicious to think that digitalisation may have different effects on firm performance in different sectors. In the same way, although MENA countries are comparable in terms of SME digitalisation levels and readiness, the role of digitalisation may be different in countries with varying institutional support for entrepreneurship and different economic contexts. A cross-country analysis, comparing Tunisia with other countries in the MENA region, may lead to interesting findings and discussion.

Finally, from a policy perspective, understanding the link between digitalisation and firm performance provides insights into new measures of policy intervention. In this context, our study could have managerial implications and could be of considerable relevance for policy makers.

The dynamic of SME digitalisation is dependent on several factors; some of them are related to the characteristics of the enterprises and others are in relation to the ecosystem. In this context, the government should play a crucial role in supporting a firm's digitalisation process. The government should lead the way by developing its e-government services to offer less cumbersome administrative procedures for SMEs. Moreover, digitalisation requires an enabling legal framework, such as the legalisation of e-invoices, e-signatures, and the regulation of e-payments and online transactions. High quality connectivity, the extension of optic-fibre and ultra-high speed internet are essential prerequisites for increased SME digitalisation. Beyond this, the government should improve cyber security to secure electronic transactions. On the other hand, it is important to develop science and technology disciplines and to support continuous training and digital skills, in order to meet the needs of enterprises and to adapt to rapid and continuous technological change. Moreover, new financing instruments that are adapted to digitalisation projects are necessary and special funds to support companies in the digitalisation process are required. Finally, promotional campaigns, a communication strategy via the media, and workshops are needed to present the opportunities and to improve awareness amongst SMEs of the benefits of digitalisation.

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## References

1. Small Businesses' Performance in Public e-Procurement: Evidence from the Italian Government's e-Marketplace. *Journal of Small Business Management*, 53, 229–250. <https://doi.org/10.1111/jsbm.12190>
2. Autio, E. (2017). Digitalisation, Ecosystems, Entrepreneurship and Policy. *Policy Brief*, 20(December), 12.
3. Autio, E., Nambisan, S., Thomas, L. D. W., & Wright, M. (2018). Digital affordances, spatial affordances, and the genesis of entrepreneurial ecosystems. *Strategic Entrepreneurship Journal*, 12(1), 72–95. <https://doi.org/10.1002/sej.1266>
4. Barua, A., Konana, P., Whinston, A. B., & Yin, F. (2004). An empirical investigation of net enabled business value. *MIS Quarterly*, 28(4), 585–620.
5. Bastı, E., Bayyurt, N., & Akin, A. (2011). A Comparative Performance Analysis of Foreign and Domestic Manufacturing Companies in Turkey. *European Journal of Economic and Political Studies*, 4(2), 127–139.
6. Belvedere, V., Grando, A., & Bielli, P. (2013). A quantitative investigation of the role of Information and Communication Technologies in the implementation of a product-service system. *International Journal of Production Research*, 51(2), 410–426. <https://doi.org/10.1080/00207543.2011.648278>
7. Bennett, R. (1997). Export Marketing and the Internet: Experiences of Web Site Use and Perceptions of Export Barriers among UK Businesses. *International Marketing Review*, 14(5), 324–344. <https://doi.org/10.1108/02651339710184307>
8. Bharadwaj, A. S., El Sawy, O. A., Pavlou, P. A., & Venkatraman, N. (2013). Digital business strategy: Toward a next generation of insights. *MIS Quarterly*, 37(2), 471–482. <https://doi.org/10.1615/TelecomRadEng.v76.i10.20>
9. Bianchi, C., and Mathews, S. W. (2013). The role of the Internet on export market growth : An empirical study in Latin America. In *Strategic Management in Latin America*. <https://eprints.qut.edu.au/56585>
10. Bley, K., Leyh, C, Schäffer, T. (2016). Digitization of German enterprises in the production sector: Do they know how “digitized” they are? In *AMCIS 2016 Proceedings*.
11. BPI France. (2017). *Histoire d'incompréhension : les dirigeants de PME et ETI face au digital*.
12. Bughin, J, Catlin, T, Hall, B, and van Zeebroeck, N. (2017). Improving your digital intelligence. *MIT Sloan Management Review*.
13. Bughin, J. and van Zeebroeck, N. (2017). The best response to digital disruption. *MIT Sloan Management Review*, 58(4), 80–86.

14. Calvino, F., & Criscuolo, C. (2019). Business Dynamics and Digitalization. OECD, Technology and Industry Policy Papers, (62), 59.
15. Cardona, M., Kretschmer, T., & Strobel, T. (2013). ICT and productivity: Conclusions from the empirical literature. *Information Economics and Policy*, 25(3), 109–125. <https://doi.org/10.1016/j.infoecopol.2012.12.002>
16. Cassetta, E., Monarca, U., Dileo, I., Di Berardino, C., & Pini, M. (2019). The relationship between digital technologies and internationalisation. Evidence from Italian SMEs. *Industry and Innovation*, 27(4), 311–339. <https://doi.org/10.1080/13662716.2019.1696182>
17. Cavusgil, S. T., & Zou, S. (1994). Marketing Strategy-Performance Relationship: An Investigation of the Empirical Link in Export Market Ventures. *Journal of Marketing*, 58(1), 1–21. <https://doi.org/10.2307/1252247>
18. Cenamor, J., Parida, V., & Wincent, J. (2019). How entrepreneurial SMEs compete through digital platforms: The roles of digital platform capability, network capability and ambidexterity. *Journal of Business Research*, 100(March), 196–206. <https://doi.org/10.1016/j.jbusres.2019.03.035>
19. Chan, C. M. L., Teoh, S. Y., Yeow, A., & Pan, G. (2019). Agility in responding to disruptive digital innovation: Case study of an SME. *Information Systems Journal*, 29(2), 436–455. <https://doi.org/10.1111/isj.12215>
20. Chrisman, J. J., & Patel, P. C. (2012). Variations in R&D investments of family and nonfamily firms: Behavioral agency and myopic loss aversion perspectives. *Academy of Management Journal*, 55(4), 976–997. <https://doi.org/10.5465/amj.2011.0211>
21. Crozet, M., & Milet, E. (2017). Should everybody be in services? The effect of servitization on manufacturing firm performance. *Journal of Economics and Management Strategy*, 26(4), 820–841. <https://doi.org/10.1111/jems.12211>
22. D'Angelo, A. (2012). Innovation and export performance: A study of Italian high-tech SMEs. *Journal of Management and Governance*, 16(3), 393–423. <https://doi.org/10.1007/s10997-010-9157-y>
23. Davies, A. (2004). Moving base into high-value integrated solutions: A value stream approach. *Industrial and Corporate Change*, 13(5), 727–756. <https://doi.org/10.1093/icc/dth029>
24. Eller, R., Alford, P., Kallmünzer, A., & Peters, M. (2020). Antecedents, consequences, and challenges of small and medium-sized enterprise digitalization. *Journal of Business Research*, 112(March), 119–127. <https://doi.org/10.1016/j.jbusres.2020.03.004>
25. Ernst and Young. (2018). Baromètre 2018 des entreprises en Tunisie.
26. Escwa. (2018). Perspectives on the Digital-Economy in the Arab Region.

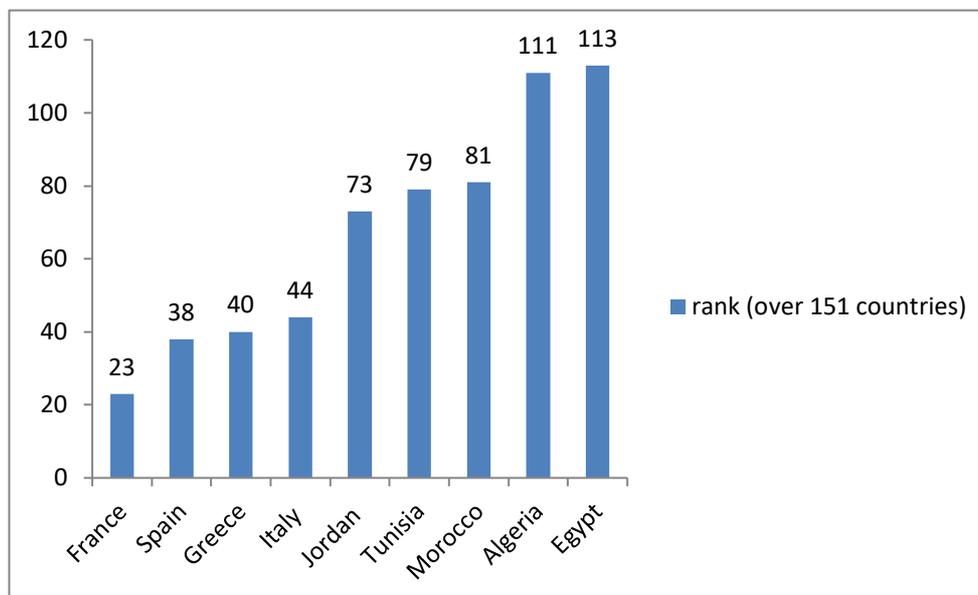
- 
27. Fang, E., Palmatier, R. W., & Steenkamp, J. B. E. M. (2008). Effect of service transition strategies on firm value. *Journal of Marketing*, 72(5), 1–14. <https://doi.org/10.1509/jmkg.72.5.1>
  28. Fuentelsaz, L., Gómez, J., & Palomas, S. (2009). The effects of new technologies on productivity: An intrafirm diffusion-based assessment. *Research Policy*, 38(7), 1172–1180. <https://doi.org/10.1016/j.respol.2009.04.003>
  29. Fuentelsaz, L., Maicas, J. P., & Montero, J. (2018). Entrepreneurs and innovation: The contingent role of institutional factors. *International Small Business Journal: Researching Entrepreneurship*, 36(6), 686–711. <https://doi.org/10.1177/0266242618766235>
  30. Hagsten, E., & Kotnik, P. (2017). ICT as facilitator of internationalisation in small- and medium-sized firms. *Small Business Economics*, 48(2), 431–446. <https://doi.org/10.1007/s11187-016-9781-2>
  31. IACE. (2016). LA TUNISIE EN TRANSFORMATION : L'IMPÉRATIF DIGITAL.
  32. Jean, R. J., Sinkovics, R. R., & Cavusgil, S. T. (2010). Enhancing international customer-supplier relationships through IT resources: A study of Taiwanese electronics suppliers. *Journal of International Business Studies*, 41(7), 1218–1239. <https://doi.org/10.1057/jibs.2010.4>
  33. Jin, Y., Vonderembse, M., Ragu-Nathan, T. S., & Smith, J. T. (2014). Exploring relationships among IT-enabled sharing capability, supply chain flexibility, and competitive performance. *International Journal of Production Economics*, 153, 24–34. <https://doi.org/10.1016/j.ijpe.2014.03.016>
  34. Kellermanns, F. W., Eddleston, K. A., Sarathy, R., & Murphy, F. (2012). Innovativeness in family firms: A family influence perspective. *Small Business Economics*, 38(1), 85–101. <https://doi.org/10.1007/s11187-010-9268-5>
  35. Kimura, F., & Kiyota, K. (2007). Foreign-owned versus domestically-owned firms: Economic performance in Japan. *Review of Development Economics*, 11(1), 31–48. <https://doi.org/10.1111/j.1467-9361.2006.00347.x>
  36. Koc, T., & Bozdog, E. (2009). The impact of AMT practices on firm performance in manufacturing SMEs. *Robotics and Computer-Integrated Manufacturing*, 25(2), 303–313. <https://doi.org/10.1016/j.rcim.2007.12.004>
  37. Kryvinska, N., Kaczor, S., Strauss, C. and Greguš, M. (2014). Servitization - its raise through information and communication technologies. In Springer (Ed.), 5th International Conference on Exploring Services Science (pp. 72–81).
  38. López Rodríguez, J., & García Rodríguez, R. M. (2005). Technology and export behaviour: A resource-based view approach. *International Business Review*, 14(5), 539–557. <https://doi.org/10.1016/j.ibusrev.2005.07.002>

- 
39. Lu, J. W., & Beamish, P. W. (2001). The internationalization and performance of SMEs. *Strategic Management Journal*, 22(6–7), 565–586. <https://doi.org/10.1002/smj.184>
  40. Marchi, V. D., Maria, E. D, Gereffi, G. (2018). *Local Clusters in Global Value Chains: Linking Actors and Territories through Manufacturing and Innovation*. (Routledge, Ed.). London.
  41. Martín-Peña, M. L., Sánchez-López, J. M., & Díaz-Garrido, E. (2020). Servitization and digitalization in manufacturing: the influence on firm performance. *Journal of Business and Industrial Marketing*, 35(3), 564–574. <https://doi.org/10.1108/JBIM-12-2018-0400>
  42. Mathews, S., & Healy, M. (2008). “From garage to global”: The internet and international market growth, an SME perspective. *International Journal of Internet Marketing and Advertising*, 4(2–3), 179–196. <https://doi.org/10.1504/IJIMA.2008.017021>
  43. Mazzarol, T. (2015). SMEs engagement with e-commerce, e-business and e-marketing. *Small Enterprise Research*, 22(1), 79–90. <https://doi.org/10.1080/13215906.2015.1018400>
  44. Moshiri, S., & Simpson, W. (2011). Information technology and the changing workplace in Canada: Firm-level evidence. *Industrial and Corporate Change*, 20(6), 1601–1636. <https://doi.org/10.1093/icc/dtro29>
  45. Mouelhi, R. (2009). Impact of the adoption of information and communication technologies on firm efficiency in the Tunisian manufacturing sector. *Economic Modelling*, 26(5), 961–967. <https://doi.org/10.1016/j.econmod.2009.03.001>
  46. Mouelhi, R., & Ghazali, M. (2018). Growth of Micro, Small and Medium enterprises (MSMEs) in MENA countries: constraints and success factors. EMNES Working Papers No.5, 1–18.
  47. OECD. (2017). *Key Issues for Digital Transformation in the G20*, (January), 163. <https://www.oecd.org/internet/key-issues-for-digital-transformation-in-the-g20.pdf>
  48. OECD. (2018). *SME Policy Index. The Mediterranean Middle East and North Africa*. <https://doi.org/10.1787/9789264304161-en>.
  49. Olejnik, E., & Swoboda, B. (2012). SMEs’ internationalisation patterns: Descriptives, dynamics and determinants. *International Marketing Review*, 29(5), 466–495. <https://doi.org/10.1108/02651331211260340>
  50. Parida, V., Oghazi, P., & Cedergren, S. (2016). A study of how ICT capabilities can influence dynamic capabilities. *Journal of Enterprise Information Management*, 29(2), 179–201. <https://doi.org/10.1108/JEIM-07-2012-0039>
  51. Parida, V., & Örtqvist, D. (2015). Interactive Effects of Network Capability, ICT Capability, and Financial Slack on Technology-Based Small Firm Innovation

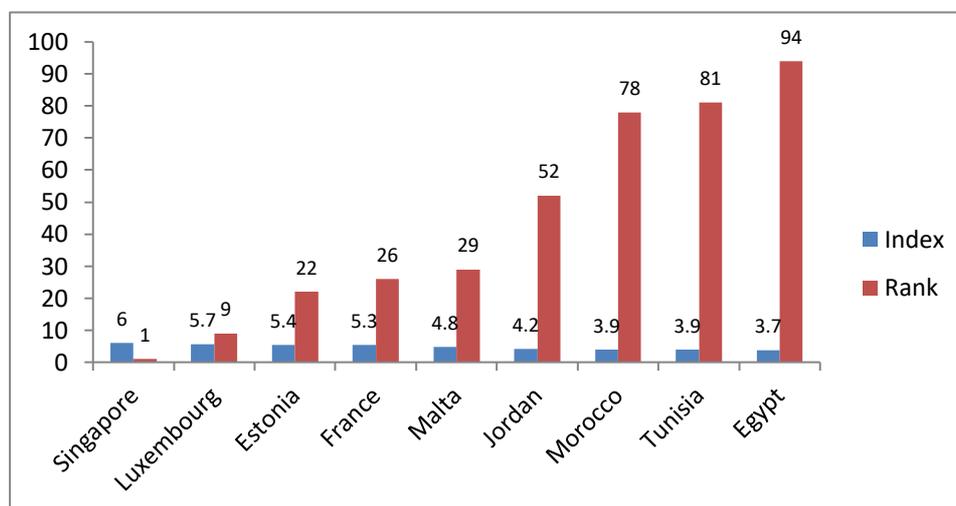
- Performance. *Journal of Small Business Management*, 53, 278–298. <https://doi.org/10.1111/jsbm.12191>
52. Patterson, M. G., West, M. A., & Wall, T. D. (2004). Integrated manufacturing, empowerment, and company performance. *Journal of Organizational Behavior*, 25(5), 641–665. <https://doi.org/10.1002/job.261>
53. Pickernell, D., Jones, P., Thompson, P., & Packham, G. (2016). Determinants of SME exporting: Insights and implications. *International Journal of Entrepreneurship and Innovation*, 17(1), 31–42. <https://doi.org/10.5367/ijei.2016.0208>
54. Sinkovics, N., Sinkovics, R. R., & Jean, R. J. B. (2013). The internet as an alternative path to internationalization? *International Marketing Review*, 30(2), 130–155. <https://doi.org/10.1108/02651331311314556>
55. Sklyar, A., Kowalkowski, C., Tronvoll, B., & Sörhammar, D. (2019). Organizing for digital servitization: A service ecosystem perspective. *Journal of Business Research*, 104(February), 450–460. <https://doi.org/10.1016/j.jbusres.2019.02.012>
56. Tilson, D., Lyytinen, K., & Sørensen, C. (2010). Digital infrastructures: The missing IS research agenda. *Information Systems Research*, 21(4), 748–759. <https://doi.org/10.1287/isre.1100.0318>
57. Tseng, K. M. K., & Johnsen, R. E. (2011). Internationalisation and the Internet in UK Manufacturing SMEs. *Journal of Small Business and Enterprise Development*, 18(3), 571–593. <https://doi.org/10.1108/14626001111155718>
58. UNCTAD. (2018). UNCTAD B2C E-commerce index 2018 focus on Africa: UNCTAD technical notes on ICT for development. Unctad, 1–23. [https://unctad.org/en/PublicationsLibrary/tn\\_unctad\\_ict4d12\\_en.pdf](https://unctad.org/en/PublicationsLibrary/tn_unctad_ict4d12_en.pdf)
59. Valenduc, G., & Vendramin, P. (2017). Digitalisation, between disruption and evolution. *Transfer*, 23(2), 121–134. <https://doi.org/10.1177/1024258917701379>
60. Verhoef, P. C., Broekhuizen, T., Bart, Y., Bhattacharya, A., Qi Dong, J., Fabian, N., & Haenlein, M. (2019). Digital transformation: A multi-disciplinary reflection and research agenda. *Journal of Business Research*. <https://doi.org/10.1016/j.jbusres.2019.09.022>
61. WEF. (2016). The global information technology report 2016. Innovating in the digital economy. <https://doi.org/10.1016/b978-0-12-804704-0.00010-4>
62. Weill, P., Woerner, S. L. (2015). Thriving in an increasingly digital ecosystem. *MIT Sloan Management Review*, 56, 27–34.
63. Westerman, G., Tannou, M., Bonnet, D., Ferraris, P., & McAfee, A. (2012). The Digital Advantage: How Digital Leaders Outperform their Peers in Every Industry. *MIT Sloan Management Review*, 1–24.

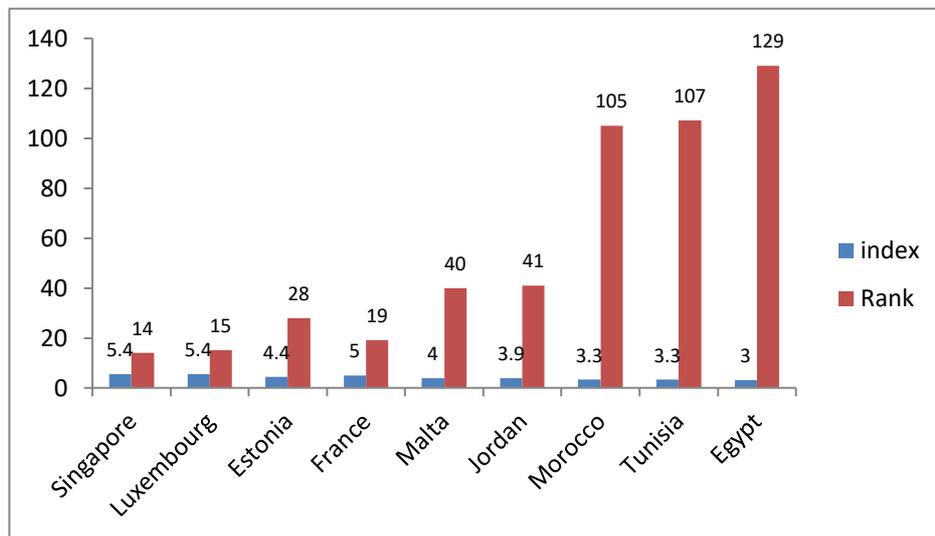
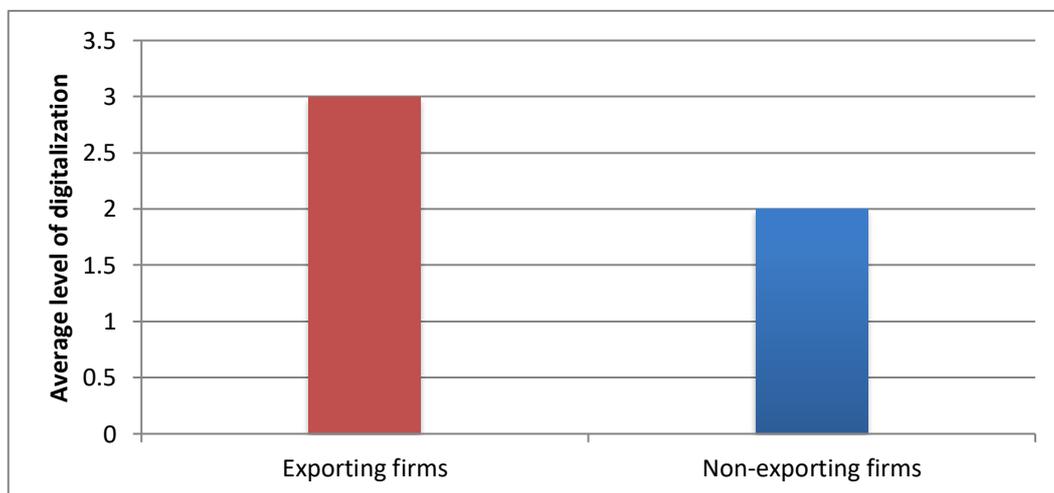
- 
64. World Bank, European Bank for Reconstruction and Development, E. I. B. (2013). Tunisia Enterprise Survey (ES) 2013. [www.enterprisesurveys.org](http://www.enterprisesurveys.org)
  65. Yunis, M., Tarhini, A., & Kassar, A. (2018). The role of ICT and innovation in enhancing organizational performance: The catalysing effect of corporate entrepreneurship. *Journal of Business Research*, 88, 344–356. <https://doi.org/10.1016/j.jbusres.2017.12.030>

## Tables and figures

**Fig.1. B2C E-commerce rank, 2018**

Source: UNCTAD

**Fig. 2. WEF, Network Readiness Index, 2016, out of 143 countries**

**Fig. 3. WEF, Business Usage sub-index, 2016, out of 143 countries****Fig. 4. Average level of digitalisation (exporting firms vs non-exporting firms)**

**Table 1. Definitions of variables**

Variables	Definition (source: World Bank, Tunisia ES, 2013)
Ln (sales)	Natural logarithm of the firm's total annual sales in the observation year (2012)
Sales growth	Average annual sales growth rate (2009-2012)
Internationalisation markets	Indicates whether or not a firm exports into foreign markets (yes=1, no=0)
Email	Indicates if the firm uses e-mail to communicate with clients or suppliers (yes=1, no=0)
Website (no=0)	Whether the firm has its own website (yes=1, no=0)
New products/ services significantly	Indicates whether, the firm has introduced new or improved products or services during the last three years (2009-2012). Examples of product innovation for services include introduction of home-delivery and/or online ordering, new forms of warranty, new forms of purchase on credit (yes=1, no=0)
New technologies for manufacturing/ services	Whether the firm has introduced any new or significantly improved methods of manufacturing products or offering services during the last three years (2009-2012). Introduction of automation of processes previously performed manually, introduction of new software to perform the service or to offer the product (yes=1, no=0)
New technologies for logistics	Whether the firm has introduced any new or significantly improved logistics, delivery, or distribution methods for inputs, products, or services during the last three years (2009-2012). Includes changes in how products or services are delivered/provided to clients and customers; introduction of scanning to register products using bar codes; changes in supply chain management (yes=1, no=0)
New technologies for marketing	Whether the firm has introduced new or significantly improved marketing methods during the last three years (2009-2012). New marketing methods in product/service promotion, such as the development and introduction of a fundamentally new brand symbol, the introduction of personalised loyalty cards, new channels or form of promoting, pricing or selling products and services (yes=1, no=0)
ICT	Whether the firm has implemented new or significantly improved information and communication technologies (ICT) in the last three years (2009-2012) (yes=1, no=0)
Age	Indicates the number of years between the foundation

Size	of the firm and the observation year (2012)
small=6-	Firm size, broken down into size-bands (micro=1-5, 49, medium=50-199 employees)
Manufacturing services=0)	Economic sector of activity (Manufacturing=1, services=0)
Family ownership (yes=1, no=0)	Indicates whether the firm is a family ownership
Foreign	Indicates whether the firms is owned by private foreign individuals, companies or organisations (having more than 50% of the firm's capital) (yes=1, no=0)

**Table 2. Descriptive statistics**

Variables	Mean	SD	Min	Max
Ln (sales)	14.434	19.924	1.5	9.993
Sales growth	0.0294	1.289	0.186	-0.584
Internationalisation	0.463	0.499	0	1
Email	0.948	0.221	0	1
Website	0.648	0.478	0	1
New products/ services	0.263	0.441	0	1
New technologies for manufacturing/ services	0.227	0.419	0	1
New technologies for logistics	0.128	0.335	0	1
New technologies for marketing	0.268	0.443	0	1
ICT	0.186	0.39	0	1
Digitalisation index	2.671	1.582	0	7
Age	21.272	12.947	2	107
Micro	0.045	0.207	0	1
Small	0.596	0.491	0	1
Medium	0.358	0.48	0	1
Manufacturing	0.506	0.5	0	1
Family ownership	0.124	0.33	0	1
Foreign	0.083	0.277	0	1

**Table 3. OLS regression estimates**

Dependent variable : Internationalisation	Coefficients		Marginal effects	
	(1)	(2)	(3)	(4)
<b>Email</b>	0.491*		0.058*	
	(0.260)		(0.033)	
<b>Website</b>	0.324***		-0.030	
	(0.123)		(0.020)	
<b>New products/services</b>	0.088		0.008	
	(0.145)		(0.023)	
<b>New technologies for manufacturing/ Services</b>	-0.137		0.044*	
	(0.163)		(0.026)	
<b>New technologies for logistics</b>	0.534**		0.002	
	(0.207)		(0.022)	
<b>New technologies for marketing</b>	0.280*		0.070***	
	(0.155)		(0.024)	
<b>ICT</b>	0.271		-0.016	
	(0.173)		(0.021)	
<b>Digitalisation index</b>		0.216***		0.017***
		(0.040)		(0.005)
<b>Age</b>	0.010**	0.011**	-0.001**	-0.002**
	(0.004)	(0.004)	(0.001)	(0.001)
<b>Small</b>	1.487***	1.570***	0.112***	0.108***
	(0.237)	(0.236)	(0.029)	(0.029)
<b>Medium</b>	2.639***	2.713***	0.108***	0.104***
	(0.261)	(0.257)	(0.033)	(0.032)
<b>Manufacturing</b>	-0.105	-0.176	0.035**	0.041**
	(0.118)	(0.118)	(0.017)	(0.017)
<b>Family ownership</b>	-0.983***	-1.040***	-0.024	-0.018
	(0.139)	(0.140)	(0.026)	(0.026)
<b>Foreign</b>	-0.193	-0.229	0.060*	0.064**
	(0.177)	(0.177)	(0.032)	(0.032)
<b>Constant</b>	11.713***	11.963***	-0.128***	-0.107***
	(0.317)	(0.243)	(0.040)	(0.029)
<b>Observations</b>	466	466	466	466
<b>R-squared</b>	0.359	0.344	0.118	0.090
<b>F value</b>	22.06***	37.51***	4.78***	8.02***

**Notes:** Robust standard errors are displayed in parentheses under the coefficient estimates; \*\*\* denotes significant at the 1% level, \*\* denotes significant at the 5% level, \* denotes significant at the 10% level. All models are significant at the 1% level.

**Table 4. Binary Probit estimation results**

	(1)	(2)	(3)	(4)
<b>Email</b>	0.139 (0.323)	0.045 (0.104)		
<b>Website</b>	0.227* (0.137)	0.073* (0.044)		
<b>New products/services</b>	0.251 (0.165)	0.081 (0.053)		
<b>New technologies for manufacturing/ Services</b>	0.273 (0.180)	0.088 (0.058)		
<b>New technologies for logistics</b>	0.063 (0.207)	0.020 (0.067)		
<b>New technologies for marketing</b>	0.029 (0.165)	0.009 (0.053)		
<b>ICT</b>	-0.126 (0.183)	-0.041 (0.059)		
<b>Digitalisation index</b>			0.127*** (0.042)	0.041*** (0.013)
<b>Age</b>	-0.009 (0.005)	-0.003 (0.002)	-0.009* (0.005)	-0.003* (0.002)
<b>Small</b>	0.431 (0.378)	0.139 (0.121)	0.429 (0.375)	0.140 (0.121)
<b>Medium</b>	0.959** (0.388)	0.310** (0.122)	0.964** (0.385)	0.314** (0.122)
<b>Manufacturing</b>	0.540*** (0.131)	0.174*** (0.040)	0.578*** (0.129)	0.188*** (0.039)
<b>Family ownership</b>	-0.222 (0.195)	-0.072 (0.063)	-0.208 (0.193)	-0.068 (0.062)
<b>Foreign</b>	1.285*** (0.285)	0.415*** (0.088)	1.282*** (0.285)	0.417*** (0.089)
<b>Constant</b>	-1.245** (0.492)		-1.196*** (0.387)	
<b>Observations</b>	466	466	466	466
<b>Log Likelihood</b>	-264.99		-266.85	
<b>Pseudo R<sub>2</sub></b>	0.176		0.170	
<b>Wald chi2</b>	94.36***		92***	

**Notes:** Robust standard errors are displayed in parentheses under the coefficient estimates; \*\*\* denotes significant at the 1% level, \*\* denotes significant at the 5% level, \* denotes significant at the 10% level. All models are significant at the 1% level.



## About EMNES

The Euro-Mediterranean Network for Economic Studies (EMNES) is a network of research institutions and think tanks working on socio-economics policy in the Euro-Mediterranean. EMNES is coordinated by the Euro-Mediterranean Economists Association (EMEA).

The research conducted by EMNES Researchers, Associates and Fellows aims to design sound and innovative socio-economic models that are inclusive, sustainable and employment creative, to devise new models for regional integration and to provide policy recommendations towards this goal.

**EMNES research agenda** is organized around the following mutually reinforcing and interconnected themes led by EMNES researchers, associates and fellows:

- Governance, institutions and institutional reforms;
- Macroeconomic policies and employment creation;
- Private sector, micro, small and medium –sized enterprises development, entrepreneurship and social business;
- Digital economy;
- Healthcare policy;
- Human capital development, education, innovation, skill mismatch and migration;
- Labor markets, employment and employability;
- Finance, financial inclusion and the real economy;
- Sustainable development;
- Regional integration;
- Euro-Mediterranean economic partnership;
- Scenarios analysis and foresight.

EMNES performs **research activities**, disseminated through series of internal and external publications (studies, working papers, policy papers, policy-graphics and books) and the organization of **annual conferences**, and **policy workshop meetings and online webinars** to bring together leading researchers, policy makers and representatives of the civil society to discuss and debate optimal policies for the future of the region.

EMNES research and outputs are underpinned on the **four fundamental principles: Independence, Scientific Excellence, Policy Relevance and Deep Knowledge of Euro-Mediterranean Affairs.**

EMNES acknowledges the financial assistance of the European Union within the context of the EU project “Support to economic research, studies and dialogue of the Euro-Mediterranean Partnership” under contract number ENPI/2014/354-488 (2014-2019).

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