

THE ROLE OF EGYPTIAN FEMALE ENTREPRENEURSHIP IN THE DIGITAL ERA POST-COVID-19

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Through a wide range of publications, surveys, events, training activities, audio-visual materials and a strong footprint on social media, the network reaches thousands of experts, think tankers, researchers, policy-makers and civil society and business stakeholders every year. While doing so, EuroMeSCo is strongly engaged in streamlining genuine joint research involving both European and Southern Mediterranean experts, encouraging exchanges between them and ultimately promoting Euro-Mediterranean integration. All the activities share an overall commitment to fostering youth participation and ensuring gender equality in the Euro-Mediterranean experts' community.

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The Role of Egyptian Female Entrepreneurship in the Digital Era post-COVID-19

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Introduction

The current “cloud revolution” accelerates the digitalisation of economies as it expands business opportunities, thus boosting the economy and enhancing business activities. During the COVID-19 pandemic, digital economy countries had the opportunity to sustain many activities remotely, while many developing countries fell into poverty and were forced to face a surge of unemployment. There were more unemployed females than males, and the female participation rate was lower than for males.

Digitalisation can accelerate female entrepreneurs’ participation in the labour market and allow them to increase their productivity growth. It can therefore help increase their standard of living, decreasing poverty and creating economic stability (Van Praag & Versloot, 2007). COVID-19 challenges the dreams of many entrepreneurs across the globe to sustain their business using technology but even more so in developing countries as their access to technology is lower than in developed countries because it is not affordable and in some rural areas not available. In this context, not all countries have been affected in the same way. As a result of the epidemic, women’s employment decreased the most throughout the Americas (a reduction of 9.4%). The Arab States saw the second-largest drop in the number of employed women, with women’s employment falling by 4.1% and men’s by 1.8% between 2019 and 2020 (ILO, 2021). The pandemic widens the gender gap rather than closing it.

Such a shock urges a reduction of the digital divide, as it is considered a necessary tool and not a luxury. Such a tool can keep businesses going and help them recover after the global shock, especially for women who had to stay at

home with their children. Women, youths and people with medium and low skills experienced a decline in employment worldwide in 2020. Female workers were disproportionately affected compared to male workers, with unemployment accounting for 38.9% of total employment before the COVID-19 crisis but rising to 47.6% of the total workforce (ILO, 2020). The lockdown due to the pandemic pushed women to learn how to benefit from digitalisation as it has a direct link to both poverty alleviation and women’s empowerment, especially in developing countries, where it plays a significant role in gender equality and economic development.

The current situation calls for international cooperation to spread knowledge and support small and medium-sized companies (SMEs) to develop and create new businesses to gain a positive bottom-up impact.

This study intends to address the following questions: What are the Egyptian female entrepreneurs’ main driving forces to accelerate their activities? What is the impact of digitalisation on Egyptian female entrepreneurs? Did the economic growth have an impact on Egyptian female entrepreneurs during the period from 1990 to 2020? The study is structured as follows: first, the “Literature review” section lays out the relevant literature on female entrepreneurial activities and digitalisation and assesses the impact of the pandemic on the formal and informal markets. The “Digitalisation and women’s participation in the Egyptian labour market” section explores the effect of COVID-19 on female entrepreneurial activities and the government role in accelerating female participation. “Methods” frames research hypotheses and describes study methodologies. The “Findings of the study” section discuss-

es the main results and defines the limitations before moving on to the conclusion and policy recommendations.

Literature review

The literature on female entrepreneurship focuses on the problems that women's experience in starting and maintaining a company, with a particular emphasis on access to education, information, funding and networks. Currently, in a world that is becoming digitally-driven, especially after COVID-19, cyberspace becomes an opportunity for women who are aiming to create and run businesses.

Digitalisation and female entrepreneurs

Evolutionary economics show that entrepreneurs act as drivers of economic growth as they explore and bring innovative ideas to markets, quicken growth, and decrease the unemployment rate (Wennekers & Thurik, 1999; Herrington & Kew, 2013; Meyer & Meyer, 2017). Studies show the relative contribution of new start-ups to job creation and their impacts on economic growth and gross domestic product (GDP) per capita (Acs & Armington, 2002; Klapper & Quesada Delgado, 2007; Naude, 2008). In 2019, the United Nations (UN) stressed the importance of information and communication technology (ICT) as the major driver of the digital economy (García et al., 2019). In accordance with the UN's Sustainable Development Goals (SDGs), countries can reduce poverty by investing in technology (SDG1), such as internet access and telephone telecommunications, which will increase access to information on education and employment prospects, as well as social and development outcomes. In addition, digital infrastructure can enhance agriculture sustainability and secure food

security (SDG2). Also, digital tools can potentially decrease inequality, especially for people who live in remote areas (SDG10). Intellectual property and a country's innovation support system are inextricably linked to a country's ability to innovate, attract foreign investment, and grow valuable enterprises that create globally competitive products and services (SDG9). The UN also emphasises the importance of women's economic empowerment in furthering their rights and well-being.

The digitalisation of economic activities has grown over time due to the incremental benefits it generates but it has been proven to have higher impacts on larger enterprises' competitive advantages than on SMEs (Nduati et al., 2015). Moreover, people are becoming the main factor in production, and their knowledge, skills and competencies in information technology have become the driving force in the development of the digital economy (Zaborovskaia et al., 2020).

Globally, female entrepreneurship has been expanding at an ever-increasing rate. According to the Global Entrepreneur Monitor (GEM, 2017), in 2016, 163 million women started or ran a new business in 74 economies throughout the world, while 111 million held leadership positions in existing enterprises. But in Arab and Middle Eastern countries, entrepreneurship is generally male-dominated as gender bias and stereotypes are more prevalent and based on common perception (Bruni et al., 2004). A woman's role is usually socially construed as staying at home and raising their children, a contribution that it is not recorded in the country's production.

A woman's role as an engine to manage the family's stability and provide healthy and educated youths is not counted either. Emerging markets, such as the

former Soviet bloc countries, have seen tremendous political, economic and social transformations to varied degrees, all of which have had a significant impact on their contemporary entrepreneurial climate. Women's motives for starting a new business are mostly due to frustration as employees (e.g., little appreciation from society and employers for their work) and the desire for more flexibility due to family obligations (Welsh & Dragusin, 2009).

Challenges facing women in starting a business are due to a variety of circumstances, including their lack of expertise, lower income, and proclivity for risk. In addition, they are impacted by the lack of training and institutional support and lack of access to the social and financial capital required for recognising and pursuing a market opportunity (Thébaud, 2015). Female entrepreneurs thus have a harder time securing financing and attracting investors to their businesses (Brush et al., 2001; Coleman, 2002). In addition, subtle discrimination (based on stereotypes) is frequently present at work, resulting in inefficient capital allocation (Buttner & Rosen, 1992; Coleman, 2000; Gicheva & Link, 2015; Verheul & Thurik, 2001). However, recently, numerous women have broken free of failure and asserted themselves as successful entrepreneurs. In high income countries, the rise in young female entrepreneurs is categorised by women gaining the possibility of shifting into paid, often white-collar work, while the opportunity cost of departing the workforce for childcare increases (Jensen, 2017).

Furthermore, network strength is a crucial factor that can reduce female engagement in entrepreneurship. Men are more likely to be socialising into entrepreneurship life than women and they are more frequently pushed into entre-

preneurship by their families (McAdam et al., 2019).

Scholars show that women-led organisations have a positive and significant impact in terms of fostering a more creative atmosphere and increasing companies' viability (Olivetti, 2013; Tsani et al., 2013). Therefore, supporting the achievement of gender equality contributes to economic growth and productivity; and, also, to the development of investment in human capital, in order to increase labour productivity. However, the widening of the gender gap in employment is similarly reflected in the unequal educational opportunities between the sexes, especially in rural areas. Studies show that in some instances women who are more productive than men are excluded from the workplace. Thus, the mobilisation of a productive workforce among which companies can select suitable employees narrows due to gender discrimination, and thus the average capacity of the workforce decreases (Nikpei & Elmi, 2015).

An investigation of the factors driving female participation in the labour market can be categorised as maternal health, declining number of children, childcare grants, or the provision of many home technology gadgets. Furthermore, the patriarchal norms can suppress, constrain or reverse the empowering female effects of paid labour and inhibit women's access to income-earning opportunities.

Still, women's role in digitalisation is mainly unexplored in this field of research. New digital paradigms have altered the way individuals work and interact, as well as the way businesses are conducted (Autio et al., 2018; Sussan & Acs, 2017). Prior studies in the field of cyber feminist research have looked at women's attitudes toward digital tech-

nology, stressing the Internet's disruptive potential in lowering the barriers to entrepreneurship for a group that has traditionally been underrepresented in the field. Women are aided in acquiring and absorbing new knowledge through the use of digitally mediated platforms (Rosser, 2005), permitting them to get more instant access to business and finance opportunities.

One of the points put out by cyber feminist studies is that offline gender disparities are mirrored in the online world. The Internet's potential is to remove barriers to entry into business and provide access to a wealth of knowledge, which is thought to provide non-trivial benefits to women who have previously been excluded from male-dominated entrepreneurial environments (Dy et al., 2018; Ughetto et al., 2019). However, for women that had resources and opportunity to work, telework is both an opportunity and a potential trap. The trap can be in the form of cybersecurity risk, compliance risk, third-party risk, automation risk, resiliency risk, and data privacy risk, all examples of digitalisation risk that required a high skills education that is absent in developing countries as they are consumers not producer or developer of technology.

The impact of a pandemic on female entrepreneurs

In the context of the COVID-19 epidemic, more women are likely to fall into poverty, wreaking havoc on women-headed households throughout the region. This is exacerbated by Middle East and North Africa (MENA) governments' inherent gender prejudices, which prioritise men as household leaders. The Arab region is expected to lose 1.7 million jobs as a result of the pandemic, with about 700,000 of these positions held by women. In the

Arab world, female labour market participation is already low, with 19% unemployment for women in 2019 compared to 8% for men (UN ESCWA, 2020).

Globally, female entrepreneurs survived the virus under economic and family stress. During the 2008 crisis, women-led businesses in Poland, France and Spain were strongly affected (Buratti et al., 2017), while, in 2020, the impact of COVID-19 was more specifically visible under the lockdown and the strict social distancing measures. COVID-19 ended the life of 4.09 million humans by mid-July 2021, with Egypt accounting for 0.4% of this total (NCHS, 2021). COVID-19 did not differentiate between women and men in business as both suffered equally in times of crisis, although women are clearly discriminated against in times of expansion. Furthermore, in European countries, female-led SMEs that are active are negatively affected by the lockdown measures (Koltai et al., 2020; Buheji & Ahmed, 2020). During the pandemic, many jobs were lost in the informal and service sectors, both of which had a substantial female labour force. Many small businesses operate in the areas most affected by pandemic-related limitations, including restaurants and face-to-face services. In this context, small businesses in low- and lower-middle-income nations are particularly vulnerable, as they receive less aid from the government (ILO, 2020).

The MENA region venture capital investment ecosystem continues to attach high priority to innovation, ensuring that start-ups are properly supported. The Abu Dhabi Investment Office announced a partnership with Microsoft to provide a range of initiatives to help start-ups scale their businesses. In Saudi Arabia, start-ups and SMEs are vital contributors to Saudi Arabia's long-term economic de-

velopment, according to the Vision 2030 strategic plan. While Egypt's government focuses on engaging start-ups and SMEs in the field of financial technology, digital entrepreneurs perceive COVID-19 as an opportunity as they depend on social media to create trust in the product displayed, especially the portal that provides customer reviews, which increases this trust. Moreover, it minimises the health risk by delivering a product to the home during the spreading of the virus (Giones et al. 2020). The adaptability and response depend on the entrepreneur's behaviour, which needs to build more communities that are resilient and sustainable. In addition to the entrepreneurs' behaviour, it is important to keep entrepreneurs proactive and optimistic. Research (Hernández-Sánchez et al. 2020) showed the importance of maintaining students' mental health. Educators also need to develop new techniques to engage more entrepreneurs in innovative techniques; and governments need to provide further funds for innovative ideas to enhance the quality of innovative products (Ratten, 2020). In a nutshell, entrepreneurs perceive COVID-19 as a natural disaster that needs to be ended and then they can regain their activities, and they minimise their cash outflow to maintain business. Risk-taker female entrepreneurs are starting to benefit from the crisis, providing new products and generating profits, especially in handmade crafts to replace imported goods.

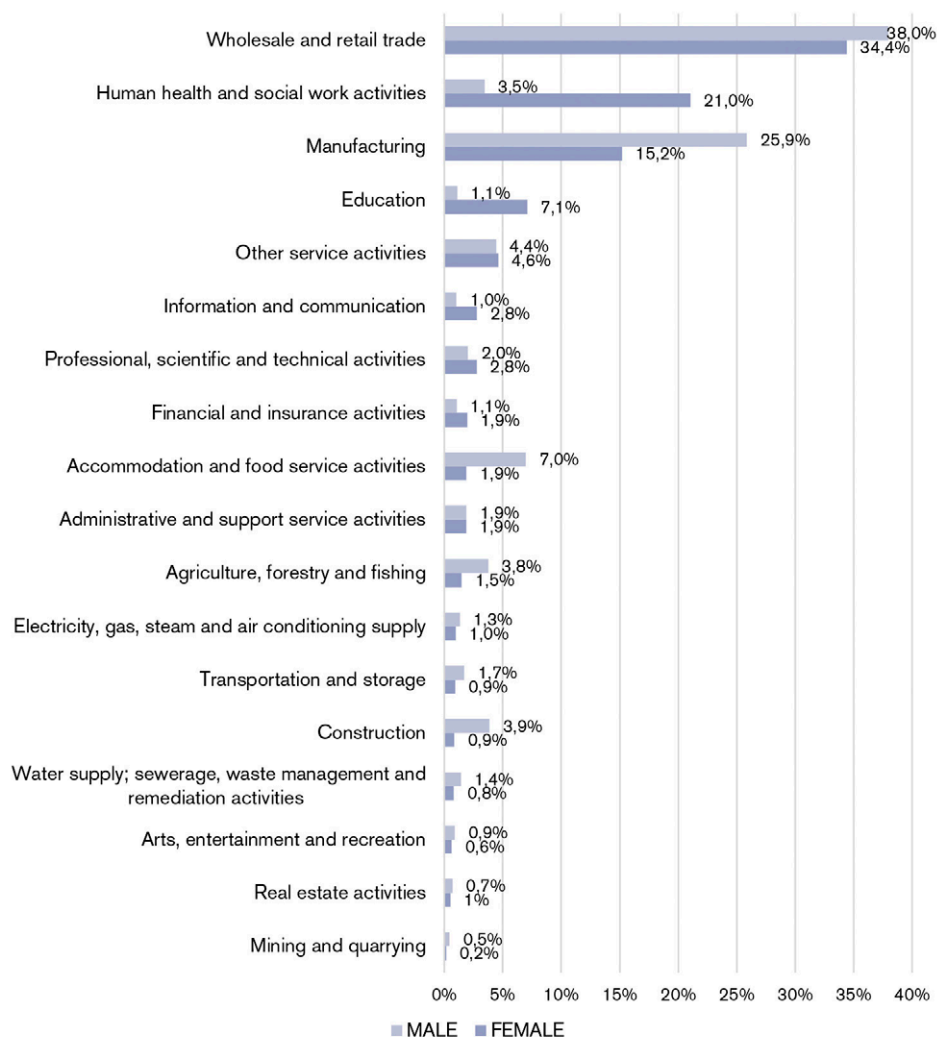
Digitalisation and women's participation in the Egyptian labour market

From the nineties until today, male unemployment has ranged between 5% and 10% while female unemployment

rates ranged between 17% and 25% (WDI, 2020). During the same period, the percentage of self-employed women ranged from 32% to 52% while men's rates ranged between 30% and 45% (WDI, 2020). Women's labour participation is based on the agriculture sector, an activity managed by women and that is not recorded in the country's labour force participation despite its capacity to create income; it is also excluded from insurance and pensions. In rural areas, women's main responsibility is to manage the house and raise children as it is build in the culture and tradition in Egypt and all Arab countries.

The national statistics survey released in 2020 showed that from 62% of the employed labour force (formal workers), around 26% became unemployed, 56% work fewer hours and 18% are intermittent workers (CAPMAS, 2020). The World Development Indicators (WDI) report showed that the percentage of self-employed women has declined since the nineties (WDI, 2020). The World Bank Enterprise Survey (2020) stressed that the number of SMEs in Egypt almost doubled between 2005 and 2019 while large companies declined by 12% during the same period. The key occupations for females are wholesale and retail, human and health care, manufacturing and education (Figure 1).

Due to culture and traditional history, Egypt views women's major role as care givers, a status that widens the gender wage gap, as it ranks 134th out of 144 countries and this problem remains a challenge to this day with regards to the country's economic growth and development (WEF, 2018). However, due to low level income and increasing family demands, women seek job opportunities either in the government public sector or in the informal sector. In 2020, the

Figure 1. Men's and women's participation in economic activities (in %) in Egypt

Source: CAPMAS, 2020.

International Labour Organization (ILO) showed that the largest share of females was in informal employment, especially in agriculture, followed by the services sector. However, females see working from home using the Internet as a way out to earn income, especially as this does not conflict with cultural barriers. In terms of home internet connection, individual internet use and male internet use,

the Arab States area is marginally above the global average, although statistics show that in 2019 approximately 58.9% of households in the region had internet connectivity at home and 54.6% of people used the Internet. While women continue to use the Internet at a lower rate in the region than globally, males use it at a substantially higher rate of 61.3% (ITU, 2021). But this data does not take into

consideration the fact that many women work from home but the internet contract is signed by the house owner, who is normally a man.

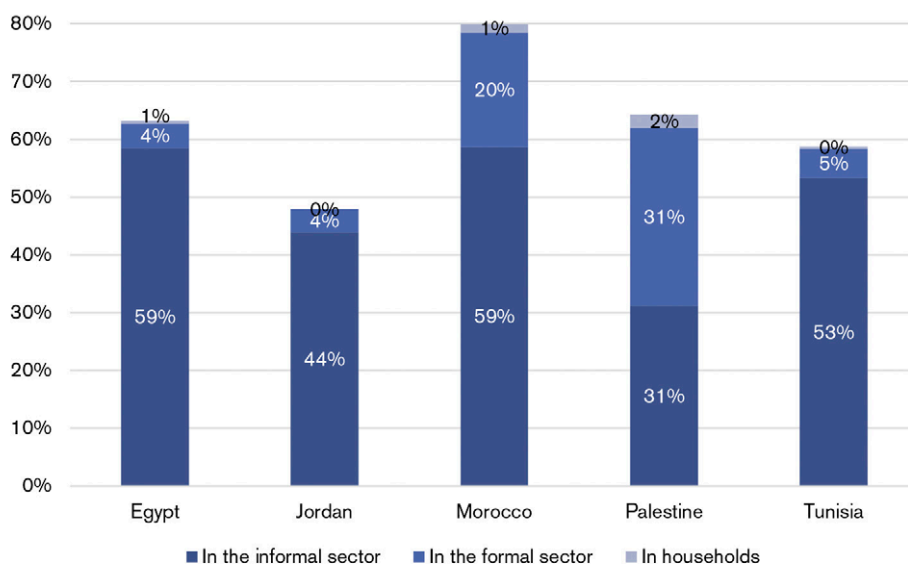
A recent study shows that the percentage of employed Egyptian women working in blue-collar jobs is decreasing (Abdou & Bassim, 2019). This decrease is due to fewer job options and the decline of the agricultural business, which employs more women. Men have more occupations than women due to the unbalanced expansion across economic activities, and men have more informal job opportunities than women.

This imbalanced expansion creates more informal positions, particularly in the construction industry, where men outnumber women (Tansel & Ozdemir, 2019). As a result, many women find themselves ei-

ther unemployed or working in informal activities or trying to build their small business.

Moreover, a recent survey show that almost half of the families depend on borrowing from relatives to overcome the current situation and only 5.4% from irregular employment grants. Additionally, the national estimates of CAPMAS (2020) showed that, despite all the economic reforms that are taking place in Egypt, female labour force participation remained low at 9% in 2019, with high unemployment and informality rates that outnumber other MENA countries. This is attributable in part to strong demographic growth, and the fact that the created jobs are in a low-value-added sectors with considerable informal employment (e.g., construction sector).

Figure 2. Share of informal employment in total employment (%)



Source: ILO, 2018.

Note: The total share of informal employment is divided into informal jobs in the informal sector (informal economic units), in the formal sector (including government units and non-profit institutions) and households (as paid domestic workers or self-employed workers producing goods exclusively for their final use by their households).

A female entrepreneur must employ all of her capabilities, previous experiences and all she has learned from modern technologies to help her small project. In the light of economies that are still suffering from the technological and scientific gap, as Egypt ranks 14th among the 29th lower-middle-income group economies and the 17th among the 19 economies in North African and Asian countries, relative to GDP, it is performing below expectations for its level of development (Dutta et al., 2020).

In the past, education systems in the MENA countries have prioritised the awarding of certificates over the development of skills. As a result, young people lack basic and other workplace skills. MENA countries must commit to building education systems that prioritise learning and skills in order to realise the economic and social development potential of education (El-Kogali & Krafft, 2020).

Currently, the Egyptian government has established many centres to develop youth innovation, such as the Technology Innovation and Entrepreneurship Center (TIEC) of the Information Technology Industry Development Agency (ITIDA), which invites entrepreneurs and anyone with an innovative idea or prototype in the field of communications and information technology to participate in the technology entrepreneurship accelerator (TEA). The Fekratek Sherkatek (Your Idea, Your Project) initiative, launched by the TIEC in 2017, financed 42 local start-ups. In 2018, it launched the Falak Startups Accelerator, a four-month accelerator programme that provides early-stage start-ups with investment of up to EGP 1 million (about USD 63,000), office space, and coaching. As a result, the ecosystem has experienced tremendous growth in recent years, attracting USD 59 million in equity investments in

2018, up from USD 9 million in 2017 (AUC & OECD, 2021).

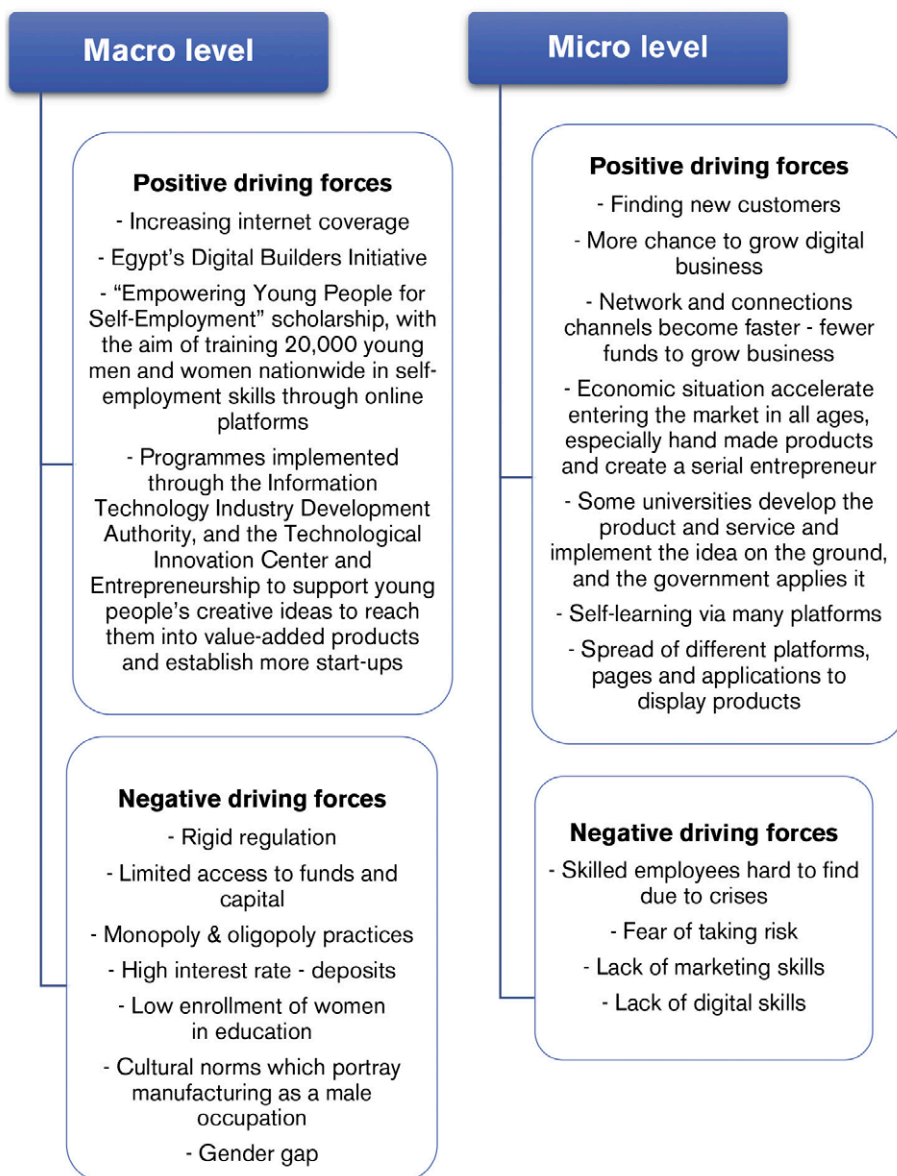
Impact of COVID-19 on Egyptian female entrepreneurs - Micro level

Many Egyptians experienced a decline in income between February 2020 and February 2021, when it reached up to 22% of total income. For self-employed individuals or employers, the COVID-19 pandemic meant they faced reductions in demand for goods and services, labour immobility and decline in input (Krafft et al., 2021). It is important to note that the poorest would be the most vulnerable to income losses, while higher income groups would have the higher and more diversified income to start with (Krafft & Davis, 2021). Some start-ups began to be heavily affected by service efficiency or labour productivity, but other start-ups began to double production capacity to improve product quality and increase their business size using software such as Link, Karam Solar, Orcas, Trip Dayzer, My Job, and Falk, among others. These start-ups relied on technology to continue working, using tools such as Slack, Zoom and Google to communicate daily and hold meetings with their team.

The government tried to mitigate the impact of COVID-19 by postponing instalments and coordinating with commercial banks to provide loans with reduced interest rates, but it is still timid and insufficient. As many women are working in informal and casual jobs, and many of them did not benefit from these measures for many considerations. Despite all these challenges, business women found during the pandemic a lifeline to continue by marketing their products and services through social media or e-commerce platforms. Start-ups operating on the Internet, e-commerce, digital payments, financial technology, software de-

velopment, logistics, and shipping and distribution sectors benefited the most from the COVID-19 pandemic. However, the government's incentive programmes and the soft loans provided by the Central Bank did not apply to small and micro companies, which explains why most companies owned by women did not benefit, since most of them are small-sized.

Figure 3. Driving forces on the macro and micro level in Egypt



Source: Prepared by the author.

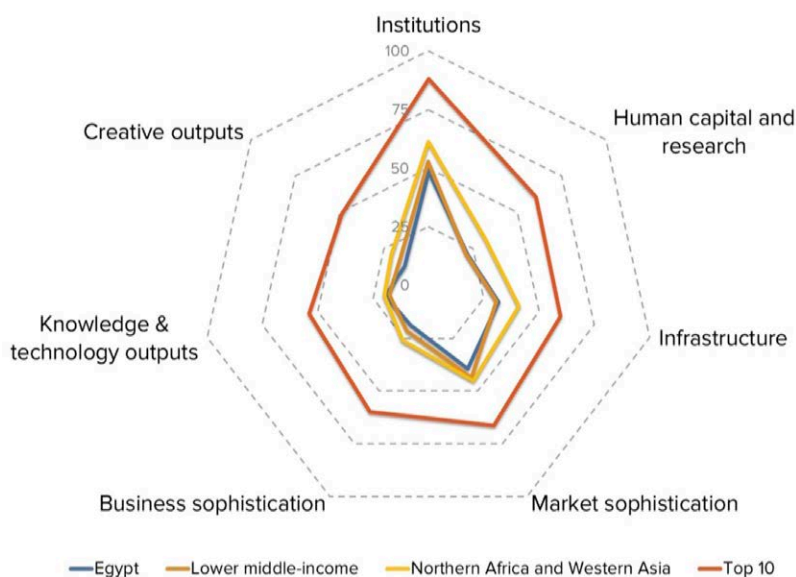
In some way, the current shock results in positive impacts reflected in pushing entrepreneurs to find new customers, improving their capabilities to develop their business, and exploring new network and connections channels. The pandemic also incentivised many people for the first time to use the Internet, which benefits digital businesses. On the other hand, from the negative consequences applied, such as the difficulty of finding skilled employees, the drop of the supply of production, the limitation of the available inputs and the high risk that business is running. Given that men still wield the majority of economic, social and political power, women's empowerment confined to same-gender contexts, such as telework from home, thus also risks perpetuating gender inequities outside of the workplace.

Government tools to accelerate Egyptian women's digital entrepreneurship

In 2021, in the Global Innovation Index (GII), Egypt ranked 94th out of 132 economies. Egypt's innovation outputs outperform its innovation inputs, ranking 102nd in terms of innovation inputs this year, higher than both 2020 and 2019, and 86th in terms of innovation production, which is a lower ranking than both 2020 and 2019. However, it ranked 13th out of 34 economies in the lower middle-income group and 17th out of 19 economies in Northern and Western Africa and Western Asia.

Fintech, which includes electronic payments for peer-to-peer transfers and bills, payroll, pension and social security

Figure 4. Egypt Global Innovation Index (GII)



Source: Dutta et al., 2020.

payments, business and online purchases, and smart wallets, has been booming in Egypt for more than a decade. Fawry was founded in 2008, and in 2020, as a tribute to the value of and need for financial inclusion, it became Egypt's first unicorn and the first tech firm to earn a \$1 billion valuation. The market capitalisation hit \$2 billion after around six months, making it the fourth largest listed firm on the Egyptian Stock Exchange in terms of valuation (Paracha, 2021).

Egyptians are still extremely reluctant when it comes to cash allocation in the project, especially since the real interest rate is still high. Moreover, the National Council for Payments has various roles, including decreasing the amount of cash being used outside of the banking sector, enhancing the payment system on a national system, and looking for financial inclusion. This can be enabled through the use of several policies, such as allowing the Ministry of Finance to disapprove any taxes and tariffs transferred independently of the banking system (Abdullah, 2020). A status quo pushes all Egyptian banking establishments to develop their banking systems. Those developments include better facilitation of online banking, contactless payments through e-wallets, and mobile bank transfers. Digitalisation of banking services in Egypt only started in mid-2019 and has since become a necessity for many during the lockdown. Egypt has made financial inclusion a priority in its long-term development strategy, with the Central Bank of Egypt (CBE) proposing measures to make electronic payments easier, thereby increasing point-of-sale (PoS) payments and ATM use (World Bank, 2020).

Egypt requires a strong, dynamic and enabling digital ecosystem at the country level, which includes high-speed Inter-

net at affordable prices globally, investment in human capital, especially digital skills, provision of digital platforms to connect businesses with consumers, provision of interoperable digital financial and payment services, digital identities and digitally literate consumers, a legal and regulatory environment, and an inclusive and innovative entrepreneurial ecosystem for digitalisation to realise its potential (Lukonga, 2020). The government's role during the crisis is seen as providing maintenance funds. Dvouletý et al. (2020) stress the positive impact of grants on company sustainability, total productivity and maintaining employability in Egypt, achieving positive results in entrepreneurship and start-ups thanks to concerted public and private sector efforts to create an environment conducive to the growth of women's start-ups, particularly in various technological fields.

Methods

This is an ex-post-facto study since it is based on an event that has already occurred and secondary data that is readily available. The main aim of this study is to further our understanding of the implications of increasing female labour force participation rates in the context of the Egyptian economy. This will be achieved by analysing, first, the socioeconomic drivers using women's education (EDU); second, government drivers using saving interest rate (SAV), and third, technological drivers using information communication technology imports (ICTM). The entire data source is from the World Bank Development Indicator. The study will cover the period from 1990-2020. In the model assessment, after interpreting the parameters and estimating the econometric model, further analysis is required to determine the significance of the model and the multicollinearity

and more indications that show the importance and vitality of our model. In this section, we did the stationarity test, correlation test, and Autoregressive Distributed Lag (ARDL) test.

$$EFEPR = \alpha_0 + \delta_1 EDU + \delta_2 INT + \delta_3 ICTM + \delta_4 SAV + \varepsilon_{it} \quad [1]$$

The variables used in the model are Egyptian Female Entrepreneurship

(EFEPR), which is used as a measure of the Egyptian female participation in the total labour market – dependent variable. While independent variables are secondary education (EDU), Egyptian imports from ICT goods (ICTM), individuals using the Internet (INT), and saving interest rate (SAV). For experimental analysis, the yearly time series data has been taken from the world development indicator database over the period 1990-2020.

Table 1. Variables

Variable	Description
Female entrepreneurship EFEPR	This indicator was chosen as it calculates the percentage of female employers as a percentage of the total female labour force in Egypt, which indicates entrepreneurship.
Education EDU	Percentage of females in secondary schools as according to the World Bank, most females who are enrolled in schools only get to finish their primary education.
Individuals using the Internet (% of population) INT	Internet users are individuals who have used the Internet (from any location) in the last 3 months.
Imports from ICT goods ICTM	Egyptian imports from ICT goods used to improve the digitalisation in Egypt.

Source: World Bank data base, 2021.

Data analysis method

This study used descriptive statistics, correlation matrix and ARDL model in testing the hypothesis. The result of the

descriptive statistics in Table 2 reveals the aggregative averages such as mean and median, and the measures of spread and variation, such as standard deviation.

Table 2. Summary statistics and correlation

	EFEP	EDU	INT	ICTM	SAV
Mean	3.518000	47.90195	23.28638	4.093643	16.76013
Median	3.525000	48.10298	20.80000	4.155560	17.22630
Maximum	6.490000	48.56597	57.28287	5.646769	23.62350
Minimum	1.940000	47.05282	0.641265	3.225590	9.593465
Std. Dev.	1.207157	0.487737	16.41535	0.593500	4.528285
Skewness	0.728918	-0.264451	0.367971	0.796874	-0.058964
Kurtosis	3.186775	1.613284	2.216851	3.645203	1.930448
Jarque-Bera	1.800140	1.835599	0.962444	2.463601	0.964874
Probability	0.406541	0.399397	0.618028	0.291767	0.617277
Sum	70.36000	958.0389	465.7276	81.87287	335.2026
Sum Sq. Dev.	27.68732	4.519859	5119.810	6.692610	389.6019
Observations	20	20	20	20	20

Source: Calculated by the author.

The correlation results suggested that all the variables had a negative relationship with Egyptian female entrepreneurial ac-

tivities, although imports of the ICT good saving rate had a positive relationship, see Table 3.

Table 3. Correlation

Correlation					
Probability	EFEPR	EDU	INT	ICTM	SAV
EFEPR	1.000000				

EDU	-0.708664	1.000000			
	0.0005	-----			
INT	-0.660543	0.781698	1.000000		
	0.0015	0.0000	-----		
ICTM	0.111069	-0.058342	0.402723	1.000000	
	0.6411	0.8070	0.0783	-----	
SAV	0.549388	-0.646417	-0.675705	-0.134883	1.000000
	0.0121	0.0021	0.0011	0.5707	-----

Source: Calculated by the author.

Findings of the study

The stability qualities of the variables used were initially explored in order to estimate equation 1. The Augmented Dickey-Fuller (ADF) and Philips-Perron (PP) tests were the two-unit root tests employed in the study. The PP unit root test has a higher reliability than the ADF, according to Hamilton (1994), since it is more resilient in the presence of serial correlation and heteroscedasticity, though it has its own drawbacks (Pesaran et al., 1999).

The unit root tests

The null hypothesis for the test (in ADF and PP) is that the data series under investigation has a unit root, which is compared to the alternative hypothesis that the series does not have a unit root (that is, it is stationary). The ADF and PP tests confirmed that EFEPR, EDU, ICTM, INT and SAV are non-stationary at their current values, as shown in Table 4. This is because at the 1% and 5% level of significance, we fail to reject the null hypothesis of unit root.

Table 4. Unit root tests

	Level		1st difference	
	Constant	Trend	Constant	Trend
EFEPR	-1.802173	-2.80702	-6.51011***	-6.379033***
EDU	-3.799724*	-2.593208	-5.329548***	-6.556487***
INT	4.301061	0.189516	-2.572467	-5.342175***
ICTM	-1.050616	-0.604523	-0.593318	-3.58713*
SAV	-1.731605	-1.5697	-4.21547**	-4.459899**

Source: Calculated by the author.

Notes: Values marked with *** represent stationary variables at 1% significance level, those with ** represent stationary at 5% and with * stationary variables at 10%. Numbers in the display are t-statistics.

The key justification for using the ARDL in this study is that the order of integration is no longer a sensitive problem, so it can be used regardless of whether the regressors are $I(0)$ or $I(1)$, as national income is typically non-stationary. The results of these tests (ADF and PP) indicate that we cannot reject the null hypothesis of the existence of a unit root at levels i.e. all the variables are non-stationary in their levels.

Bounds cointegration test

Following the application of unit root tests, Pesaran et al. (1999) developed the ARDL approach to determine the existence of a long-term relationship between economic growth and unemployment. Table 5 shows the results of the ARDL cointegration test.

The findings of the ARDL bounds test and the estimated F-test show that there

Table 5. ARDL bounds test results

Test Statistic	Value	Signif.	I(0)	I(1)
Asymptotic: n=1000				
F-statistic	4.474172	10%	2.2	3.09
k	4	5%	2.56	3.49
		2.5%	2.88	3.87
		1%	3.29	4.37

Source: Calculated by the author.

is a long-term link between variables. At a 1% level of significance, the decision rule is based on the F-statistics (4.474172), which is above the upper

bound critical value of 4.37. As a result, the null hypothesis of no cointegration is rejected. The results of the boundaries test match those of the other tests.

Table 6. Serial correlation

Breusch-Godfrey Serial Correlation LM Test:

Null hypothesis: No serial correlation at up to 2 lags

F-statistic	1.322230	Prob. F(2,10)	0.3094
Obs*R-squared	4.182795	Prob. Chi-Square(2)	0.1235

Source: Calculated by the author.

The autocorrelation is mainly a statistical expression of the degree of overlap between a given time series over consecutive time periods and a lagged variant of itself. According to the Breusch serial correlation test, the probability is 0.3587, which represents no serial correlation. To put it another way, there is no discernible relationship or pattern between a variable's current value and its value in past time periods. Positive serial correlation is shown by numbers closer to +1, whereas negative serial correlation is indicated by values between zero and -1.

Autoregressive Distributed Lag (ARDL)

Autoregressive Distributed Lag (ARDL) models are an integral part of estimating scientific processes over time. Coefficients tell us about the immediate effect of some variable but have little to say about the long-term effect. The results obtained in Table 5 confirmed that cointegration between the variables exists,

then the next step is to identify the long-run relation.

Results obtained confirm that a positive and significant relationship between education and Egyptian female entrepreneurship, and it was revealed that a unit increase in education will result in an increase of 3.88% in Egyptian female entrepreneurs. Moreover, there is a positive and significant relationship between imported ICT goods and Egyptian female entrepreneurs specifically. Results show that a unit increase in ICTM will result in a decrease of 1.08% on Egyptian female entrepreneurs. There is also a positive and significant relationship between saving rates and Egyptian female entrepreneurs. Results show that a unit increase in saving will result in an increase of 0.44% on Egyptian female entrepreneurs. The majority of micro and small businesses in low-income nations rely on global supply networks, which has harmed many small-scale enterprises, particularly after the devaluation, de-

spite the fact that the technology is available. In addition, only a small percentage of businesses rely on innovation. This necessitates the creation of novel intellectual property systems, developing national intellectual property policies and

processes to facilitate the creation and protection of intellectual property at the national level. Fostering these activities improves a country's potential to develop economically valuable intellectual property assets.

Table 7. Long run co-integration results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-171.8903	81.68926	-2.104197	0.0800
EFEPR (-1)*	-0.426324	0.178201	-2.392370	0.0539
EDU(-1)*	3.557857	1.684072	2.112652	0.0791
ICTM(-1)*	1.278805	0.718336	1.780231	0.1253
INT	-0.076866	0.042435	-1.811378	0.1200
SAV(-1)	-0.033609	0.059549	-0.564400	0.5929
D(EDU)*	3.882030	1.368645	2.836404	0.0297
D(EDU(-1))	1.718643	0.957093	1.795692	0.1227
D(ICTM)	-0.416834	0.440404	-0.946481	0.3804
D(ICTM(-1))*	-1.080199	0.443367	-2.436357	0.0507
D(SAV)*	0.445601	0.140203	3.178265	0.0191
D(SAV(-1))	0.262451	0.145205	1.807455	0.1207

* p-value incompatible with t-Bounds distribution.

$$EC = EFEPR - (8.3454*EDU + 2.9996*ICTM - 0.1803*INT - 0.0788*SAV - 403.1917)$$

Source: Calculated by the author.

Both Figure 5-a and 5-b below show that the cumulative sum and cumulative sum of square residuals lie within the 5% crit-

ical line of significance. This implies that there is stability in the model.

Figure 5-a. CUSUM Test

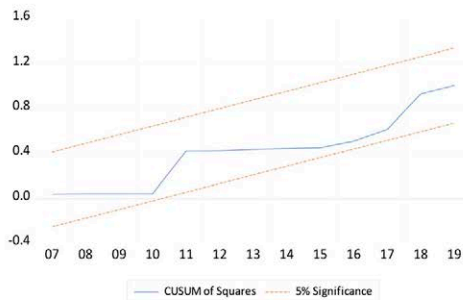
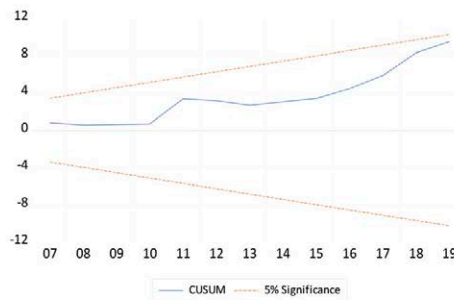


Figure 5-b. CUSUM squared Test



Source: Elaboration following author's calculation.

Conclusion

Egypt's digital transformation is an expensive process that requires development of the infrastructure. The Egyptian government adopts policies to foster transforming the country to become a digital economy. There are ongoing projects to provide rural areas with access to technology in terms of e-education, e-government, and e-health services.

However, unequal access to it will hinder the potential for effective use of inexpensive digitalisation, contributing to an unequal distribution of benefits. Individuals with minimal education, poor literacy, those living in rural areas, and those with weak connectivity, all of whom could be potential entrepreneurs but are unable to enter the market, may be omitted. Digitalisation would then have a disruptive influence on jobs and the skills required

by the market. Individuals who use the Internet have a negative but insignificant relationship with Egyptian female employers, according to the findings.

This helps in the development of a clear policy conclusion that promotes women's participation in the labour market, raises living standards, and so aids in the implementation of appropriate policies in Egypt. The study looked at whether the government's investment in digitalisation benefits SMEs by helping to provide chances for them to operate and compete.

While education is important in improving Egyptian women's performance, women's education has an impact on entrepreneurs. It is also a motivator, as technological abilities raise the bar for small enterprises to grow into large corporations.

These results provide the policy-makers with a better understanding of the key drivers to make female entrepreneurship grow. Policy-makers should develop undergraduate curricula and link them with existing business opportunities in artificial intelligence and digitalisation. The government needs to provide free Internet to accelerate education and learning, and since nothing is for free this will provide more data analysis to develop other services and other activities. Providing free Internet will boost the possibilities for women to join formal markets and generate more value inside the business cycle.

The challenges ahead are significant, and policy-makers are urged to adopt new approaches to stimulate female entrepreneurship that endorse a thorough consideration of digital aspects. Policy initiatives require consideration of the social, economic and cultural context in which female entrepreneurship intersects with digital engagement. Developing countries face challenges, not limits, in terms of the digital gap and public data privacy. Planners and decision-makers must adopt policies, employ tools, and consider legislative, economic and social issues, such as rates of technology knowledge, public interest and trust. It is critical in order to boost public engagement in urban development, not just in rules and legislation but also in making it apparent and operational.

The study showed that five main reasons allowed women to develop their investment ideas and open the door for the possibility of Egyptian female entrepreneurship and economic independence. These reasons are the digital development of e-commerce markets, trade fairs held by government agencies special-

ised in supporting national businesses, the organisation of workshops and training programmes to enhance women's knowledge of establishing successful business activities, the launch of social associations for businesswomen, as well as development programmes to support women's businesses represented by domestic projects.

Furthermore, the government should provide more support for women's integration into the labour force after this pandemic in different ways: the first is the launch of a national programme to build women's capacity and increase their competitiveness in the labour market, specifically in continuing to help sectors such as ICT flourish; second, the reformulation of the system of prevailing values that prevent women's empowerment through information campaigns that use the lessons learned from this pandemic to help reshape people's public awareness; third, the conduct of surveys and public opinion surveys that provide gender-detailed data as up-to-date inputs to the policy-making process and the evaluation of interventionist actions; fourth, decision-makers in Egypt and neighbouring countries, especially countries that receive migrants, must coordinate by providing a package of assistance policies to support small projects through training, financial support and providing support programmes for them. Such policies would encourage them not to emigrate by providing job opportunities in the home country. In addition, a hotline in each governorate should be provided to respond to inquiries and suggestions of Egyptians returning from abroad who wish to learn about available job opportunities as well as investment opportunities and areas of SMEs in cooperation with state ministries.

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