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Does Digitalization Matter? Evidence from Egyptian and Jordanian Firms

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DOES DIGITALIZATION MATTER? EVIDENCE FROM EGYPTIAN AND JORDANIAN FIRMS[1]

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Abstract

Generally, digitalized firms are more productive, more likely to export, and more likely to rely skilled labor. This paper thus analyzes the effect of digitalization on firms' performance (measured by exports and sales) and labor characteristics (measured by female workers, unpaid workers, part-time workers and workers with permanent contract). To do so, I rely on a newly collected dataset that focuses on firms' digitalization. I use variables related to digitalization (whether the firm has a website or not, uses smartphones or not, online selling and buying, the Internet, is listed on an application and self-built sales website that enables online payments). The main findings show that the results are more robust for labor characteristics than for performance variables. Indeed, while, in Egypt, digitalization is associated to more women, less unpaid workers and more workers with permanent contract, the result is less robust for sales and exports. Yet, for sales, the use of the Internet is significant in both Egypt and Jordan. Listing the firm on an application is positively associated to sales in Egypt but not in Jordan. In terms of exports, self-built websites for payments in Egypt and using Internet in Jordan are significant.

Keywords: digitalization, firm, MENA region.
JEL Classifications: D80, O30, O33.

ملخص

بشكل عام، الشركات الرقمية هي شركات أكثر إنتاجية، ولديها فرصة أكبر للتصدير، وللاعتماد على العمالة الماهرة. وبالتالي، فإن هذه الورقة تحلل أثر الرقمنة على أداء الشركات (مقاسا بالصادرات والمبيعات) وخصائص العمل (مقاسا بالعاملات والعاملات غير المأجورات والعاملات بدوام جزئي والعاملات بعقود دائمة). للقيام بذلك، أعتمد على مجموعة بيانات تم جمعها حديثًا تركز على رقمنة الشركات. أستخدم المتغيرات المتعلقة بالرقمنة (سواء كانت الشركة لديها موقع اليكتروني أم لا، تستخدم الهواتف الذكية أم لا، تقوم بعمليات البيع والشراء عبر الإنترنت، الإنترنت، مدرج في موقع اليكتروني للتطبيقات والمبيعات ذاتيًا يتيح الدفع عبر الإنترنت). تظهر النتائج الرئيسية أن النتائج أكثر قوة بالنسبة لخصائص العمل منها بالنسبة لمتغيرات الأداء. في الواقع، في حين أن الرقمنة في مصر مرتبطة بمزيد من النساء، والعاملين بدون أجر أقل، والمزيد من العمال الذين لديهم عقود دائمة، فإن النتيجة أقل قوة بالنسبة للمبيعات والصادرات. ومع ذلك، بالنسبة للمبيعات، فإن استخدام الإنترنت مهم في كل من مصر والأردن. يرتبط إدراج الشركة في الطلب ارتباطًا إيجابيًا بالمبيعات في مصر ولكن ليس في الأردن. من حيث الصادرات، فإن المواقع الإلكترونية المبنية ذاتيًا للمدفوعات في مصر واستخدام الإنترنت في الأردن مهمة.

1. Introduction

Since the 2000s, the world has witnessed a significant digitalization and digital connectivity has received increasing interest from researchers, practitioners, and policymakers in developed and developing countries (Goldfarb et al., 2019). The increasing concern about the digital connectivity appears from several studies in the international literature that discuss the development impact of Information, Communication, and Technology (ICT) in developed and developing countries as fast, affordable and reliable digital connectivity is a must to induce growth, development and citizens' well-being. This contributes to the emergence and dissemination of innovations notably in trade, agriculture, transportation, and to the modernization of public administrations, including tax administration (Ndung'u, N. and Signé, L., 2020). This is why, for the Middle East and North Africa (MENA) region, digital connectivity is a developmental priority raising the prospects of growth, employment, poverty reduction and curbing corruption. Firms are also significantly affected by such developments. This paper examines, thus, the effects of digitalization on firms in the MENA region.

The empirical literature on the impact of digitalization on firms' performance, while abundant, is relatively scarce for the MENA region. For instance, Škare and Soriano (2021) argue that firms' agility is a function of county/industry level of digitalization and investments in intangible assets. Hagsten (2022), using a dynamic system of Generalized Method of Moments (GMM) estimations, shows a positive and significant association between the proportion of firms selling online and the proportion of broadband internet connected employees. In the same vein, DeStefano et al. (2018) find that ADSL broadband causally affects firm size (captured by either sales or employment) but not productivity after controlling for the endogeneity between these two variables. For Finland, Hautala-Kankaanpää (2022), using a structural equation modeling, shows that digital platforms positively affect supply chain capability and improve firm performance. In contrast, Brousseau (2003) shows that France was far behind other industrialized economies in terms of e-commerce adoption because of the implosion of the Internet financial bubble in 2000 and the fact that many Internet-based business models did not fit the French distribution channels, which affected its firms. Guo amd Xu (2021) suggest that the intensity of digital transformation is more positively associated (and a more lasting impact) to operating performance than financial performance. However, most Latin American firms fail to capitalize on the benefits of market digitalization, and their performance declines as a result (Sanchez-Riofrio et al., 2022).

Against this background, this paper analyzes the effect of digitalization on firms' performance (measured by exports and sales) and labor characteristics (measured by female workers, unpaid workers, part-time workers and workers with permanent contract). To do so, I rely on a newly collected dataset that focuses on firms' digitalization. I use variables related to digitalization (whether the firm has a website or not, uses smartphones or not, online selling and buying, the Internet, is listed on an application and self-built sales website that enables online payment). The main findings show that the results are more robust for labor characteristics than for performance

variables. Indeed, while, in Egypt, digitalization is associated to more women, less unpaid workers and more workers with permanent contract, the result is less robust for sales and exports. Yet, for sales, the use of the Internet is significant in both Egypt and Jordan. Listing the firm on an application is positively associated to sales in Egypt but not in Jordan. In terms of exports, self-built websites for payments in Egypt and using Internet in Jordan are significant.

The remainder of the two papers is organized as follows. Section 2 explains the theoretical framework. Section 3 provides an overview of digitalization in our countries of interest. Section 4 describes the data and presents some stylized facts. Section 5 is dedicated to the methodology and estimation strategy. Section 6 analyses the empirical results and section 7 concludes and provides some policy recommendations.

2. Theoretical Framework

In order to study the impact of digitalization on firms' performance, this paper relies on three main theoretical frameworks.

First, the Schumpeterian growth theory is important to analyze how digital technologies can affect firms. Indeed, innovations result from entrepreneurial investments that are motivated by the prospects of monopoly rents (Aghion, 2002). This will lead to the notion of creative destruction, which shows the process by which new innovations replace older technologies. In this context, only the most productive firms will bear the disruptions caused by technological innovations.

Second, the "General Purpose Technology (GPT) hypothesis" (Richard et al., 2005) refers to technologies that would act as an enabler for further innovations, by which they exhibit an influence on economic growth and productivity beyond the effect of regular capital goods. This means that several innovation types pertaining to digitalization can generate positive externalities for firms and make them more productive. However, this depends on the type of the firms as the literature distinguishes between firms that are intensive in, dependent on and enhanced by digitalization. Indeed, firms that are intensive in digital technologies operate in a sector that is highly dependent in innovation and technologies such as the ICT one. Thus, constant innovation is fundamental for such firms. Second, firms that are dependent on digital technologies need the latter in their production process even if they do not personally innovate. This applies to sectors such as electrical products. Finally, the third group encompasses firms that are enhanced by digital technologies. This group includes firms that use digital technologies as an auxiliary service, which improves their performance but they are neither intensive nor dependent on such technologies. This can apply to all other economic activities.

The third theoretical framework is the skill-biased technical change one. The latter is a shift in the production technology that favors skilled over unskilled labor since it will shift demand away from low-skilled activities and raise the relative demand and wages of the better skilled. This makes

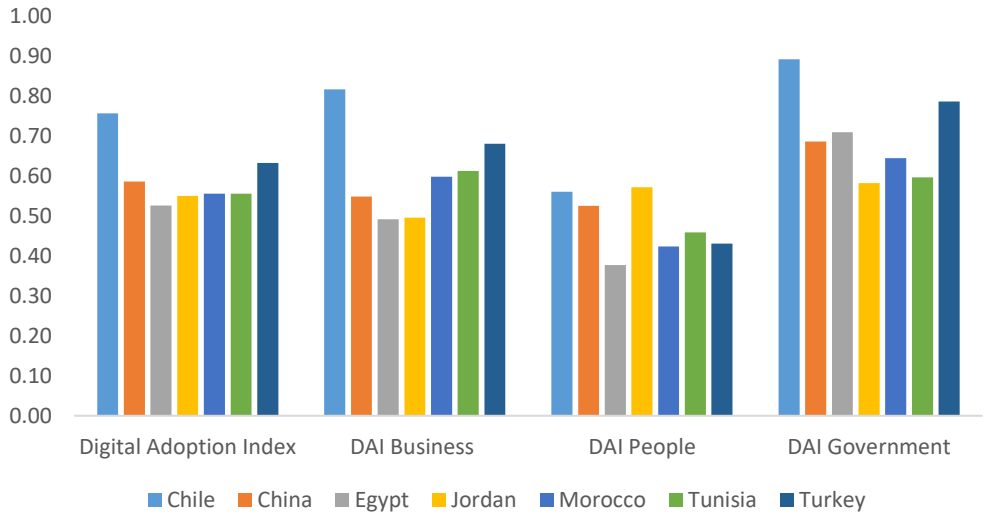
technology–skill rather complementary (Acemoglu, 2002 and Hornstein et al. 2005). Consequently, the quality of jobs offered by innovating (or digitalized) firms is likely to be higher, which makes them less likely to hire unpaid workers for instance. In addition, the literature shows that the use of digital platforms provides women with a greater access to markets, knowledge and more flexible working arrangements. This makes digitalized firms more likely to hire women.

Against this background, two hypothesis will be tested:
Hypothesis 1: Digitalized firms are more productive and are more likely to export and to increase their domestic sales.
Hypothesis 2: Digitalized firms demand more qualified workers and are women intensive.

3. Overview of Digitalization in Egypt and Jordan

Before presenting the main trends in the firm-level dataset, I first show the status of digitalization in the two countries and compare them to three main comparator emerging markets, which are Turkey, Chile, and China. Figure 1 shows the digital adoption index and confirms that Egypt has the lowest index compared to all the countries. Moreover, when our two countries of interest are compared, while Jordan has a higher index for business and people, Egypt has a higher one for government pointing out the digital transformation that the government witnessed in recent years through several initiatives and measures (see Zaki, 2023).

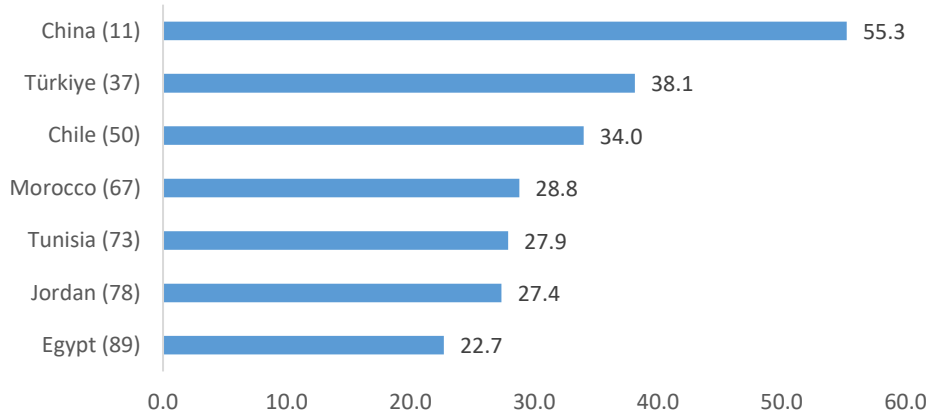
Figure 1. Digital Adoption Index



Source: Author's own elaboration using the DAI dataset.

Among the reasons that can explain such a pattern is innovation Figure 2 shows that our two countries of interest are performing worse than other comparator economies given that their global innovation index is lower than Morocco, Turkey, and China. Obviously, innovation and the adoption of digital technologies are highly correlated.

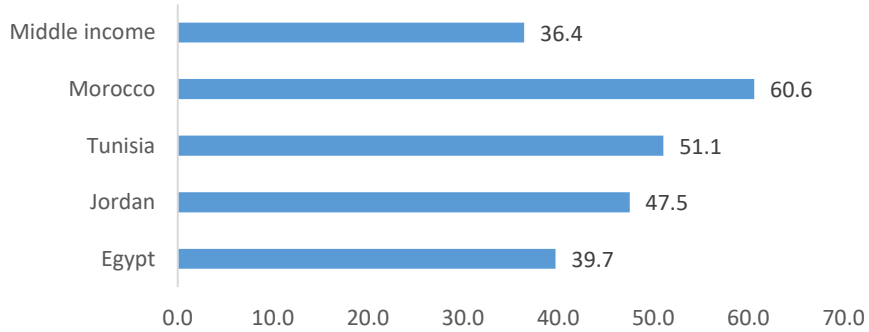
Figure 2. Global Innovation Index (2022)



Source: Author's own elaboration using the Global Innovation Index dataset.
Note: The overall GII score is the simple average of the Innovation Input and Output Sub-Index scores from the World Intellectual Property Organization.

This finding is confirmed by Figure 3 given that Egypt has the lowest share of individuals using the Internet to the total population (39.7%) while that of Jordan is higher (47.5%).

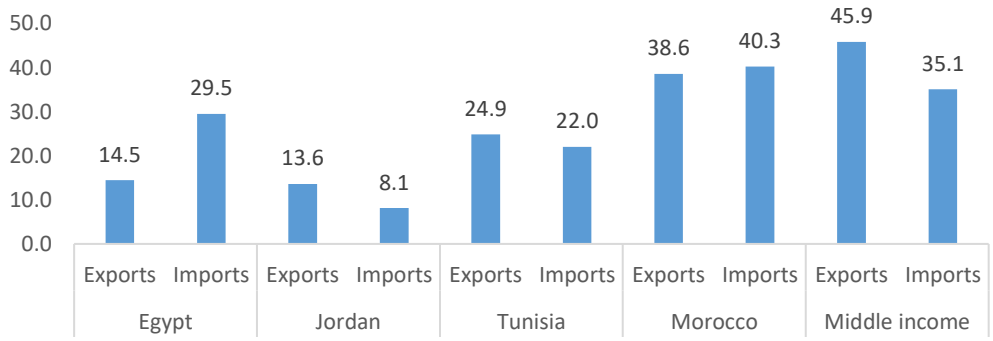
Figure 3. Individuals using the Internet (% of population)



Source: Author's own elaboration using the World Development Indicators Online dataset.

At the trade level, Egypt and Jordan has a significantly lower share of communication and computer exports in total exports (Figure 4), especially when compared to Morocco or to Middle Income countries (MIC). This shows how these two countries are still facing several challenges that hinder the competitiveness when it comes to information, technology, and communication exports.

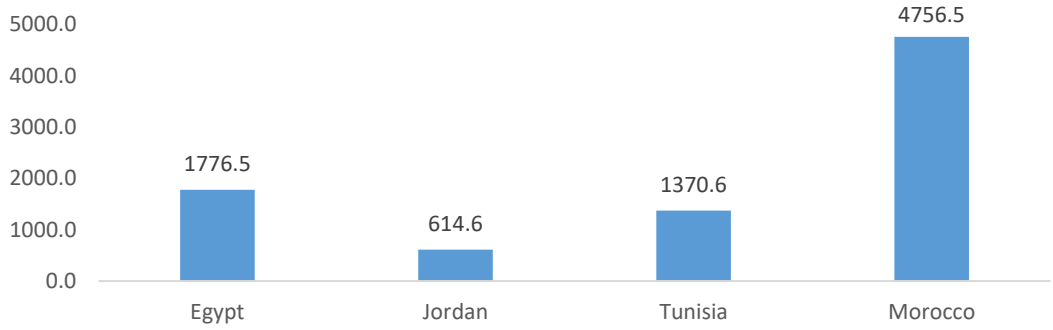
Figure 4. Communications, computer, etc. (% of)



Source: Author's own elaboration using the World Development Indicators Online dataset.

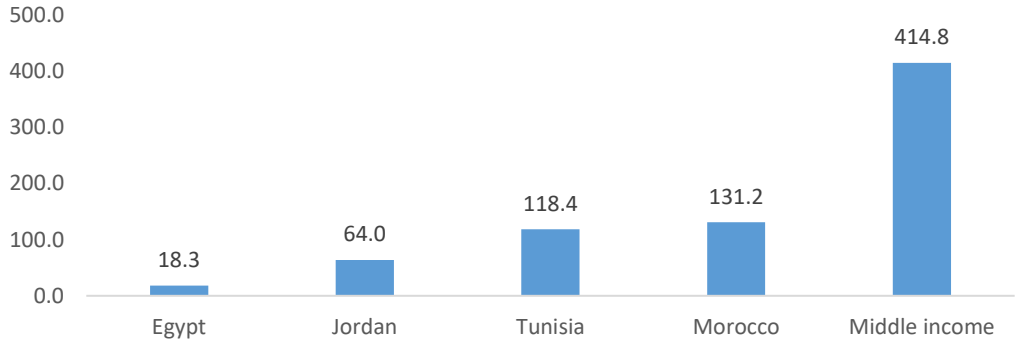
Access to secure Internet servers is also an important determinant of digitalization. Figures 5 and 6 show that Egypt has the lowest secure internet servers per million people compared to other diversified economies of the MENA region or to MICs.

Figure 5. Secure Internet servers



Source: Author's own elaboration using the World Development Indicators Online dataset.

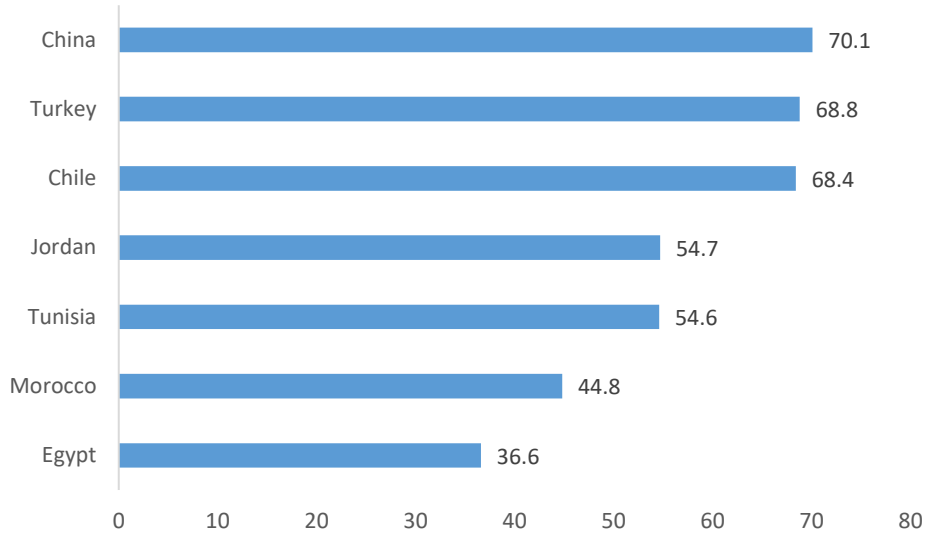
Figure 6. Secure Internet servers Per 1 million people



Source: Author's own elaboration using the World Development Indicators Online dataset.

As a result, the use of e-commerce in these countries is likely to be low compared to other similar economies. Indeed, Figure 7 shows the UNCTAD B2C e-commerce index that measures an economy's preparedness to support online shopping. While Egypt is the lowest among MENA countries, Jordan is performing better, but still worse than Turkey and China.

Figure 7. UNCTAD B2C E-commerce Index (2020)



Source: UNCTAD (2020).

After examining these macroeconomic characteristics, a firm-level analysis is conducted in order to analyze the characteristics of digitalization in the MENA region.

4. Data and Stylized Facts

This paper relies on a newly collected dataset by the Economic Research Forum (Cairo, Egypt) in the framework of the Open the Open Access Micro Data Initiative (OAMDI) for the Arab countries, Iran and Turkey. OAMDI offers researchers several types of micro data that ERF has collected, harmonized and made publicly available for researchers.

The questionnaire includes several modules as follows: basic information on the firm (sector of operation size, owner's gender and education, and types of owners). Second, it includes another module on digitalization (whether the firm has a website or not, uses smartphones or not, online selling and buying, the Internet, is listed on an application and self-built sales website that enables online payment). Third, it describes the characteristics labor used (women, digital skills, etc.). Finally, a module analyzes the main challenges faced by firms when it comes to digitalization such as electricity outage, days without Internet connection, and cost of digitalization). This survey has been done for three countries (Egypt, Jordan, and Morocco) over two waves for around 1000 observation per country.

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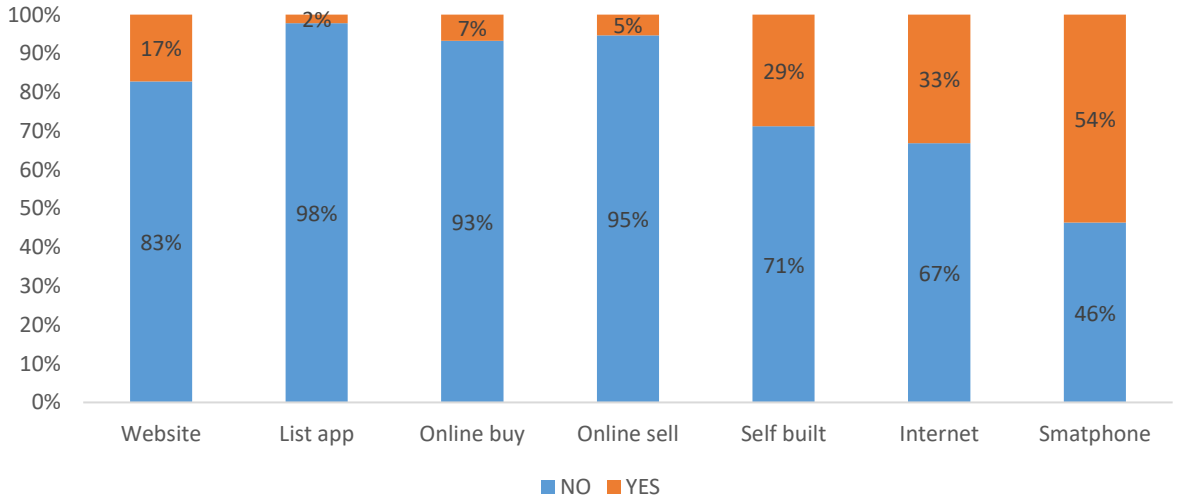
This survey has been done for three countries (Egypt, Jordan, and Morocco) over two waves for around 1000 observation per country. Three remarks are worth to be mentioned: all the statistics that are presented below have to be interpreted as associations without any causal relationships. Indeed, as it is a cross-section dataset without a panel dimension, it is not possible neither to focus on changes, nor to detect temporal variation in causal impact. Second, it is important to bear in mind also that these data have been collected in 2022 during the pandemic, which shows that some firms might have adopted such digitalization measures as a survival strategy. Finally, the respective weights have been used in different calculations.

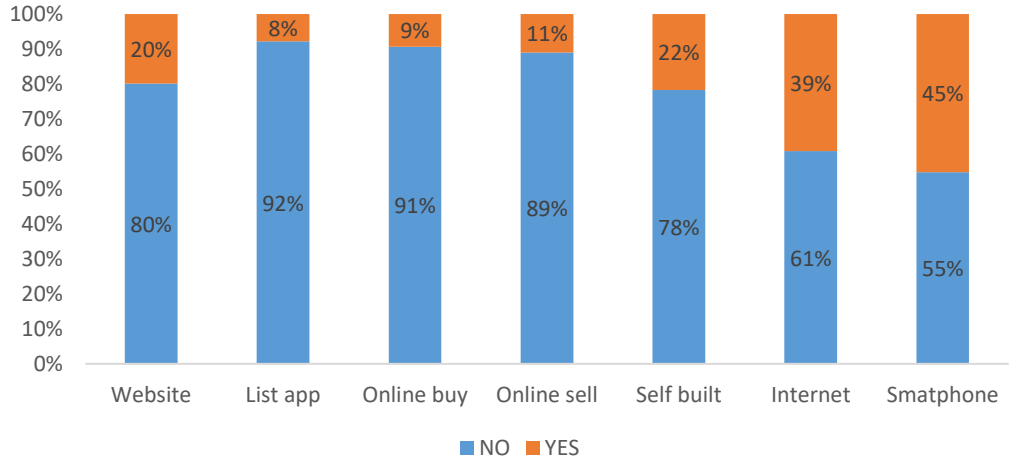
The characteristics observed at the macroeconomic level in the previous section are reflected on the microeconomic levels given that most of the firms do not adopt digital tools as it is shown in both Figures 8 and 9. Yet, Jordan is performing slightly better than Egypt in all measures except for the use of smartphones in business and the use of self-built websites for payments.

Figure 8. Share of firms adopting a digital tool in Egypt (%)



Source: Author's own elaboration using the Firm Digitalization dataset (2022).
Notes: Weights are used.

Figure 9. Share of firms adopting a digital tool in Egypt (%)



Source: Author's own elaboration using the Firm Digitalization dataset (2022).
Notes: Weights are used.

Obstacles faced by firms might explain why firms do not adopt any type of digital tool. Table 1 compares three obstacles: power outage measured the number of power outage in (last month) 2022, the number of days with no internet access (interruption) in last month and the number of days with no online services (interruption) in last month. Three remarks are worthy to note. First, overall, problems are less frequent in Jordan than in Egypt as the number of outage, the number of days without internet and without online services are lower.

Second, when firms adopting digital platforms are compared to those that do not adopt, the former face more obstacles than the latter, especially for power outages. Indeed, Table 1 shows that, in Egypt, while the number of power outages is almost 10 for firms that have a listed application, it is 2 for those who do not have one. The same analysis applies to having a website, using online sales, and using a smartphone. Yet, there are a few exceptions as, for instance, power outages are higher for firms that have a listed application or a website that who do not have one. In Jordan, power outages are also higher for firms that have a website, self-built website for payments and using Internet.

Third, when different tools are compared, it is important to note that more advanced tools are generally associated to more barriers (whether power outages or the number of days without internet or online services). This applies to firms that have a website, listed application, and self-built website.

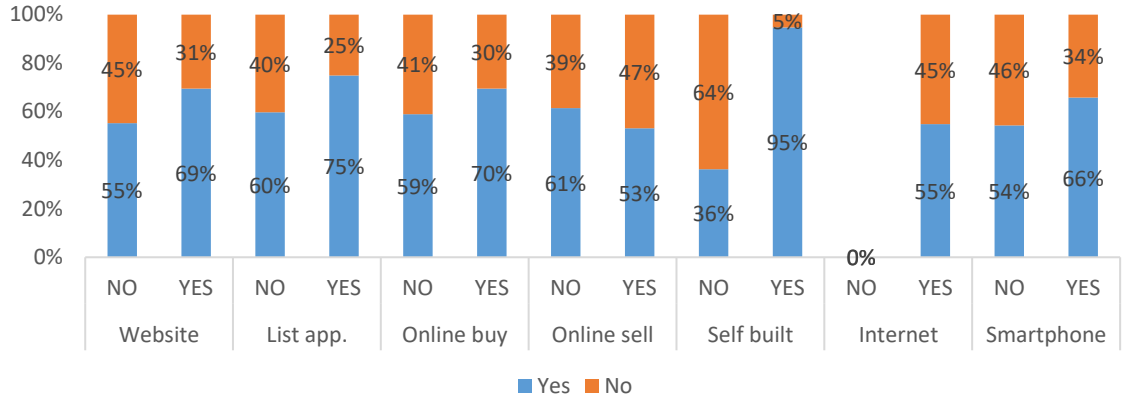
Table 1. Obstacles faced by firms

Egypt						
	Power outage		No. days w/o internet		No. days w/o online ser.	
	NO	YES	NO	YES	NO	YES
Website	2.14	3.81	0.54	1.12	7.91	6.52
List app.	2.24	9.87	0.93	0.32	7.85	1.21
Online buy	5.02	2.50	0.83	0.88	3.07	8.34
Online sell	2.20	3.62	1.60	0.41	10.87	4.80
Self-built	3.82	3.13	0.42	0.39	5.58	2.89
Internet		2.21		1.39		6.40
Smartphone	1.88	3.31	3.34	0.39	7.15	7.12
Jordan						
	Power outage		No. days w/o internet		No. days w/o online ser.	
	NO	YES	NO	YES	NO	YES
Website	0.48	0.64	0.70	0.71	0.24	0.38
List app.	0.57	0.53	0.63	0.95	0.34	0.21
Online buy	0.65	0.50	0.77	0.66	0.40	0.25
Online sell	0.61	0.54	0.62	0.74	0.28	0.33
Self-built	0.43	0.92	0.59	1.28	0.23	0.66
Internet	0.44	0.50	0.07	0.66	0.92	0.28
Smartphone	0.64	0.52	0.80	0.65	0.27	0.34

Source: Author's own elaboration using the Firm Digitalization dataset (2022).
Notes: (i) Weights are used. (ii) Power outage is measured the number of power outage in (last month) 2022. No. days w/o internet is measured by the number of days with no internet access (interruption) in last month. No. days w/o online ser. is measured by the number of days with no online services (interruption) in last month.

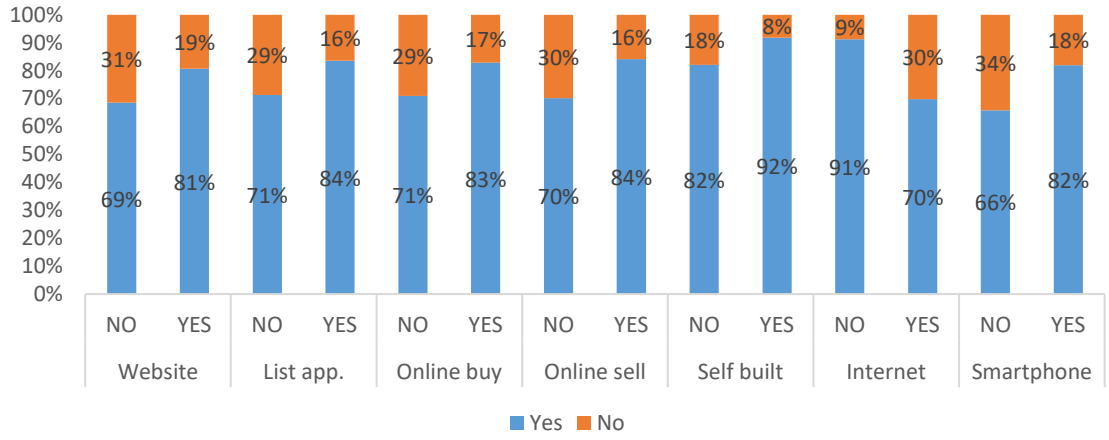
Another important dimension in firms that adopt any type of digital technologies pertain to the skills of their personnel. Figures 10a and b compares digital skills that required for managerial positions for firms that adopt any dimension of the aforementioned measures. For all these measures, the share of firms that require such skills is higher for those who adopt compared to those who do not, especially for self-build website. Moreover, the share of firms that respond positively is higher in Jordan than in Egypt.

Figure 10a. Digital skills and managerial positions in Egypt



Source: Author's own elaboration using the Firm Digitalization dataset (2022).
Notes: Weights are used.

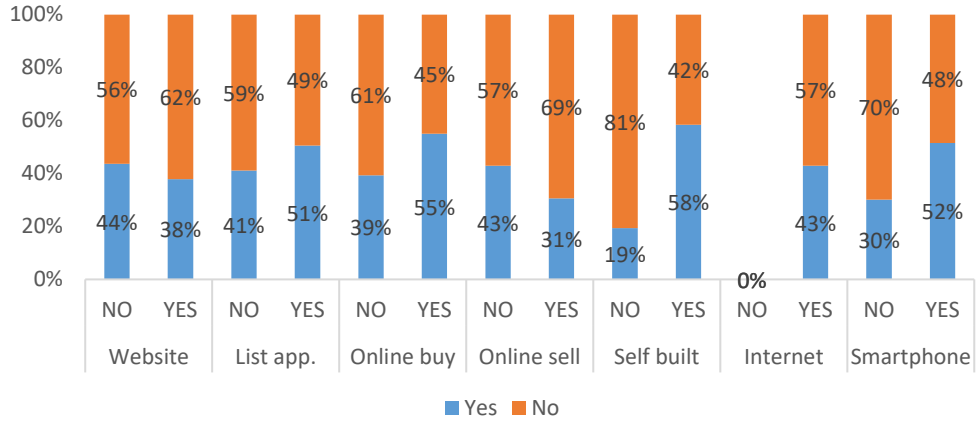
Figure 10b. Digital skills and managerial positions in Jordan



Source: Author's own elaboration using the Firm Digitalization dataset (2022).
Notes: Weights are used.

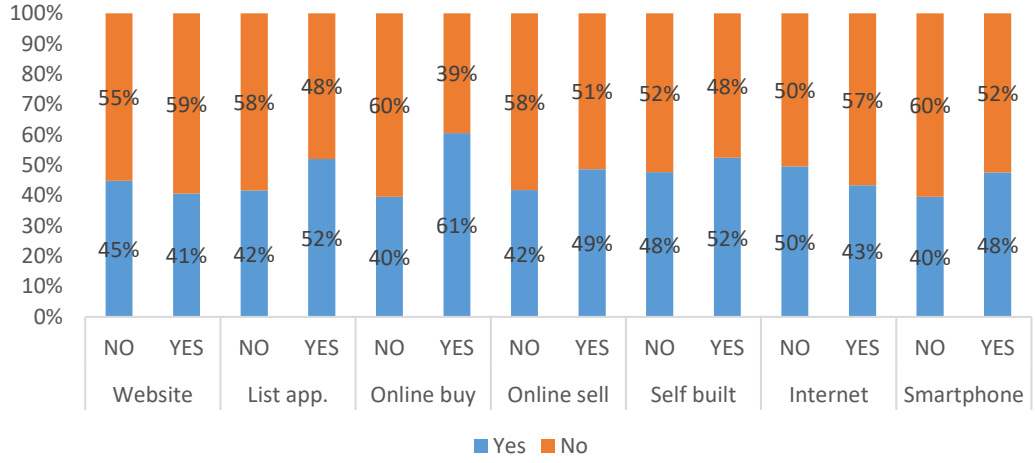
In the same vein, Figures 11a and b shows whether digital skills are required when workers are recruited. While the share of firms that require such skills is higher for firms who adopt any digital tool compared to those who do not adopt, it is lower when compared to the skills needed for managerial positions in both Egypt and Jordan. This is in line with Wrede et al. (2020) who show that top management is essential in firms' digital transformation as managers rely on three main actions: understanding digitalization, setting the formal context for digitalization, and leading change.

Figure 11a. Digital skills and recruited workers in Egypt



Source: Author's own elaboration using the Firm Digitalization dataset (2022).
Notes: Weights are used.

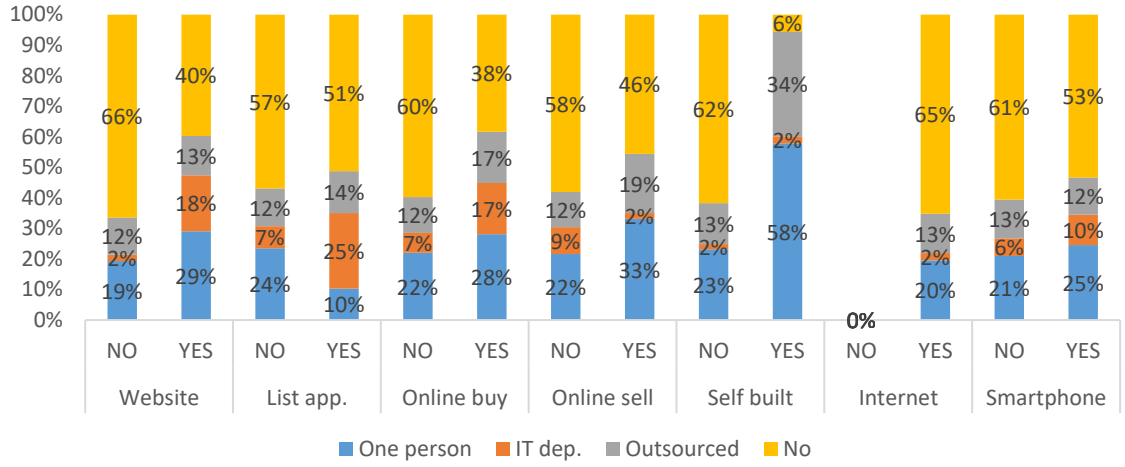
Figure 11b. Digital skills and recruited workers in Jordan



Source: Author's own elaboration using the Firm Digitalization dataset (2022).
Notes: Weights are used.

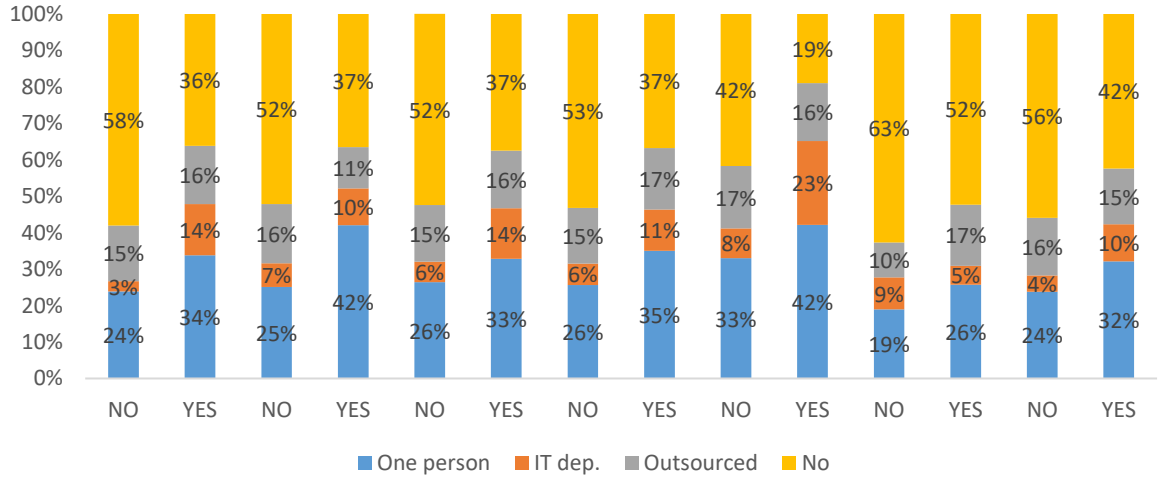
Finally, Figures 12a and b show whether these firms have an IT person, a team or they outsource this service. While firms that do not have any digital tool mostly do not have neither an IT person nor a team, the firms that have one either outsource or have just one person in both Egypt and Jordan. Outsourcing such tasks help firms avoid high costs related to staff and technology maintenance and increase the absorptive and innovative capacity of the firm (Moreno et al., 2020). Yet, it might be associated to various risks such as the lack of qualification among their providers' staff or the potential lack of compliance with contracts (Gonzalez et al., 2010).

Figure 12a. The availability of an IT Person or Team in Egypt



Source: Author's own elaboration using the Firm Digitalization dataset (2022).
Notes: Weights are used.

Figure 12b. The availability of an IT Person or Team in Egypt



Source: Author's own elaboration using the Firm Digitalization dataset (2022).
Notes: Weights are used.

In order to analyze how such digital tools affect firms' performance, I compare firms that adopt and use such tools to those that do not in both Egypt and Jordan. Table 2 shows the results of the t-statistics test that measures the whether the difference between the two groups is statistically significant or not. In terms of sales, online buying and selling, the use of internet and self-built website are associated to higher sales in Egypt. In contrast, there is no significant difference between the sales of firms that have a website, that are listed on an application, or that use smartphone. In Jordan, the results are different since the use of Internet and websites are statistically different between the two groups. When performance is measured by the exporting status of the firm, the use of the Internet is significantly different between exporters and non-

exporters in Jordan, while the use of smartphones is associated to a higher probability of exports. This shows that firms in both Egypt and Jordan are generally facing several impediments to exports, which explains the limited effect of digitalization on the likelihood of exporting.

Table 2. Sales, Exports, and Digitalization

	Egypt		Jordan	
	Ln(Sales)	Prob. Exp.	Ln(Sales)	Prob. Exp.
Website	-0.266	-0.107	-0.292*	-0.0715
	(-1.43)	(-1.63)	(-2.17)	(-0.70)
List app.	-0.561	0.0163	-0.292*	-0.0715
	(-1.60)	(0.13)	(-2.17)	(-0.70)
Online buy	-0.990***	-0.00406	-0.284	0.115
	(-4.53)	(-0.05)	(-1.42)	(0.77)
Online sell	-0.925*	-0.233	-0.211	0.0509
	(-2.22)	(-1.79)	(-1.34)	(0.43)
Self-built	-0.506*	0.0241	-0.198	-0.00106
	(-2.32)	(0.31)	(-1.36)	(-0.01)
Internet	-0.643**	-0.0705	0.100	0.191
	(-3.23)	(-0.96)	(0.27)	(0.83)
Smartphone	-0.462	0.157*	-0.548***	-0.384***
	(-1.96)	(2.00)	(-4.29)	(-3.74)

Source: Author's own elaboration using the Firm Digitalization dataset (2022).
Notes: t statistics in parentheses, * p<0.05, ** p<0.01, *** p<0.001.
(ii) These figures represent the difference between the average sales or exporting status of non-digitalized and digitalized firms. A negative value means that digitalized firms are performing better.

Table 3 compares the labor characteristics in the two countries by analyzing four variables: the share of females, the share of part-workers (as a proxy either instable jobs or outsourcing some tasks as it has been mentioned before), share of indefinite workers (as a proxy for jobs quality) and finally the share of unpaid workers (as a proxy of vulnerable jobs). Significant differences are observed between the two types of firms (those who adopt vs. those that do not adopt any digital tools) as, in Egypt, firms that adopt such tools are more likely to hire women (negative coefficient between those who do not adopt and those who adopt), less likely to recruit unpaid workers and more likely to have indefinite workers. The difference in having part-time workers is not statistically significant in two countries (with the exception of a few measures that are significant at 10% in Egypt and Jordan).

Table 3. Labor Characteristics and Digitalization

	Egypt				Jordan			
	Share Fem.	Share Part.	Share Indef.	Share Unpaid.	Share Fem.	Share Part.	Share Indef.	Share Unpaid.
	-0.111***	0.0530**	-0.0863***	0.116***	-0.0775***	0.0346	-0.0498*	0.0453***
Website	(-7.78)	(-3.3)	(-4.81)	(-8.64)	(-4.74)	(1.72)	(-2.21)	(3.37)
	-0.0329	0.00763	-0.0553	0.0796**	-0.0775***	0.0346	-0.0498*	0.0453***
List app.	(-1.19)	(0.25)	(-1.63)	(3.04)	(-4.74)	(1.72)	(-2.21)	(3.37)
	-0.109***	0.0162	-0.0666**	0.0514**	-0.0149	0.0520	-0.0132	0.0226
Online buy	(-6.41)	(0.85)	(-3.12)	(3.10)	(-0.62)	(1.79)	(-0.40)	(1.16)
	-0.0776*	-0.0669*	-0.0224	0.0627*	-0.0795***	0.0192	-0.0738**	0.0114
Online sell	(-2.28)	(-2.06)	(-0.57)	(2.26)	(-4.21)	(0.83)	(-2.84)	(0.73)
	-0.103***	0.0120	-0.0231	0.0549***	-0.0526**	0.0227	-0.0256	0.00352
Self-built	(-6.03)	(0.62)	(-1.07)	(3.31)	(-2.95)	(1.04)	(-1.05)	(0.24)
	-0.121***	0.0425*	-0.0972***	0.0912***	-0.0726*	0.0214	-0.00919	0.0444
Internet	(-6.99)	(2.08)	(-4.81)	(5.17)	(-2.06)	(0.49)	(-0.18)	(1.55)
	-0.0345	-0.00895	-0.0179	0.0146	-0.121***	0.0455*	-0.0721**	0.0581***
Smartphone	(-1.96)	(-0.51)	(-0.80)	(1.00)	(-7.58)	(2.16)	(-3.06)	(4.05)

Source: Author's own elaboration using the Firm Digitalization dataset (2022).
Notes: t statistics in parentheses, * p<0.05, ** p<0.01, *** p<0.001.
(ii) These figures represent the difference between the average value of different variables of non-digitalized and digitalized firms. A negative value means that digitalized firms are performing better.

After presenting this brief overview, the next section examines this relationship empirically in order to identify the determinants and the implications of digitalization.

5. Methodology

The paper examines the implications of digitalization by running the following regression:

$$Y_i=\beta_0+\beta_1 Size_i+\beta_2 Ln(Age_i)+\beta_3 Main\ City_i + \beta_4 Ln(sharefor) + \beta_5 Ln(sharegov) +\beta_6 Digit_i+\lambda_i+\epsilon_i$$

Where Y_i is measured by the value sales and exporting status as performance variables. As per labor characteristics, I rely on four measures that include measured by female workers, unpaid workers, part-time workers and workers with permanent contract. The main variable of interest $Digit_i$ is a vector of variables that measure digitalization and includes whether the firm has a website or not, uses smartphones or not, online selling and buying, the Internet, is listed on an application and self-built sales website that enables online payment.

The vector of control variables include: $Size_i$ is a categorical variable that takes the value of 1 if the firm is micro, 2 if small, 3 is medium and 4 if large. $Ln(Age_i)$ is the natural logarithm of the firm's age. $Main\ City_i$ s a dummy variable that takes the value of 1 if the firm is located in the main city and zero otherwise. *Ln(sharefor)* and *Ln(sharegov)* measure respectively the share of

foreign and government ownership in the firm. λ_i controls for sector fixed effects and ϵ_i is the error term.

To check the robustness of the results, a Propensity Score Matching (PSM) is used where I compare a treated group (firms adopting a digital tool) to a control group (firms who do not, but have similar characteristics). Hence, our treatment here will be the likelihood of adopting any type of the seven digital tools. More specifically, we first run a probit where the dependent variable takes the value of 1 if the firm adopts a digital tool and zero otherwise. We can hence obtain the propensity score measuring the predicted probability (p). We then match each participant to one or more nonparticipants on propensity score, using the "Nearest neighbour matching" (using age, firm size, education of the owner, share of government and foreign ownerships, the firm's location and the sector where it operates).[3] The choice of these variables pertains to how well the observed characters determine the likelihood of adopting a digital tool (Zaki, 2023).

The data used in this paper is based on the recently collected dataset by the Economic Research Forum (Cairo, Egypt). Two empirical remarks are worth to be mentioned. First, our estimates have to be interpreted as association rather than causations as there is a clear endogeneity between our dependent variable and independent ones. Second, all these regressions use the relevant weights.

6. Empirical Results

Tables 4 and 5 show the implications of digitalization on sales and exports in Egypt and Jordan. For sales, the use of the Internet is significant in both Egypt and Jordan. This confirms the findings of DeStefano et al. (2018) and Hagsten (2022) who show a positive and significant impact of the proportion of broadband internet on firms' performance. This effect remains robust for Jordan in both the OLS and PSM estimations (Table 5). Moreover, having a website or selling online boost exports in Jordan. In Egypt, listing the firm on an application is positively associated to sales. In terms of exports, self-built websites for payments are significant in Egypt, with the use of the Internet significant in the two countries. For other variables, the results are less robust when OLS is contrasted with PSM.

Two potential reasons can explain these findings: first, the limited effect on sales and exports can be due to the different challenges firms are facing at the legal, infrastructural, and institutional levels when it comes to digitalization. Second, at the empirical level, even if our results are run through a PSM estimation, they might still suffer an endogeneity given that the most productive firms are more likely to adopt or use different digital platforms. While, by design, PSM can only control for observed variables included in the probit model, it might not be able to control for endogeneity if it is due to unobserved omitted variables. This is still an area subject to further research in order to find the appropriate instrument.

[3] We use also other matching techniques (radius and Kernel matching) and the results remain robust.

More interestingly, Tables 6 and 7 present the effect of digitalization on labor characteristics. First, in Egypt, several digital tools (website, online buying, online selling, internet, and self-built website) are associated to a higher share of female workers in both OLS and PSM results. Indeed, the use of digital platforms provides women with a greater access to markets, knowledge and more flexible working arrangements. This is similar to the findings of Ughetto et al. (2020) who argue that new digital technologies provide an opportunity space in the creation new ventures for women. Similarly, in Turkey, Sohbetov (2018) argues that a unit increase in per credit card e-commerce transactions leads and in internet penetration to an increase in female employment rate by 0.13 units and by 0.33%, respectively.

As per the skills required, based on the skill bias technological change theory, adopting such digital measures should increase the demand for skilled workers that are should be formal, paid with indefinite contracts. This is verified in the results as the share of unpaid workers and part-time workers decreases with firms that adopt any digital measure. The share of indefinite workers is also higher for these firms. These results confirm those of Grande et al. (2020) who, using data from the Third European Company Survey, find a positive association between indices of innovation and job quality. In the same vein, Bolli and Pusterla (2022) show a positive association between digitalization and job satisfaction due to the increase in productivity and work that is more interesting.

Table 4. Implications of Digitalization – Sales and Exports – OLS

	Egypt		Jordan	
	Ln(Sales)	Prob. Exp.	Ln(Sales)	Prob. Exp.
Website	-0.644***	0.103	0.0901	0.00883
	(0.238)	(0.0951)	(0.155)	(0.121)
List app.	1.319**	-0.274	0.151	-0.131
	(0.604)	(0.242)	(0.226)	(0.176)
Online buy	0.0298	0.0968	-0.00402	-0.122
	(0.329)	(0.131)	(0.202)	(0.157)
Online sell	-0.744**	0.0297	0.0665	-0.0631
	(0.355)	(0.142)	(0.188)	(0.146)
Self-built	0.485	0.799***	-0.354	-0.189
	(0.383)	(0.235)	(0.389)	(0.244)
Internet	0.389*	0.356***	0.361**	0.304**
	(0.204)	(0.0838)	(0.144)	(0.121)
Smartphone	-0.235	-0.0244	0.413**	0.0806
	(0.234)	(0.0923)	(0.175)	(0.121)

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 5. Implications of Digitalization – Sales and Exports – PSM

	Egypt		Jordan	
	Ln(Sales)	Prob. Exp.	Ln(Sales)	Prob. Exp.
Website	-0.327	0.0598	0.624***	0.163
	(0.251)	(0.0767)	(0.232)	(0.153)
List app.	0.198	0.0744	0.582	-0.0980
	(0.397)	(0.222)	(0.379)	(0.206)
Online buy	1.191***	-0.0196	0.379	-0.357**
	(0.394)	(0.0787)	(0.258)	(0.154)
Online sell	0.00432	-0.0130	0.414**	0.0266
	(0.258)	(0.0718)	(0.211)	(0.149)
Self-built	1.343**	0.0573	-0.280	-0.377
	(0.576)	(0.144)	(0.321)	(0.281)
Internet	0.235	0.0578	0.618***	0.503***
	(0.287)	(0.101)	(0.176)	(0.161)
Smartphone	0.489*	-0.190**	0.478**	0.0435
	(0.273)	(0.0909)	(0.207)	(0.133)

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 6. Implications of Digitalization – Labor Characteristics – OLS

	Egypt				Jordan			
	Share Fem.	Share Part.	Share Indef.	Share Unpaid.	Share Fem.	Share Part.	Share Indef.	Share Unpaid.
Website	0.0886***	-0.0645***	0.0779***	-0.0342**	0.0567***	0.0134	-0.0159	0.00109
	(0.0196)	(0.0243)	(0.0224)	(0.0154)	(0.0199)	(0.0236)	(0.0259)	(0.0153)
List app.	-0.0420	-0.0751	0.180***	-0.00616	-0.0247	-0.0215	-0.00915	0.0135
	(0.0496)	(0.0608)	(0.0559)	(0.0386)	(0.0284)	(0.0334)	(0.0367)	(0.0217)
Online buy	0.0703***	-0.0110	0.0449	-0.0285	0.0670***	-0.00471	0.0439	0.0247
	(0.0268)	(0.0330)	(0.0305)	(0.0209)	(0.0254)	(0.0300)	(0.0329)	(0.0195)
Online sell	0.0438	0.00429	-0.0248	-0.0380*	0.0275	-0.00532	-0.000465	0.0267
	(0.0292)	(0.0359)	(0.0332)	(0.0227)	(0.0240)	(0.0282)	(0.0311)	(0.0183)
Self-built	0.238***	0.104	0.0865	-0.00698	0.0565	0.0108	-0.00997	-0.0153
	(0.0591)	(0.0655)	(0.0555)	(0.0261)	(0.0372)	(0.0441)	(0.0529)	(0.0290)
Internet	0.0711***	-0.0679***	0.0767***	0.00383	0.0858***	0.00232	0.0158	-0.00875
	(0.0178)	(0.0238)	(0.0190)	(0.0156)	(0.0197)	(0.0246)	(0.0270)	(0.0165)
Smartphone	0.0261	0.0196	0.0170	-0.0361***	-0.0153	0.0135	-0.00540	0.0379***
	(0.0202)	(0.0192)	(0.0229)	(0.0110)	(0.0206)	(0.0226)	(0.0259)	(0.0133)

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 7. Implications of Digitalization – Labor Characteristics – PSM

	Egypt				Jordan			
	Share Fem.	Share Part.	Share Indef.	Share Unpaid.	Share Fem.	Share Part.	Share Indef.	Share Unpaid.
	0.148***	-0.0551**	0.0688**	-0.0601***	0.0524*	0.0115	-0.0199	-0.000781
Website	(0.0233)	(0.0251)	(0.0284)	(0.0159)	(0.0279)	(0.0287)	(0.0300)	(0.0232)
	0.0190	0.0257	0.0582	-0.0176	-0.0156	-0.00965	-0.0188	0.0262
List app.	(0.0338)	(0.0455)	(0.0515)	(0.0360)	(0.0296)	(0.0480)	(0.0434)	(0.0295)
	0.123***	-0.0416*	0.0508*	-0.0459***	0.0713**	0.0106	0.0441	0.0215
Online buy	(0.0222)	(0.0217)	(0.0307)	(0.0176)	(0.0297)	(0.0359)	(0.0329)	(0.0239)
	0.0639**	-0.0254	0.00135	-0.0426**	0.0242	0.0137	0.0143	0.0270
Online sell	(0.0249)	(0.0215)	(0.0263)	(0.0170)	(0.0203)	(0.0285)	(0.0317)	(0.0199)
	0.101***	0.0891**	0.0204	-0.0453*	0.0222	-0.0110	0.0813	-0.0359
Self-built	(0.0370)	(0.0419)	(0.0430)	(0.0275)	(0.0380)	(0.0520)	(0.0557)	(0.0347)
	0.115***	-0.0744***	0.0721***	-0.0328	0.0873***	0.00877	-0.00888	-0.0137
Internet	(0.0220)	(0.0275)	(0.0272)	(0.0241)	(0.0256)	(0.0281)	(0.0285)	(0.0200)
	0.0295	0.0132	0.0307	-0.0223	-0.0111	0.00162	0.0365	0.0133
Smartphone	(0.0203)	(0.0219)	(0.0253)	(0.0140)	(0.0209)	(0.0242)	(0.0290)	(0.0140)

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

7. Conclusion and Policy Implications

This paper analyzes the effect of digitalization on firms' performance (measured by exports and sales) and labor characteristics (measured by female workers, unpaid workers, part-time workers and workers with permanent contract). To do so, I rely on a newly collected dataset that focuses on firms' digitalization. I use variables related to digitalization (whether the firm has a website or not, uses smartphones or not, online selling and buying, the Internet, is listed on an application and self-built sales website that enables online payments) and performance (sales and exports). The main findings show that the results are more robust for labor characteristics than for performance variables. Indeed, while, in Egypt, digitalization is associated to more women, less unpaid workers and more workers with permanent contract, the result is less robust for sales and exports. Yet, for sales, the use of the Internet is significant in both Egypt and Jordan. Listing the firm on an application is positively associated to sales in Egypt but not in Jordan. In terms of exports, self-built websites for payments in Egypt and using Internet in Jordan are significant.

From a policy perspective, this paper highlights some of the main relationships between firms' performance and digitalization. The hypothesis is that firms adopting more digitalized platforms, would develop more. If not, they tend to be small and in the periphery. Thus, unequal access to opportunities plays a large role in explaining under-performance and the limited effect of digital tools on sales and exports. Ramzy and Zaki (2021) point out that there is a dire need to improve digital infrastructure—including coverage and outreach— as it is a prerequisite to boost e-commerce and for successful integration of African and MENA countries into global trade in the

digital era. Many areas in these countries (especially rural areas) still lack broadband connectivity. If such reforms are taken into account, digital technologies can have the potential to help "democratize entrepreneurship" as they help small and medium firms to have a wider access to international markets and knowledge diffusion.

One of the findings of the paper shows also to what extent digitalization is associated to an increase in female workers and a decrease in unpaid jobs. Therefore, digitalization can be perceived as a tool that increase women labor force participation and improve working conditions. From a development perspective, this should help MENA countries implement Sustainable Development Goals (SDGs). For instance, digitalization can help achieve Goal 9 on industry and innovation, Goal 8 on decent employment as it is associated to lower the share of unpaid workers in more digitalized firms, and Goal 5 on gender equality as it increases the share of female workers.

Finally, it is important to note that MENA countries may be reluctant to adopt new technologies that threaten the jobs of low-skilled workers. It is important for governments to invest in education programmes and initiate reskilling programmes that can ensure complementarity between labour skills and technologies (Ndung'u and Signé, 2020). Digitalization and training policies have a two-way relationship: while such policies can enhance skills development for digitalization, digitalization increases the viability of these policies via the availability of online courses.

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