

Which Firms Are More Digitized? A Comparative Study between Egypt and Jordan

Chahir Zaki

WHICH FIRMS ARE MORE DIGITIZED? A COMPARATIVE STUDY BETWEEN EGYPT AND JORDAN¹

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Working Paper No. 1635

April 2023

The author is grateful to Magued Osman for his constructive feedback and comments.

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¹This paper has benefited from a generous financial support from the Economic Research Forum through the Carnegie Program under the theme “Transregional Research on Private Sector Development, Digitalization, and Disruptive Technologies”.

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First published in 2023 by
The Economic Research Forum (ERF)
21 Al-Sad Al-Aaly Street
Dokki, Giza
Egypt
www.erf.org.eg

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Abstract

Digitalization refers to the transition from an industrial age characterized by traditional technologies to a new era in which commerce, innovation, and other dimensions are driven by digital technologies. The objective of this paper is twofold: first to examine the characteristics of the firms who adopt digital technologies by focusing on two emerging markets, which are Egypt and Jordan. Second, this paper analyzes the potential explanations behind the under-performance of these two countries compared to other emerging economies. The main findings show that firms having an owner whose education level is university and above and who is a woman are more likely to be digitized, especially in Egypt. Moreover, firms that spend on R& D and operating in the services sector adopt and use different digital platforms. Small and medium firms are generally facing several impediments and are not as digitized as large ones. Numerous bottlenecks hinder digitalization in these countries namely the legal and human infrastructure as well as the general quality of institutions including service restrictions.

Keywords: digitalization, firm, MENA region.

JEL Classifications: D80, O30, O33.

ملخص

تشير الرقمنة إلى الانتقال من عصر صناعي يتميز بالتكنولوجيات التقليدية إلى عصر جديد تكون فيه التجارة والابتكار والأبعاد الأخرى مدفوعة بالتكنولوجيات الرقمية. الهدف من هذه الورقة ذو شقين: أولاً دراسة خصائص الشركات التي تعتمد التكنولوجيات الرقمية من خلال التركيز على سوقين ناشئين، هما مصر والأردن. ثانياً، تحليل هذه الورقة التفسيرات المحتملة وراء ضعف أداء هذين البلدين مقارنة بالاقتصادات الناشئة الأخرى. تظهر النتائج الرئيسية أن الشركات التي يكون مستوى تعليم مالكيها على درجة جامعية وما فوق (وخاصة إذا كانت امرأة) فمن المرجح أن يتم رقمتها، خاصة في مصر. علاوة على ذلك، فإن الشركات التي تنفق على البحث والتطوير وتعمل في قطاع الخدمات تعتمد وتستخدم منصات رقمية مختلفة. تواجه الشركات الصغيرة والمتوسطة عموماً عدة عوائق ولكنها لا تمتلك التكنولوجيا الرقمية مثل الشركات الكبيرة. وتعوق العديد من الاختناقات رقمنة الهياكل الأساسية القانونية والبشرية في هذه البلدان، فضلاً عن الجودة العامة للمؤسسات، بما في ذلك القيود المفروضة على الخدمات.

1. Introduction

Digitalization refers to the transition from an industrial age characterized by analogue technologies to a new era in which commerce, innovation, knowledge acquisition, communication and many other aspects of modern life are driven by digital technologies (Acemoglu, and Restrepo, 2019 and Ramzy and Zaki, 2021). The introduction of digital technologies is considered disruptive to business in the sense that new technologies are rapidly reshaping business models and introducing different ways for businesses to connect with their customers and to deliver their products and services. This becomes even more important in the post pandemic era where firms have to make use of e-commerce, social media platforms, and websites in order to expand (Škare and Sorinao, 2021).

While the literature on the determinants of digitalization is rich, that on the Middle East and North Africa (MENA) region is rather scant at both the macroeconomic and the microeconomic levels. First, the macroeconomic studies show that the quality of institutions, infrastructure, and the quality of human capital are key determinants of digitalization. For instance, Myovella et al. (2021), using a spatial Durbin model for 41 geographically connected SSA countries, find that GDP per capita, gross capital formation, political stability, regulatory efficacy and electricity infrastructure are important for digitalization. At the microeconomic level, Arora and Rathi (2019), using a logistic regression and chi-square test, show that diversification, profitability, level of competition, managerial factors, and technology are important determinants for the adoption of digitalization in India. Yet, the size of the firm and government initiatives are not statistically significant factors. In the same vein, using the World Bank Enterprise Survey for Nigeria with a Propensity Score Matching (PSM) method, Olurinola et al. (2021) find that size of the firm, educational attainment of the top manager of the firm, business age, employment, and sector of operation are key determinants of digitalization. Moreover, Gutiérrez, and Gamboa (2010) examine the determinants of information and communications technology (ICT) usage among low-income people in Colombia, Mexico, and Peru. They find that the most important factor affecting the digitalization of low-income people in all three countries was lack of education.

The cases of Egypt and Jordan are of particular interest as they are in dire need to increase exports and boost small and medium firms that are still excluded from the digital transformation process. In fact, several reforms are needed to let firms in these two countries benefit from digital transformation, which can transform the lives and livelihoods of their populations. Thus, the objective of this paper is twofold: first to examine the characteristics of the firms who adopt digital technologies by focusing on two emerging markets, which are Egypt and Jordan. Second, this paper analyzes the potential explanations behind the under-performance of these two countries compared to other emerging economies. The main findings show firms having an owner whose education level is university and above and who is a woman (especially in Egypt) are more likely to be digitized. Moreover, firms that spend on R& D and operating in the services sector adopt and use different digital platforms. Small and medium firms are generally facing several impediments

and are not as digitized as large ones. Digitalization in these countries is hindered by the legal and human infrastructure as well as the general quality of institutions including service restrictions.

The remainder of the two papers is organized as follows. Section 2 maps the most important laws, measures and policies that have been implemented in Egypt and Jordan. Section 3 describes the data. Section 4 presents the main trends of digitalization in the two countries using the newly collected dataset. Section 5 explains the methodology used to examine the determinants of firms' digitalization and section 6 presents the empirical results. Section 7 analyzes the potential reasons behind these trends. Section 8 concludes and provides some policy recommendation.

2. Overview of Digital Measures and Policies

The objective of this section is to provide a mapping of different measures and policies that have been implemented in Egypt and Jordan. In addition, the legal framework has also been adapted in order to cope with these developments.

In Egypt, the following measures have been implemented:

Visions and Plans:

- “Digital Egypt” is a comprehensive plan that lays the foundations for the transformation of Egypt into a digital society at all levels, especially the digital infrastructure and the regulatory and legislative framework.
- “2030 Strategy”: that focuses on several objectives such developing the information, communication, and technology (ICT) infrastructure; fostering digital inclusion; achieving the transition to a knowledge-based economy; building capacities and encouraging innovation; and ensuring cybersecurity.
- The government has developed national payment systems and supervised frameworks to reduce the risks and create safe, efficient, and effective systems to further advance digital payments.

Tools and Portals:

- “Nafeza”: a new portal to facilitate and expedite the review and release of foreign shipments at a port of entry. The initiative is implemented by the Egyptian Customs Authority to modernize and automate customs administration in line with the “Trade Facilitation Agreement” that was ratified in 2018.
- “Fawry”: the main provider of e-payments and digital finance solutions that provides accessible and reliable tool for both banked and unbanked users across the nation.
- “Meeza”: prepaid cards that have been issued by Egyptian banks (around seven million as of 2021). This represents the first national e-payment card to make governmental payments or carry out any other local financial transactions.
- Network operators (Orange, WE, Vodafone and Etisalat) are now using e-wallets.

Yet, despite these measures, there several challenges that limit the effectiveness of such measures, as it will be shown in section 7.

Legal framework:

- Cybercrime law (law No. 175 of 2018 called Anti-Cyber and Information Technology Crimes Law and its executive regulation) related to the crimes of hacking and attacking the Internet networks belonging to the state or public legal persons.
- E-commerce law: to implement an e-commerce company in Egypt that will promote its products through websites or mobile applications, the firm has to abide by several laws. The latter include Companies Law No.159 of 1981, Investment Law No.72 of 2017, and Decree No.26 of the year 2020 regarding the issuance of the licensing regulation promulgated by the Supreme Council for Media Regulation (SCMR) and the National Telecommunications Regulatory Authority (NTRA).
- E-signature law: its law was issued in 2004 and established the Information Technology Industry Development Agency (ITIDA) that regulates “e-signature” to support Egypt’s e-commerce.
- Intellectual property law: it is regulated by the Decree no. 497 of 2005 related to the protection of intellectual property rights, Law no. 120 of 2008 establishing the Economic Courts that reviews economic matters including those involving intellectual property. At the international level, Egypt is a signatory to the Paris Convention of the Protection of Intellectual Property and the Madrid Agreement regarding international registration of trademarks. Furthermore, Egypt is a member of the World Intellectual Property Organization.
- The Personal Data Protection Law: was issued and is in line with international laws and the European Union's General Data Protection Regulation (GDPR).

In Jordan, we list some of the plans and tools that have been recently implemented:

Visions and Plans:

- REACH 2025: is the digital transformation vision of Jordan launched in 2016 that aims at adopting digital solutions and building a digital society. This vision consists of seven dimensions including smart specialization and demand-driven innovation, public sector innovation, tech start-ups and entrepreneurs, ICT skills, capacity and talent, enabling business environment, smart digital economy infrastructure, and governance (Adaileh, Mohammad and Alshawawreh, 2021).
- e-Government (SMART) program: this program was conceived as part of the sustainable development plan of the Kingdom of Jordan. It aims at improving government service delivery, increasing the efficiency of public sector, and providing the required infrastructure.

Tools and Portals:

- National Broadband Network Program: this program aims at establishing the National Fiber Optic Network (NFON) to improve the connectivity in Jordan. 4570 kilometers of NFON have been extended and installed to connect different sites to improve the development of the Jordanian educational system, increase in the use of Information Technology and communication for educational purposes in universities, schools, community colleges, and educational centers throughout the Kingdom.
- Single Window Solution: this measure allows trade stakeholders to trade electronically, submitting and distributing documents including customs declarations, import/export permit applications, trading invoices and certificates of origin to accelerate and secure the supply chain. Jordan Customs and the Aqaba Special Economic Zone Customs (ASEZC) began the customs modernization program in 1997 with the implementation of ASYCUDA++ that became fully operational in 1999 and led to quicker customs clearance and release procedures. These reforms have been pursued in 2006 with the implementation of several single window locations endowed with X-ray cargo inspection systems, upgrade from ASYCUDA++ to ASYCUDAWorld, training and capacity building programs for customs officers and improvement of communications between Jordan Customs and the business community through the customs service centres. It is important to mention that ASYCUDAWorld was designed to operate through GSM networks that are already heavily present in Arab countries. In fact, being web-based, the ASYCUDAWorld system allows Customs Administrations and traders to handle most of their transactions via Internet.

Legal framework:

- Cybercrime law: Cybercrime Law No. 27 was adopted in June 2015, replacing the Law of Information System Crimes. This law criminalizes unlawful access to websites or information systems.
- E-commerce law: No. 15 of 2015 concerning Electronic Transactions that aims at boosting e-commerce. This law grants electronic records the same legal value as original documents made in writing. Yet, the Electronic Payment and Transfer of Money Regulation No. 111 of 2017 is subject to several restrictions and requirements that complicate the use of such tools.
- E-signature law: in 2015, Jordan has enacted the Electronic Transactions Law No. 15 of 2015 that regulates the use of electronic signatures.
- Intellectual property laws: Jordan has an old law related to Copyright law that was issued in 1992. At the international level, Jordan is a signatory to the Patent Cooperation Treaty and the Madrid Protocol, and World Intellectual Property Organization treaties on both copyrights and on performances and phonographs. This is why it had to amend and update several laws to comply with these agreements.
- Personal data protection: as of 2023, personal data protection is not regulated in Jordan under a specific law.

Briefly, even though both Egypt and Jordan have promulgated several laws from a *de jure* perspective, there are still several progressive reforms needed when it comes to the enforcement, the impartiality, the effectiveness and the transparency (*de facto*) of such laws are still questionable. In addition, such law have to be inclusive of different online platforms and sectors (Saqqaf et al., 2023)

3. Data

This paper relies on a newly collected dataset by the Economic Research Forum (ERF - 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. In what follows, the paper examines the characteristics of firms that are more digitized than other at three levels: characteristics of the owner, of the firm and the sector where the firm operates.

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. Yet, in order to explain the reasons behind the main trends of the data, we rely on several macroeconomic indicators that analyze the quality of institutions, infrastructure, and education in these countries. 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 all the measures.

4. Which Firms Are More Digitized?

4.1. Owners' Characteristics

At the individual level, the education level of the owner matters for digitalization. As it is shown in Table 1, for both Egypt and Jordan, those who have an education level above university are more likely to use a website, to list the firm on an application, to use online buying and selling, to

use safe-built website, the Internet, and smartphones. Yet, three important remarks are worthy to note. First, in all these dimensions, owners who have studied at universities or above are performing better in Jordan than Egypt except in self-built sites and the use of smartphones. Second, in both of the two countries, the average share of those who adopt any digital measure does not exceed 20% in the two countries (without taking into account the use of Internet and smartphones that are widely use given their accessibility). Third, the lowest share in the two countries are those of using applications, online buy and sell, and the use of self-built sites.

Table 1. Digitalization Measures and Owner’s Education

		Egypt		Jordan		
		Below	Above	Below	Above	
Website	NO	83%	77%	NO	88%	72%
	YES	17%	23%	YES	12%	28%
List App.	NO	98%	100%	NO	95%	89%
	YES	2%	0%	YES	5%	11%
Online Buy	NO	93%	92%	NO	95%	86%
	YES	7%	8%	YES	5%	14%
Online Sell	NO	95%	92%	NO	93%	85%
	YES	5%	8%	YES	7%	15%
Self-built	NO	81%	60%	NO	86%	75%
	YES	19%	40%	YES	14%	25%
Internet	NO	75%	51%	NO	76%	43%
	YES	25%	49%	YES	24%	57%
Smartphone	NO	50%	44%	NO	58%	53%
	YES	50%	56%	YES	42%	47%

Source: Author’s own elaboration using the Firm Digitalization dataset (2022)

Notes: Weights are used.

When gender is taken into consideration, Table 2 shows that women are slightly more likely to adopt digital measures than men in some of the dimensions for both Egypt and Jordan. For instance, while 70% of firms owned by women use the Internet in Egypt, only 31% of those owned by men do. This holds for more accessible digital tools such as online buy and sell where women are slightly better performing than men are. Yet, in more advanced tools such as listing the firm on an application or using a self-built website for payments, firms owned by men are more likely to become more digitalized. This confirms the digital divide that is observed in most of developing countries where women often have less access to technology compared and men, which affects earning (additional) income, increase employment opportunities, and access knowledge and education (Glodfarb and Tucker, 2019 and Gal et al., 2019).

Table 2. Digitalization Measures and Owner's Gender

		Egypt		Jordan		
		Male	Female	Male	Female	
Website	NO	83%	77%	NO	80%	78%
	YES	17%	23%	YES	20%	23%
List App.	NO	98%	100%	NO	92%	93%
	YES	2%	0%	YES	8%	7%
Online Buy	NO	93%	92%	NO	91%	89%
	YES	7%	8%	YES	9%	11%
Online Sell	NO	95%	92%	NO	89%	88%
	YES	5%	8%	YES	11%	12%
Self-built	NO	70%	86%	NO	78%	84%
	YES	30%	14%	YES	22%	16%
Internet	NO	69%	30%	NO	61%	59%
	YES	31%	70%	YES	39%	41%
Smartphone	NO	46%	46%	NO	54%	60%
	YES	54%	54%	YES	46%	40%

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

Notes: Weights are used.

4.2. Firms' Characteristics

When firms' characteristics are taken into account, Table 3 shows that the larger the firm, the more likely it will adopt and use a digital tool. The difference across the spectrum of firm size is significant as, for instance, 35% of large firms in Egypt and 51% in Jordan are listed on application while only 1% of micro firms in Egypt and 5% in Jordan, 3% of small ones in Egypt and 15% in Jordan. This apply to self-built websites, the Internet, and the use of websites. The literature shows that the fixed cost of digitalization is high given that the acquisition and maintenance expenses can be costly and prohibitive, especially in countries that rely on imported software products and are significantly impacted by foreign exchange rates (in terms of volatility and availability of foreign currency). Interestingly, small firms in Egypt perform relatively well when it comes online buy and sell, compared to large ones as 11% and 10% of the former use online buy and sell while only 1% and 4% of the latter do.

Table 3. Digitalization Measures and Firm Size

		Egypt				Jordan				
		Micro	Small	Medium	Large	Micro	Small	Medium	Large	
Website	NO	93%	68%	19%	16%	NO	88%	61%	36%	26%
	YES	7%	32%	81%	84%	YES	12%	39%	64%	74%
List App.	NO	99%	97%	98%	65%	NO	95%	85%	74%	49%
	YES	1%	3%	2%	35%	YES	5%	15%	26%	51%
Online Buy	NO	95%	89%	81%	99%	NO	94%	83%	79%	41%
	YES	5%	11%	19%	1%	YES	6%	17%	21%	59%
Online Sell	NO	96%	90%	99%	96%	NO	93%	80%	65%	62%
	YES	4%	10%	1%	4%	YES	7%	20%	35%	38%
Self-built	NO	98%	47%	40%	68%	NO	89%	71%	63%	37%
	YES	3%	53%	60%	32%	YES	11%	29%	37%	63%
Internet	NO	75%	43%	37%	0%	NO	72%	19%	32%	0%
	YES	25%	57%	63%	100%	YES	28%	81%	68%	100%
Smartphone	NO	52%	40%	38%	67%	NO	57%	52%	45%	54%
	YES	48%	60%	62%	33%	YES	43%	48%	55%	46%

Source: Author's own elaboration using the Firm Digitalization dataset (2022)

Notes: Weights are used.

Another important determinant of digitalization is innovation. Indeed, the more a firm spends on research and development, the more it is likely to adopt and use digital tools. Table 4 confirms this finding as 33% of firms that spend on R&D have a website, while this share for those that do not is 14% in Egypt. In Jordan, similar figures are observed as (34% and 13%, respectively). A similar conclusion is observed but in a more pronounced way for self-built websites, online selling and buying. Moreover, in most of the dimensions (with the exception of self-built websites), Jordan is better performing than Morocco.

4.3. External Characteristics

The sector where the firm operates matters. Generally, Table 5 shows that firms operating in the services sector are the most digitalized as they are more likely to use online selling and buying, to have a self-built website, and to use the Internet. This likelihood is smaller for firms in the primary sector and to a lesser extent the manufacturing one. This shows to what extent digital platforms are still under-utilized in the manufacturing sector and that more reforms are needed in order to help firms adopt such measures (especially in terms of infrastructural and legal infrastructure).

Table 4. Digitalization Measures and Innovation

		Egypt		Jordan		
		No RD	RD	No RD	RD	
Website	NO	86%	67%	NO	87%	66%
	YES	14%	33%	YES	13%	34%
List App.	NO	98%	97%	NO	95%	87%
	YES	2%	3%	YES	5%	13%
Online Buy	NO	96%	83%	NO	95%	82%
	YES	4%	18%	YES	5%	18%
Online Sell	NO	95%	91%	NO	94%	79%
	YES	5%	9%	YES	6%	21%
Self-built	NO	96%	17%	NO	84%	75%
	YES	4%	83%	YES	16%	25%
Internet	NO	70%	49%	NO	66%	46%
	YES	30%	51%	YES	34%	54%
Smartphone	NO	51%	32%	NO	63%	43%
	YES	49%	68%	YES	37%	57%

Source: Author's own elaboration using the Firm Digitalization dataset (2022)

Notes: Weights are used.

Table 5. Digitalization Measures and Economic Activity

		Egypt			Jordan			
		Prim.	Manuf.	Services	Prim.	Manuf.	Services	
Website	NO	78%	87%	82%	NO	85%	80%	80%
	YES	22%	13%	18%	YES	15%	20%	20%
List App.	NO	100%	97%	98%	NO	89%	92%	92%
	YES	0%	3%	2%	YES	11%	8%	8%
Online Buy	NO	100%	99%	91%	NO	97%	92%	90%
	YES	0%	1%	9%	YES	3%	8%	10%
Online Sell	NO	99%	96%	94%	NO	94%	86%	89%
	YES	1%	4%	6%	YES	6%	14%	11%
Self-built	NO	77%	98%	66%	NO	86%	77%	78%
	YES	23%	2%	34%	YES	14%	23%	22%
Internet	NO	72%	77%	63%	NO	96%	65%	60%
	YES	28%	23%	37%	YES	4%	35%	40%
Smartphone	NO	37%	62%	43%	NO	34%	49%	55%
	YES	63%	38%	57%	YES	66%	51%	45%

Source: Author's own elaboration using the Firm Digitalization dataset (2022)

Notes: Weights are used.

5. Methodology

To examine the adoption of different digital variables, a probit model (a linear probability model is also used as a robustness check) as follows:

$$Y_i = \beta_0 + \beta_1 \ln(Emp_i) + \beta_2 Gender_i + \beta_3 Educ_i + \beta_4 Exp. Status_i + \beta_5 \ln(Age_i) + \beta_6 RD_i + \sigma_i + \lambda_i + \epsilon_i$$

where Y_i measures the different digital variables, namely 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. $\ln(Emp_i)$ measures the size of the firm by taking the natural logarithm of employment. $Educ_i$ is a dummy variable that takes the value of 1 if the education level of the owner is university or above and zero otherwise. $Gender_i$ is a dummy variable that takes the value of 1 if the owner is a female and zero otherwise. $Exp. Status_i$ is a dummy variable that takes the value of 1 if the firm is exporting and zero otherwise. $\ln(Age_i)$ is the natural logarithm of the difference between 2022 (year of data collection) and the year of establishment. RD_i is a dummy variable that takes the value of 1 if the firm is spending on R&D and zero otherwise. σ_i are regional fixed effects, λ_i sector fixed effects to control for regional and sector unobservables and ϵ_i is the error term.

Three remarks are worth to be mentioned. First, as it has been argued before, all the statistics that are presented below have to be interpreted as associations without any causal relationships. Second, the respective weights have been used in all the regressions. Third, to examine the intensity of digitalization adoption, an index has been constructed using the principal component analysis method. A larger value of the index means that the firm is more digitalized.

6. Empirical Results

Tables 6 and 7 show the results of the determinants of digitalization in Egypt and Jordan. Generally, in Egypt, the larger the firm, the higher the likelihood of adopting and using different digital tools. This result holds for all the dimensions except smartphones and the overall index. In Jordan, all the dimensions are positively affected by the size of the firm. In terms of human capital, the education of the owner matters for firms in Jordan more than Egypt as the variable of university and above is globally insignificant in Egypt and significant in Jordan (for all indices except for smartphones and self-built websites). These results are confirmed by Olurinola et al. (2021) who find that size of the firm, educational attainment of the top manager of the firm, employment, and sector of operation are key determinants of digitalization. In addition, Gutiérrez, and Gamboa (2010) show that the most important factor affecting the digitalization of low-income people in Colombia, Mexico, and Peru was lack of education.

Gender matters to a certain extent in Egypt for whether the firm is listed on an application or not pointing out the digital divide that can be observed for this variable. Yet, this variable is insignificant in the Jordanian case.

Table 6. Determinants of Digitalization in Egypt

	Website	List app.	Online buy	Online sell	Self-built	Internet	Smartphone	Index
Ln(Emp)	0.549*** (0.0890)	0.362*** (0.125)	0.180** (0.0887)	0.248*** (0.0749)	0.110 (0.202)	0.472*** (0.136)	0.00257 (0.0871)	-0.0153 (0.0604)
Univ. and above	0.550*** (0.188)	0.424 (0.330)	0.372 (0.261)	-0.157 (0.245)	0.0949 (0.365)	0.420** (0.203)	0.176 (0.217)	-0.173* (0.0887)
Female	0.0112 (0.356)	-0.933*** (0.283)	-0.0513 (0.452)	0.277 (0.377)	0.242 (0.420)	0.870* (0.450)	-0.0732 (0.367)	-0.275** (0.138)
Exp. Status	0.0398 (0.0887)	-0.186* (0.112)	0.0125 (0.110)	0.0532 (0.130)	0.416** (0.193)	0.279*** (0.102)	0.0425 (0.110)	0.311*** (0.0628)
Ln(Age)	-0.0143 (0.0830)	-0.107 (0.102)	-0.0494 (0.0978)	-0.0506 (0.0905)	0.217 (0.191)	0.00165 (0.0895)	-0.0827 (0.116)	0.204*** (0.0630)
Delta	0.0370 (0.214)	-0.0394 (0.345)	-0.225 (0.289)	0.144 (0.252)	1.162*** (0.347)	0.193 (0.236)	-0.0657 (0.245)	0.111 (0.102)
Upper Egypt	-0.343 (0.210)	-0.0657 (0.317)	0.0839 (0.259)	-0.244 (0.308)	0.433 (0.497)	0.0526 (0.215)	-0.412 (0.259)	-0.543*** (0.136)
Frontier Gov.	0.864 (0.633)		0.848 (0.631)	-0.694 (0.439)	0.666 (0.546)	1.534*** (0.533)	0.238 (0.487)	-0.328 (0.399)
R and D	0.144 (0.148)	-0.0587 (0.271)	0.293** (0.144)	0.0396 (0.170)	1.930*** (0.366)	0.207 (0.155)	0.188 (0.182)	0.755*** (0.113)
Manuf.	-0.212 (0.619)	-1.239*** (0.359)	1.032** (0.492)	0.570 (0.412)	-0.879 (1.283)	0.0196 (0.673)	-0.609 (0.635)	0.882* (0.497)
Services	-0.116 (0.600)		1.849*** (0.385)	0.831** (0.375)	0.776 (1.232)	0.150 (0.652)	-0.105 (0.608)	1.068** (0.485)
Constant	-2.138*** (0.637)	-2.638*** (0.476)	-3.758*** (0.512)	-2.701*** (0.474)	-3.567*** (1.362)	-1.686** (0.709)	0.433 (0.682)	-1.934*** (0.513)
Observations	765	726	765	765	163	535	520	163

Robust standard errors in parentheses

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

Exporting status is positively associated to the overall index of digitalization, the use of self-built websites, and the use of the Internet in Egypt but insignificant for Jordan. Moreover, age does not seem to exert a significant effect neither in Egypt nor in Jordan.

Being located in Amman matters for Jordanian firms pointing out the importance of investing in digital infrastructure in other regions. In Egypt, it is obvious that firms that are located in Upper Egypt face more difficulties when it comes to the adoption and use of digital tools given the lack on investments. For a development perspective, inclusion of remote areas should be a priority in order to increase the use of digitalization measures.

Among the most significant variables, research and development exerts a statistically significant effect in both Jordan and Egypt for the measures of digitalization. This is in line with Arora and Rathi (2019) who find that managerial factors and technology are important determinants for the adoption of digitalization in India. At the sectoral level, services are generally more prone to digitalization as it is shown in the case of the Internet (in Jordan), online buying, and online selling (in Egypt).

Table 7. Determinants of Digitalization in Jordan

	Website	List app.	Online buy	Online sell	Self-built	Internet	Smartphone	Index
Ln(Emp)	0.473*** (0.0669)	0.406*** (0.0675)	0.263*** (0.0526)	0.278*** (0.0534)	0.398*** (0.113)	0.769*** (0.134)	0.0455 (0.0644)	0.279*** (0.0619)
Univ. and above	0.401*** (0.121)	0.285* (0.154)	0.371*** (0.117)	0.318*** (0.109)	0.273 (0.289)	0.622*** (0.130)	0.0908 (0.133)	0.502*** (0.155)
Female	0.162 (0.190)	-0.181 (0.233)	0.139 (0.165)	0.101 (0.148)	0.0938 (0.358)	-0.0492 (0.196)	-0.195 (0.184)	-0.0626 (0.197)
Exp. Status	-0.0311 (0.0434)	-0.0570 (0.0552)	-0.0865** (0.0405)	-0.0415 (0.0398)	-0.0951 (0.0951)	0.0779* (0.0456)	0.0230 (0.0463)	0.0139 (0.0490)
Ln(Age)	0.0553 (0.0536)	0.0566 (0.0688)	-0.0625 (0.0531)	-0.00246 (0.0500)	-0.00793 (0.116)	-0.0821 (0.0605)	0.0399 (0.0631)	0.0540 (0.0613)
Amman	0.358*** (0.121)	-0.0877 (0.148)	0.426*** (0.121)	0.106 (0.107)	-0.0320 (0.272)	0.417*** (0.126)	0.212 (0.132)	-0.171 (0.153)
R and D	0.417*** (0.0947)	0.290*** (0.111)	0.355*** (0.0828)	0.360*** (0.0815)	0.293 (0.264)	0.246** (0.123)	0.315*** (0.112)	0.268* (0.137)
Manuf.	0.481 (0.369)	0.337 (0.211)	0.507 (0.559)	0.548 (0.442)	-0.317 (0.347)	1.672*** (0.623)	0.00251 (0.748)	0.754 (0.694)
Services	0.363 (0.336)		0.588 (0.533)	0.368 (0.423)		1.632*** (0.604)	-0.165 (0.726)	0.792 (0.665)
Constant	-2.786*** (0.373)	-2.532*** (0.189)	-2.847*** (0.560)	-2.489*** (0.443)	-1.948*** (0.424)	-3.603*** (0.661)	-0.467 (0.767)	-1.844*** (0.699)
Observations	889	872	889	889	173	669	523	101

Robust standard errors in parentheses

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

In a nutshell, the most important determinants of adopting a digitalization measure are the owner's education level, firm size and R&D spending. Gender matters but to a lesser extent.

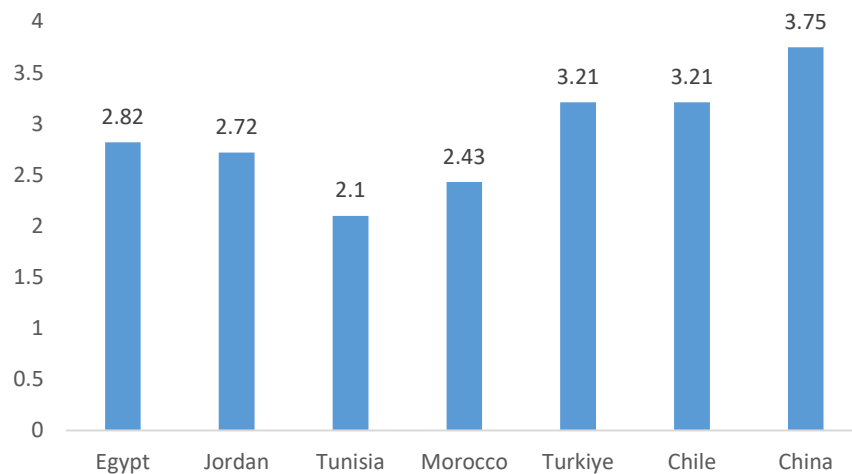
7. Potential Explanations

The objective of this section is to explain two points: why Jordan is generally doing better than Egypt when it comes to digitalization and what are the main bottlenecks that hinder the development of digitalization in these countries.

7.1. Physical Capital and Infrastructure

First, despite the improvement of infrastructure in these countries, they have a lower Logistics Performance Index when compared to similar emerging markets such as Turkey, Chile, and China. This shows to what extent the quality of infrastructure needs to improve in order to be ready to accommodate the digital infrastructure. Figure 1 shows that Egypt has a slightly higher than Jordan but lower than the above-mentioned countries. As it was mentioned before, investing in infrastructure has to be inclusive in order to help different regions adopt different digitization measures.

Figure 1. Logistics Performance Index - 2018

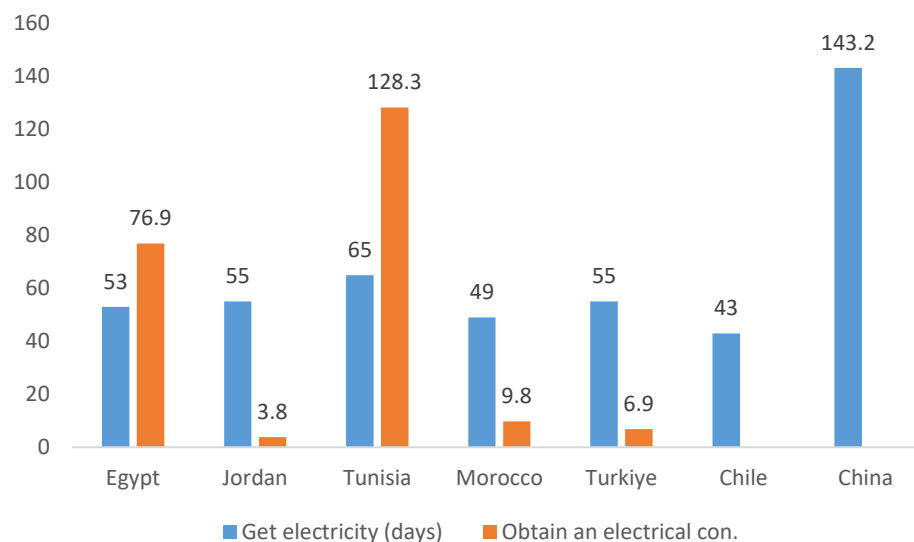


Source: World Development Indicators.

Notes: Quality of trade and transport-related infrastructure (1=low to 5=high)

Electricity is a fundamental determinant of digitalization to guarantee Internet access and stable connection. Yet, Figure 2 shows that while the time to obtain an electricity connection in Jordan is significantly low (around 4 days), it reaches 77 days in Egypt. This clearly does not give enough incentives to firm to adopt digital technologies.

Figure 2. Time to get and obtain electricity connection - 2018

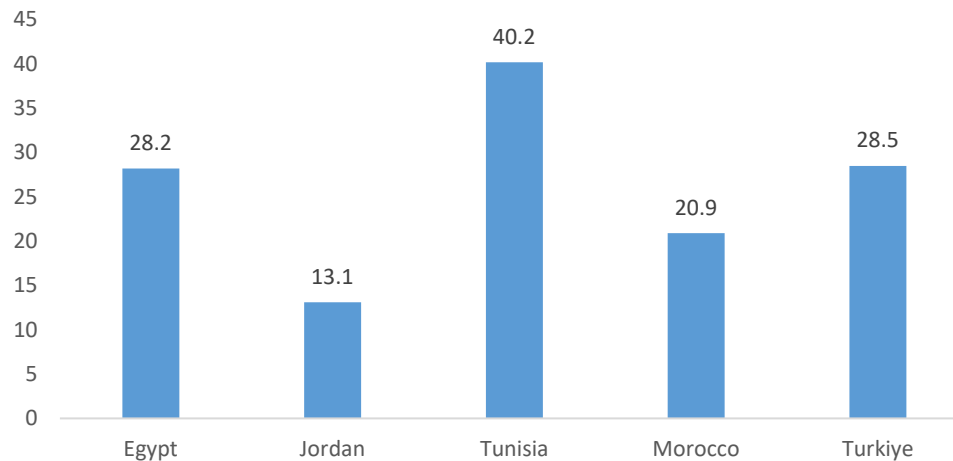


Source: World Development Indicators.

Moreover, another point that explains why Jordan performs better than Egypt is shown in Figure 3 where Egyptian firms report more electrical outages than Jordanian ones (28% and 13%

respectively). Tunisia has a more significant problem as 40% of firms experience electrical outages that negatively affect digitalization and the reliance of production and sales on digital platforms.

Figure 3. Firms experiencing electrical outages (% of firms)



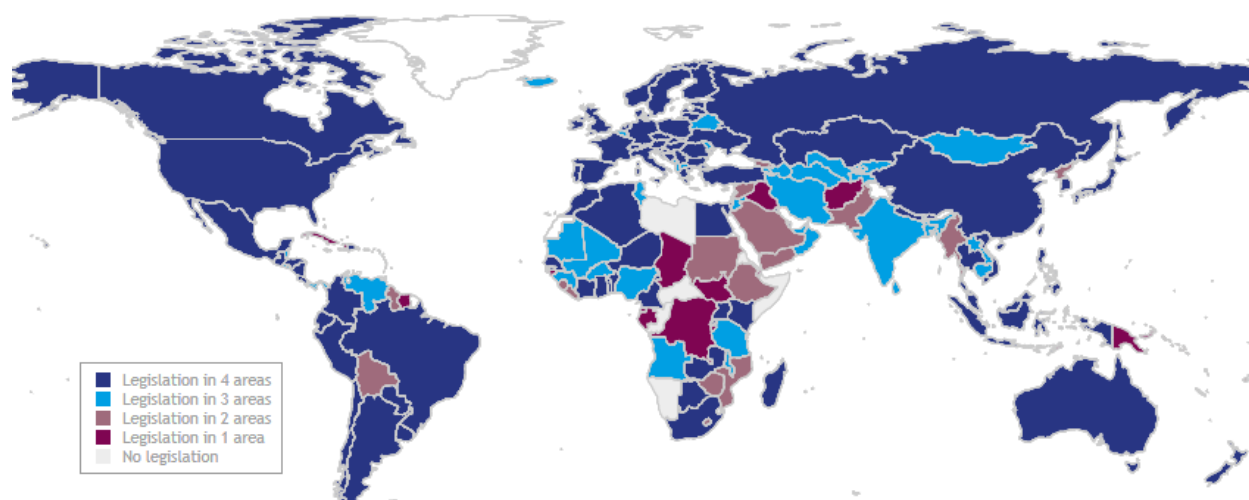
Source: World Development Indicators.

Note: These data come from the most recent World Bank Enterprise Survey for each country.

7.2. Institutions and Legal Framework

While most of the emerging markets have recently adopted different laws pertaining to e-commerce such as -transactions laws, consumer protection laws, privacy laws cybercrime laws, there are still several challenges in terms of enforcement and implementation. Figure 4 shows that both Egypt and Jordan have a legislation in four and three areas respectively, which is relatively high compared to other countries. Yet, enforcement, impartiality and effectiveness are still challenged because of the relatively poor quality of institutions. Indeed, Table 8 shows that, generally, Egypt has lower indices of governance measured by the control of corruption, rule of law and government effectiveness when compared to Jordan. This again explains partially why the latter is doing better than the former, as digitalization is sensitive to the quality of institutions. Labhard and Lehtimäki (2022) that the growth effects of digitalization may be greater when institutions and governance are of high quality. Indeed, better institutions help define a framework for market transactions, establish accountability for the stakeholders (e.g. by increasing the traceability of agents and actions), and by enable enforcement.

Figure 4. Summary of E-commerce Legislations



Source: UNCTAD Online Dataset

Notes: The areas are e-transactions laws, consumer protection laws, privacy laws cybercrime laws.

This is why, in Egypt, CIPE (2019) identifies a number of challenges that limit the transition towards a cashless economy. First, there is a lack of a clear plan for the National Council for Payments with specific interim objectives to guide the universal implementation of the cashless payment system. At the legislative level, none of the laws regulating non-bank financial services includes any provision that requires parties to use electronic payments or payments through bank accounts (e.g. Companies Law, Capital Market Law, Insurance Services Law, Mortgage Law, and Financial Leasing Law). Finally, there is also an overlapping jurisdiction between the National Council for Payments and other government agencies.

Table 8. Averages of Institutional Variables for MENA Countries (1995 – 2019)

Country	Democracy - Polity Index	Control of Corruption	Government Effectiveness	Rule of Law
Jordan	3.67	0.14	0.09	0.31
Morocco	3.10	-0.22	-0.12	-0.07
Tunisia	4.40	-0.13	0.26	-0.07
Egypt	2.48	-0.59	-0.47	-0.23

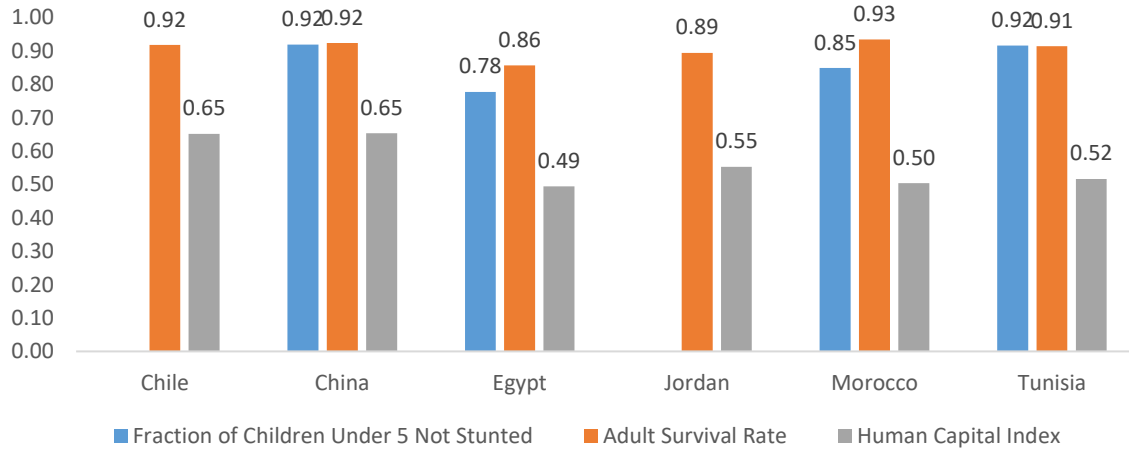
Source: Calculated by the authors using data from Freedom house Polity IV, and World Governance Indicators.

7.3. Education and Human Capital

Another potential explanatory factor is education and human capital given that digitalization requires a highly skilled labor. Yet, both of the two countries are still lacking the relevant skills, especially for blue collars (Aboushady and Zaki, 2021). Figure 6a and 6b show that Egypt and Jordan have a lower human capital index when compared to China and Chile. Moreover, as it was

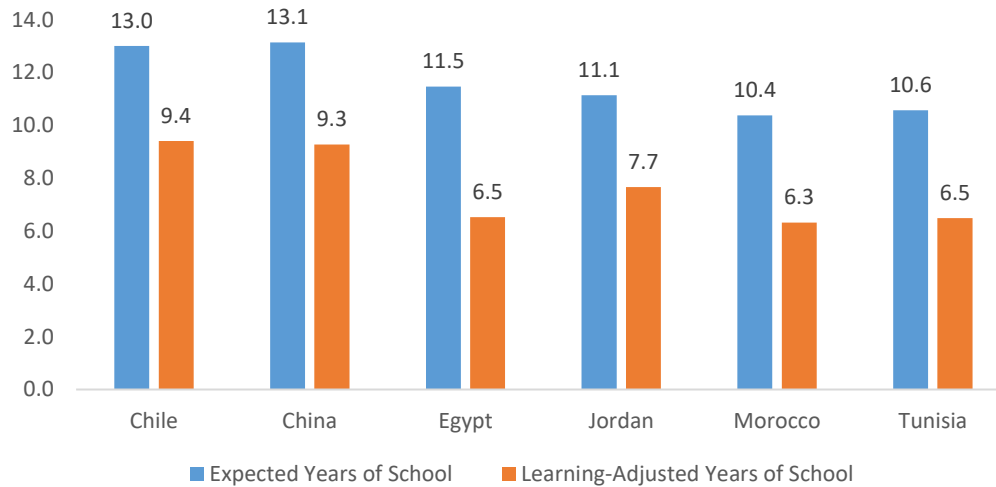
mentioned before, Jordan is performing better than Egypt, especially for the adult survival rate and the learning-adjusted years of schooling.

Figure 6a. Education and Human Capital



Source: Human Capital Index online dataset.

Figure 6b. Education and Human Capital



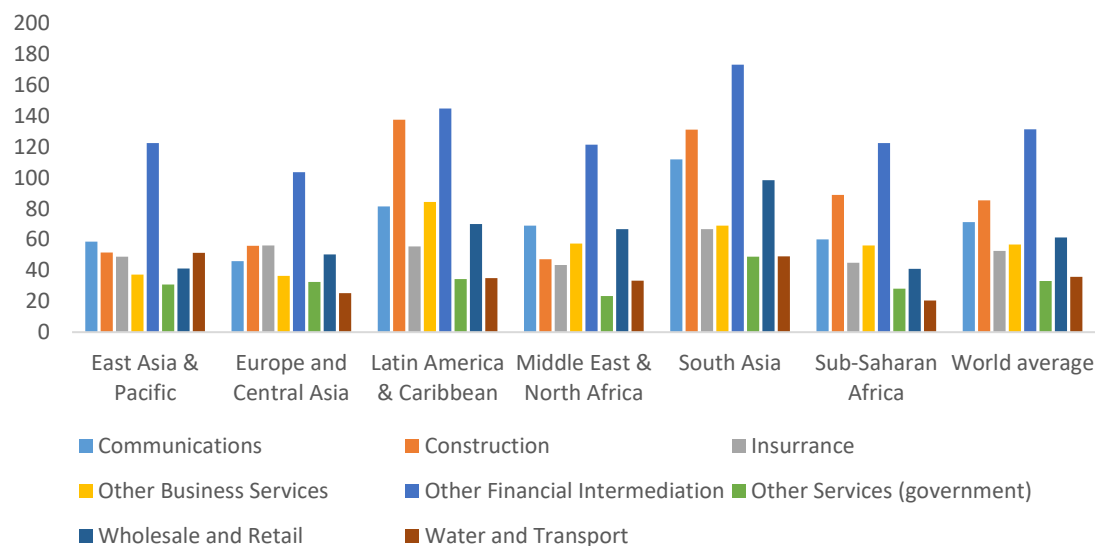
Source: Human Capital Index online dataset.

7.4. Trade Policy

Digitalization is highly intensive in services. Yet, most of the services are more protected in the MENA region compared to other regions (see Figure 7). This, consequently, make services less competitive and might affect the adoption of digital tools (Karam and Zaki, 2013 and 2022). This is even more important for the manufacturing sector that relies heavily on services including ICTs. Indeed, exploitation of world markets requires competitive firms' competitiveness that is a function of the cost and quality of the inputs (including services inputs) they have access to. Hence, while further efforts towards service liberalization, are necessary, the latter should increase the

competitiveness of local service sectors, and therefore help attract foreign firms in the MENA region and increase technological spillovers.

Figure 7. Ad-valorem Equivalent of Service Trade Restrictiveness Index by sector



Source: CEPII dataset.

8. Conclusion and Policy Implications

The objective of this paper is twofold: first to examine the characteristics of the firms who adopt digital technologies by focusing on two emerging markets, which are Egypt and Jordan. Second, this paper analyzes the potential explanations behind the under-performance of these two countries compared to other emerging economies.

The main findings show firms having an owner whose education level is university and above and who is a woman are more likely to be digitized. Moreover, firms that spend on R& D and operating in the services sector adopt and use different digital platforms. Small and medium firms are generally facing several impediments and are not as digitized as large ones. The quality of institutions, investing in human capital and in legal and human infrastructure are key to improve the status of digitalization in these countries.

From a policy perspective, this paper highlights some of the main relationships between firms' characteristics and digitalization. First, unequal access to opportunities plays a large role in explaining under-performance. Such inequality is pronounced at the level of the firm size, the sector to which belong the firm and the gender. Below a number of policy recommendations that have to be taken into account. First, more efforts are needed in order to make small and medium firms better digitized (UNCTAD, 2019). Second, while the service sector is performing relatively well, government policies need to focus on the manufacturing sector and provide the legislative framework needed in this regard. Indeed, given the servicification of the manufacturing sector

(Karam and Zaki, 2020), the competitiveness of the manufacturing sector depends on an efficient and competitive services sector including the information, communication and technology sector. Third, at the macroeconomic level, more policies are needed to improve the quality of labor and human capital, as digitalization requires highly skilled labor. Finally, improving the quality of institutions is key in order to improve the digitalization of firms in the MENA region given that most of the digital measures are highly sensitive to the quality of institutions (including the enforcement of related laws).

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