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Digital Technology and Inequality: The Impact on Arab Countries

Shahid Yusuf

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Send correspondence to:
Shahid Yusuf
Chief Economist, Growth Dialogue, George Washington University
shahid_yusuf@hotmail.com

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Abstract

The focus of this paper is on whether and how digital technologies could lead to a change in inequality over the course of the next decade. The paper is divided into five sections. Section 1 reviews the literature on the international experience with the diffusion of digital technology and trends in key macroeconomic variables, in particular: productivity, the displacement of labor, the worldwide trend in inequality, and how this affects growth. Much of the research is on advanced countries. Nevertheless, it can provide a window into the likely medium- and longer-term trends in Arab countries where digitalization advances. Section 2 examines the spread of digital technology in Arab countries and the impact of digitalization on inequality. As there is considerable heterogeneity among Arab countries, the section differentiates countries according to their capacity for absorbing digital technology. The potential impact of digital technology on jobs and wages in Arab countries and some comparators is tackled in section 3. Section 4 assesses the actual impact on inequality in the recent past and what is probable over the longer term. Section 5 presents suggestions on how Arab countries could maximize the gains from the new technology and cushion the effect on jobs and inequality. Finally, section 6 concludes.

Keywords: Digital technology, Inequality, Arab countries, Impact of technology on jobs and wages

JEL Classification: O3, O4

Introduction

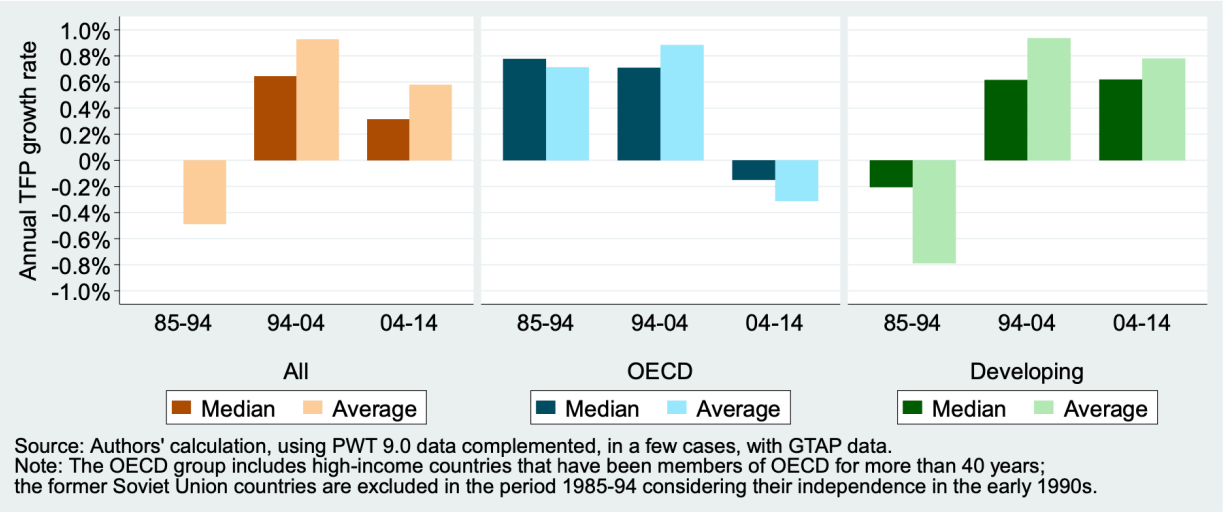
Material progress and rising per capita incomes since the late nineteenth century can be traced, for the most part, to gains in productivity.[1] At the heart of this process of economic betterment lies the discovery of new ideas[2] embodied in general purpose technologies (GPT). Electricity and internal combustion engines were among the earlier GPTs, and others have followed. Digital technologies, which include computerization, the Internet, and other electronic marvels, entered the GPT pantheon in the last quarter of the twentieth century. Since then, digital technologies have diffused into every corner of the economy. The automation of production processes, proliferation of web-based services, and increasing use of AI/machine learning enabled by Big Data, the Cloud, and superfast computers are ushering in an era in which machines are able to effectively displace humans in a wide range of routine and cognitive tasks and are beginning to make inroads into professions.[3] This has raised both expectations and fears. The expectation is that the digital GPT will generate the productivity and growth acceleration that followed within two or three decades of the introduction of earlier GPTs. It can do this by reducing the cost of creating, distributing, and promoting new high-value products. The fear is that, as machines take over an increasing number of tasks, occupations would begin to disappear, some types of work would become deskilled (as happened in the course of the First Industrial Revolution), and the world of work would change; job opportunities would become scarce and more polarized and incomes would become more unequal.[4] In Arab countries, where unemployment – both open and disguised – is already high, digital technologies could exacerbate inequality. The focus of this paper is on whether and how digital technologies could lead to a change in inequality over the course of the next decade.

The paper is divided into five sections. Section 1 reviews the literature on the international experience with the diffusion of digital technology and trends in key macroeconomic variables, in particular: productivity, the displacement of labor, the worldwide trend in inequality, and how this affects growth. Much of the research is on advanced countries. Nevertheless, it can provide a window into the likely medium- and longer-term trends in Arab countries where digitalization advances. Section 2 examines the spread of digital technology in Arab countries and the impact of digitalization on inequality. As there is considerable heterogeneity among Arab countries, the section differentiates countries according to their capacity for absorbing digital technology. The potential impact of digital technology on jobs and wages in Arab countries and some comparators is tackled in section 3. Section 4 assesses the actual impact on inequality in the recent past and what is probable over the longer term. Section 5 presents suggestions on how Arab countries could maximize the gains from the new technology and cushion the effect on jobs and inequality. Finally, section 6 concludes.

1. Digital technology, productivity, growth and jobs: The developed country perspective

After more than four decades, neither the expectation of more rapid growth nor the fear of massive job displacement has been realized. Digital technologies have diffused faster than other GPTs, but the anticipated productivity gains have yet to materialize.[5] Mature economies, which have rapidly assimilated digital technologies, have experienced synchronized declines in productivity growth since the 1980s.[6] Recovery from the financial crisis was notably slower and weaker than recoveries from past recessions in the United States and in Europe.[7] The slump in productivity following the financial crisis of 2008-2009 was the most severe, and the productivity slowdown lasted longer than any time in the past (Figure 1). Although employment had recovered by 2018-2019, there was little increase in real wages; in part because there are fewer well remunerated jobs in manufacturing industries for the unskilled and semi-skilled, and the jobs available in services for such workers pay lower wages.[8]

Figure 1. Annual TFP growth in OECD countries and EMDEs (median and averages)



Source: Authors' calculation, using PWT 9.0 data complemented, in a few cases, with GTAP data.
Note: The OECD group includes high-income countries that have been members of OECD for more than 40 years; the former Soviet Union countries are excluded in the period 1985-94 considering their independence in the early 1990s.

Source: Kim and Loayza (2019). Productivity Growth. http://documents1.worldbank.org/curated/en/130281557504440729/pdf/Productivity-Growth-Patterns-and-Determinants-across-the-World.pdf

The experience of the United States underscores the modest productivity outcomes of digital technologies to date. Over a 50-year period starting in 1967, total factor productivity (TFP) in the United States has trended downward. From an average rate of 0.68 percent per annum between 1985 and 1995, TFP rose to 1.52 percent between 1996 and 2004[9] before falling back to 0.55 percent per annum during 2004-2016 and below 0.5 percent between 2017 and 2019. In the EU, for example, productivity remains in the doldrums.[10] European countries started out at a lower rate but, with productivity gains largely erased in the decade following the financial crisis and the Great Recession that followed in its wake,[11] the estimates made using the EU-KLEMS database show that TFP was increasing annually at a rate of 0.65 percent between 1985 and 1995. It then fell

fractionally to 0.43 percent between 1995 and 2007 and slid further to an annual rate of 0.23 percent from 2007 to 2015.[12]

A decline in the share of manufacturing in GDP has been ongoing in the US since the mid 1990s – and, to a lesser extent, in Germany and Japan as well – but this alone may not account for a weakening of growth performance.[13] Productivity growth in manufacturing has slowed in all three countries since around 2004 (Baily, Bosworth, and Doshi 2020).[14] However, hope springs eternal. For mature economies and EMDEs such as China, sustaining growth and high levels of employment are among the principal objectives over the next several decades. Digital technologies and other GPTs in the wings could serve as the drivers of productivity.

1.1. GPTs displacing labor: Is it different this time?

Every new technology has given rise to fears of job losses and that countries would be saddled with armies of unemployed workers and rising inequality.[15] However, each time around, higher productivity raised per capita incomes, generated demand, and created jobs. New occupations widened employment opportunities. Although the pace of growth following the onset of the First Industrial Revolution in the late eighteenth century was slow, it did pick up speed starting the 1820s.[16] Growth responded more quickly to the Second Industrial Revolution in the latter part of the nineteenth century, which ushered in GPTs such as electricity and the internal combustion engine. Growth was even more responsive to the Third Industrial Revolution after World War II. Nevertheless, new technologies continue to evoke fears of irreversible job losses and revive memories of the Luddites who, over a three-year period (1811-1813), attempted to slow the march of mechanization by destroying textile-making equipment.[17] Digital technologies have evoked similar sentiments; there is worry that with the influx of robot capital, most production line and farming jobs will disappear; increasing the number of jobs in the services sector as well.

These recent fears have been fanned by a slew of projections. Frey and Osborne (2017) estimated that digital technologies could, in principle, displace 47 percent of workers in the United States spread across 702 occupational groupings.[18] Automation in all its guises could put 25 percent of jobs at high risk in the United States according to Muro et al. (2019)[19] and 36 percent at moderate risk. More than a third of jobs could be imperiled in Finland, along with 59 percent in Germany and between 45 percent and 60 percent in Europe.[20] A report by McKinsey Global Institute (2017)[21] projected the loss of 30 percent of jobs to automation worldwide by 2030, with 375 million workers affected. The nearly 2,000 experts surveyed by Pew also concluded that large numbers of occupations would shed jobs.[22] An OECD study (2018)[23] painted a more sanguine picture; claiming that there is wide regional variation in the number of jobs at immediate risk – from four percent in Oslo to 40 percent in West Slovakia. Jobs in factories that absorb the unskilled and those with high school education or less are decreasing even though the volume of manufacturing output is increasing.[24] Overall, some 20 million jobs could be lost to robots worldwide with each robot eliminating 1.6 workers (another estimate by Acemoglu and Restrepo

estimates job losses of 3.9 workers per robot).[25] Robotization reduced manufacturing employment by 275,000 between 1994 and 2014, but in this case, the displaced workers were absorbed into other jobs in their workplace. New entrants who would have joined the factory workforce found employment in services, which averted a net loss of jobs.[26] Furthermore, there is an additional wrinkle to the automation story. One side effect is a partial deskilling of the workforce with a number of craft skills becoming redundant;[27] more time is spent monitoring machines than in actually making things.[28]

In a *World Without Work*, Daniel Susskind (2019)[29] foresees continuing "task encroachment." He maintains that advances in AI will begin displacing jobs done by professional and skilled workers as well,[30] with more jobs lost through substitution than will be replaced through machine-labor complementarity.[31] The minority who will work with machines, write the algorithms, train the neural network learning programs, and invent, design, and engineer the hardware that undergirds digital technologies are going to need increasingly specialized, tertiary level skills, with STEM skills in highest demand (Blanas et al. 2019; Morikawa 2017).[32] Berg et al. (2018)[33] offer corroborating evidence showing that automation can raise productivity but, by displacing labor, it depresses wages and worsens inequality.

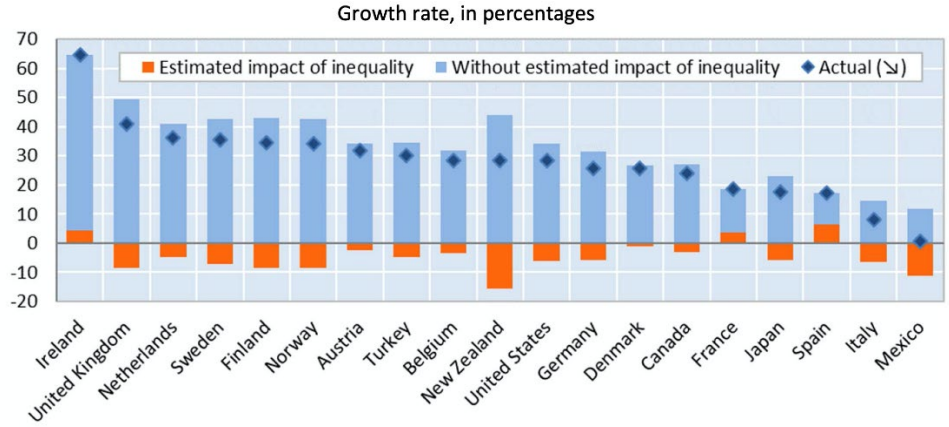
Whether the projected displacement of jobs comes to pass remains to be seen. Research has not uncovered a significant winnowing of jobs in either advanced or developing countries. There has been displacement, but nothing that approximates the projections. However, in a few advanced economies, the combined effects of technology, globalization, and other factors have increased inequality, and the share of labor in GDP has drifted downward worldwide.[34] But, research remains equivocal on causation. In Japan (and Germany) for example, robot intensity appears to have stimulated demand for labor, or at least has not resulted in a net reduction.[35] The research of Klenert et al. (2020)[36] on the EU concludes that the increased use of robots does not lead to a decline in employment in general and low-skill employment in particular. Based on the survey of adult skills (PIAAC), a report from the OECD concluded that only about nine percent of jobs were at high risk (M. Arntz et al. 2016).[37] A study focused on the United States by Mann and Puttmann (2017)[38] found that commuting zones generating more AI patents experienced an increase in employment overall, although factory employment fell. Services were the big gainers. PwC (2018)[39] projects the net creation of 93 million jobs in China by 2037; substantially offsetting the jobs lost.

Past shocks did disrupt the labor market, but these disruptions were transient in nature – although the post financial crisis recession germinated populist and nativist sentiments in western countries that have not subsided. Laid off workers and new entrants were eventually absorbed by expanding activities, but the political ripples have not died out.[40] The optimistic assumption is that the past will be the prologue. Technology will not cause extensive unemployment because new opportunities will emerge,[41] although occupational polarization and greater income inequality

cannot be ruled out (OECD 2016).[42] Displaced workers will be absorbed by changes in the structure of demand into different jobs, some of which will be newly emergent (Bessen 2019).[43] The analysis and management of large data sets and other IT-related activities may multiply. Healthcare, personal, and leisure services are other areas where job growth is likely. This optimism has been tempered by the COVID-19 pandemic, which has severely impacted employment. While many of these jobs could come back, automation and AI could reduce the total. The bigger worry is that the lingering effects of the pandemic could presage a decade of slow growth, especially in countries where the incidence of inequality is high.

Theoretical investigations surveyed by Erhart (2009)[44] suggest that an unequal distribution of income and wealth could hamper growth – a worry for Arab countries. Slower growth could, in turn, worsen inequality if it constrains productivity and income earning opportunities for households in lower income categories. According to suggestive but not entirely conclusive empirical research, inequality is a brake on the rate of growth and on its durability.[45] As Dabla-Norris et al. (2015)[46] note: "If the income share of the top 20 percent (the rich) increases, then GDP growth actually declines over the medium term, suggesting that the benefits do not trickle down. In contrast, an increase in the income share of the bottom 20 percent (the poor) is associated with higher GDP growth." Other research by the IMF (2017)[47] concludes that the persistence of growth can be undercut by political and economic crises that can be caused by worsening inequality. The OECD (2014)[48] estimates that the three percentage point average increase in the Gini coefficient across OECD countries has reduced GDP growth by 0.35 percent per annum for a period of 25 years (Figure 2). Supporting evidence comes from Panizza (2002), Ostry et al. (2014), Cingano (2014), and van der Weide and Milanovic (2018).[49] However, not all the cross-sectional evidence bears this out.[50] The outcomes appear to vary across regions; the relationship varies over time, is non-linear, and can vary depending on the index of inequality. Although "the median response of real per capita GDP growth to shocks in income inequality is negative and significant for the full sample, the dispersion around the estimates is large, with at least one fourth of the countries in the sample presenting a positive effect, the negative median effect is driven by the Middle East and Central Asia and the Western Hemisphere. Across income levels, only the findings for emerging markets indicate that more inequality slows economic growth" (F. Grigoli et al. 2016).[51] Growth in countries with high levels of income inequality can be more unstable and recessions can persist for longer periods (Morelli 2017).[52] While a case can be made on both social and economic grounds to contain or reduce inequality, the relationship between inequality and growth deserves further empirical attention.

Figure 2. The effect of change in inequality in 1985-2005 on subsequent cumulative growth 1990-2010

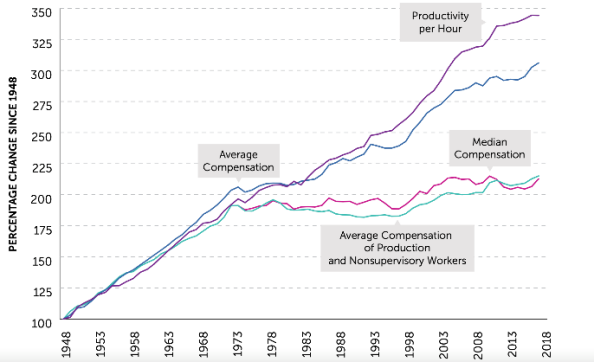


Source: OECD (2014). https://www.oecd.org/social/Focus-Inequality-and-Growth-2014.pdf

1.2. Where is inequality heading worldwide?

The fear that digital technologies will decimate blue and many white-collar jobs alike may have been unfounded thus far, but the spread of digital technology may be responsible for quickening another trend, which is the widening gap between the upper quintile of income earners and the rest, or what has come to be known as the "great divergence" (Figure 3).[53] In mature economies, the past decade witnessed the emergence of lower paid, less secure, and less regulated "gig" type jobs and "crowdworking";[54] a shrinking of the industrial blue-collar workforce and a concern that the middle class is hollowing because of encroachment by digital technologies (OECD 2019).[55]

Figure 3. Productivity and compensation growth in the United States

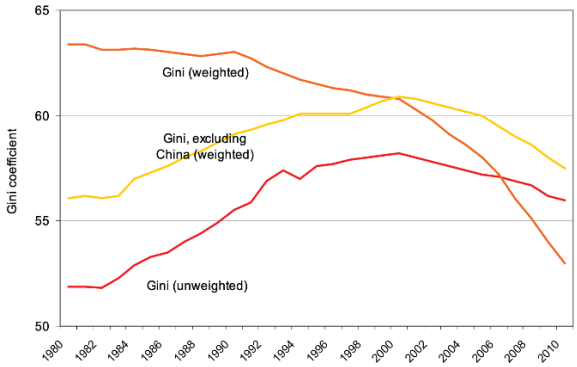


Source: D. Autor et al. (2020) https://workofthefuture.mit.edu/wp-content/uploads/2021/01/2020-Final-Report4.pdf

Global inequality measured by the (unweighted and weighted – excluding China) Gini coefficients rose during 1980-2000 and declined through 2010 (Figure 4).[56] Income growth in China and India contributed substantially to the (weighted) decline from the early 1980s.[57] Intra country inequality (again measured by Gini coefficients) is a mixed bag:[58] the average for EMDEs is 40 percent. Inequality has declined in some Latin American countries but has risen in others such as China, Indonesia, some of the African countries, and in many of the developed economies, such as the United States, for example.[59] On balance there is a modest degree of convergence in inequality:

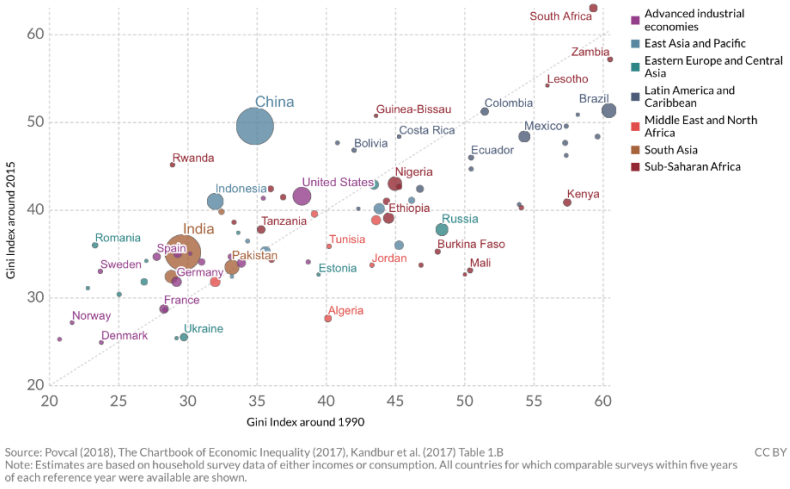
those with a Gini coefficient in excess of 40 did not experience much increase while those below 40 did not benefit from a decline (Figure 5).[60]

Figure 4. International income inequality



Source: UN (2013). Inequality Matters https://www.un.org/esa/socdev/documents/reports/InequalityMatters.pdf

Figure 5. Inequality in 1990 and 2015 as measured by Gini Coefficient

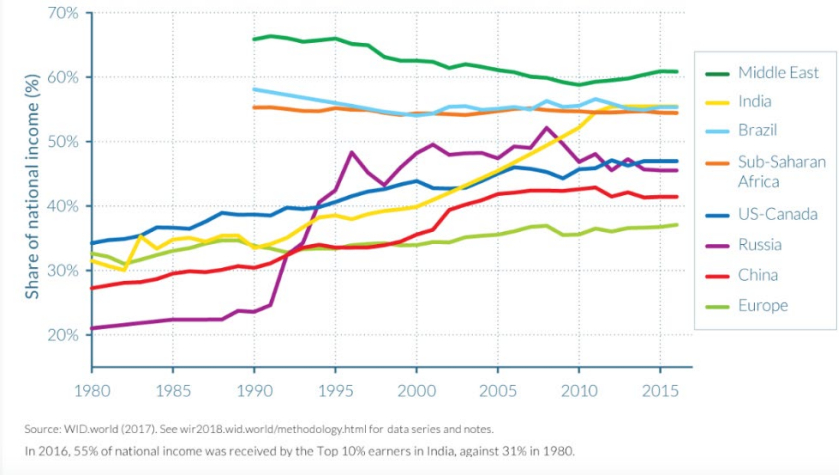


Source: Povcal (2018), The Chartbook of Economic Inequality (2017), Kandbur et al. (2017) Table 1.B CC BY
Note: Estimates are based on household survey data of either incomes or consumption. All countries for which comparable surveys within five years of each reference year were available are shown.

Source: Our World in Data. https://ourworldindata.org/income-inequality-since-1990

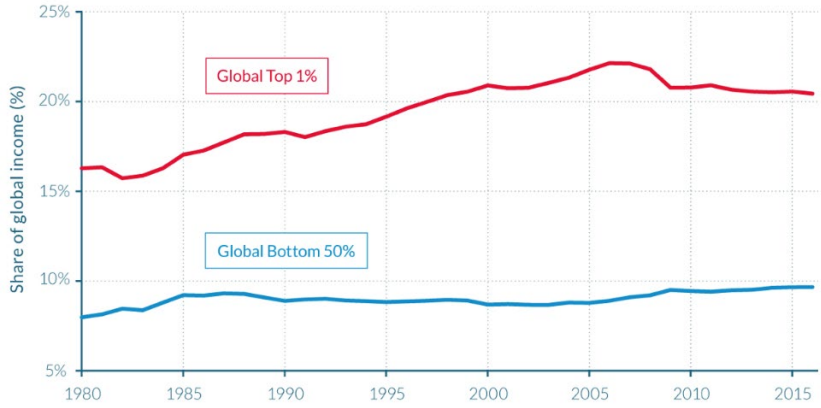
Measured by the share of income accruing to the top 10 percent of earners, the evidence through 2015 points to rising inequality, most notably in North America, China, India, and Russia. The shares are also largely unchanged in SSA, Europe, and some Latin American countries (Figure 6).[61] However, the share of income accruing to the top one percent of income earners has also climbed since the 1980s, while that of the bottom 50 percent has flatlined (Figure 7).

Figure 6. Income shares of top 10 percent: 1980-2016



Source World Inequality Report (2018). https://wir2018.wid.world/executive-summary.html

Figure 7. Income shares of top 1% and bottom 50%



Source: World Inequality Report (2018). https://wir2018.wid.world/executive-summary.html

The COVID-19 pandemic could result in an increase in both international and intra country inequality depending on the pace of global recovery in growth and trade, the implications for GVCs, how it impinges on the demand for petroleum, and if it accelerates the diffusion of labor displacing digital technology.[62] Global inequality could worsen if poverty deepens in the majority of EMDEs and even if a number of East Asian countries are able to limit the damage and recover fairly quickly.[63]

2. Digital technology and inequality: The Arab experience

Inequality is attracting the attention of politicians and researchers in several Arab countries as poverty and precarity (the size of the vulnerable population) is on the rise because of the slow growth in productivity and GDP, the inadequacy of the social safety net, and the poor quality of public services. Intergenerational mobility is waning and there are fewer job opportunities for those in lower quintiles whose numbers are increasing.[64] The hope is that the spread of digital technology could improve productivity and even narrow income differentials, although that would

depend on the coordinated implementation of macroeconomic, education, and labor market policies.[65] A McKinsey report (2016)[66] on the Middle East indicated that the region could add nearly four percent of GDP by fully exploiting the potential of digital technology. In addition, Bohsali et al. (2017)[67] found that less than two percent of the Gulf Cooperation Council (GCC) workforce were holding digital jobs compared to the EU average of 5.4, with considerable room for enlargement.

The COVID-19 pandemic has introduced new uncertainties. By sowing uncertainty, it could depress investment in more productive industries and constrain reallocation.[68] As noted by the World Bank (2020): "The widespread restrictions that have been introduced to combat the COVID-19 pandemic may damage within-sector productivity through its impacts on health, business models, and workplace practices." Much depends on the speed, strength, and persistence of global recovery. How the Arab countries fare will depend on a number of factors. Oil prices will affect the leading exporters of petroleum products, while the recovery of tourism, the demand for labor in the GCC countries, FDI, and the return flow of remittances will determine household incomes in Jordan, Lebanon, the North African countries, and Yemen.

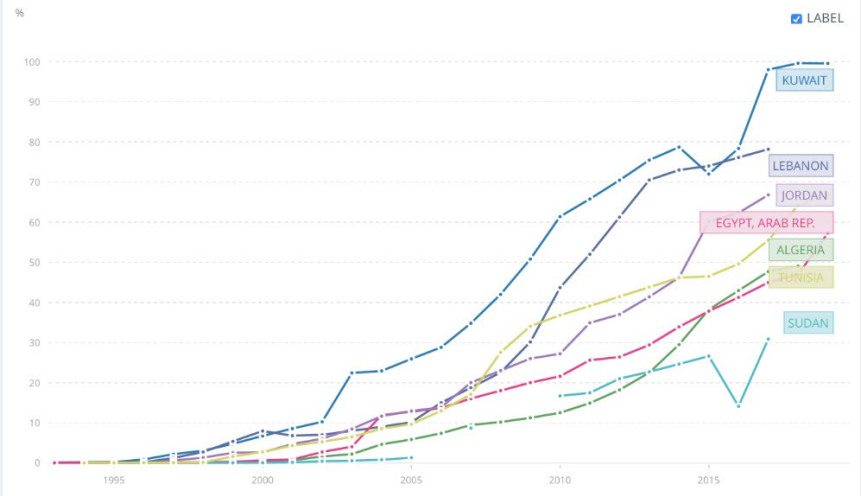
2.1. Differentiating and benchmarking Arab countries

In light of the heterogeneity of Arab countries, the spread of digital technologies and its implications for inequality vary considerably. The 22 Arab countries can be subdivided into three categories according to their potential for absorbing technology during the decade of the 2020s.

Heading the list are the high-income GCC countries: Saudi Arabia, the UAE, Bahrain, Kuwait, Oman, and Qatar, with the human resources (national and immigrant) and capital to exploit digital technologies. Next come five middle-income countries, which have established a base of manufacturing and tradable services and are positioned to take advantage of digital technologies in order to improve their growth prospects. This group includes Egypt, Jordan, Morocco, Tunisia, and Algeria. That leaves several others that are low on the income and development scale – Somalia, Sudan, Mauritania, Djibouti, and Comoros – or countries in the grip of sociopolitical turmoil or a severe economic malaise exacerbated by political divisions. The former includes Yemen, Syria, and Libya, while Lebanon falls into the latter category. Iraq straddles both categories.

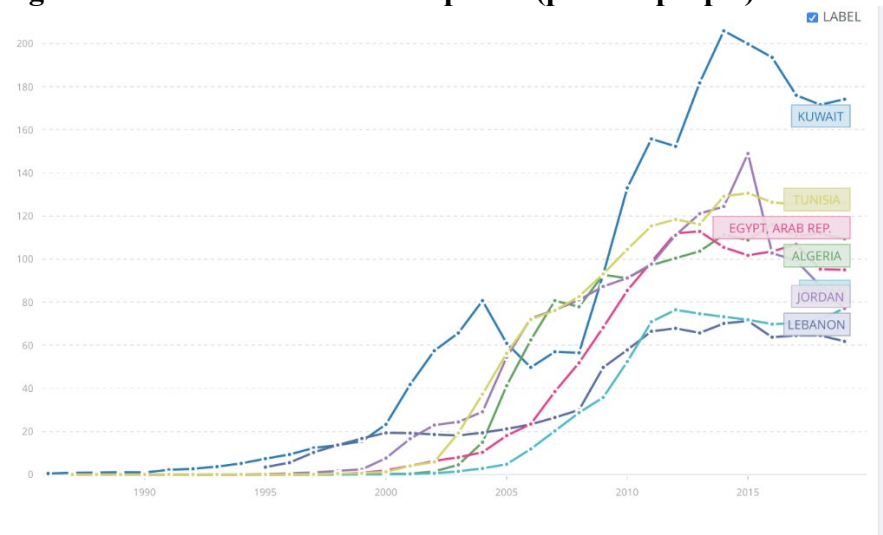
A benchmarking[69] of these countries using two indicators of digital technology usage (the Internet and mobile devices) shows that the GCC countries clearly lead the field followed by the middle-income industrializing ones. The low-income and "troubled" countries barely make the cut and their entry into the digital economy lies far in the future (Figures 8 and 9).

Figure 8. Individuals using the Internet (% of population)



Source: WDI

Figure 9. Mobile cellular subscriptions (per 100 people)



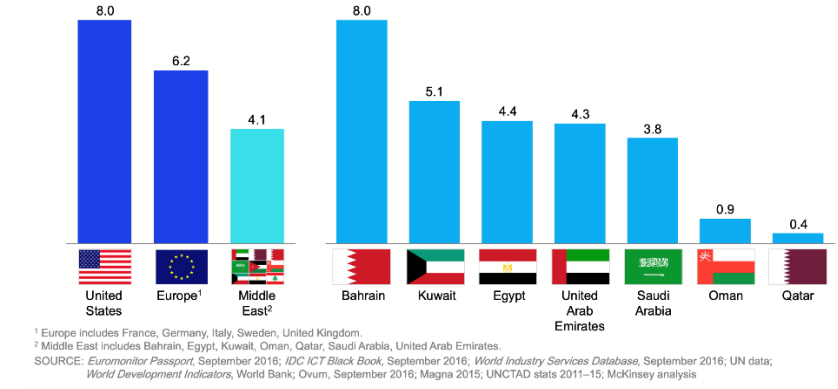
Source: WDI https://data.worldbank.org/indicator/IT.CEL.SETS.P2?locations=KW-DZ-LB-EG-SD-JO-TN

Additional insight can be gleaned from a McKinsey report that brings out the variation among countries ranging from middle-income ones, such as Egypt and Jordan, and high-income GCC countries (Figure 10). Only the latter have made deep inroads into digitalization. From Oman downwards, all have catching up to do before they reach Malaysia's level. In addition, all the Arab countries are deficient in ICT supply and innovation. However, the contribution of the digital economy to GDP is inching upwards and is conspicuously high in Bahrain (Figure 11).

Figure 10: Ranking of countries by overall digitization (red = low, green = high)

Source: McKinsey (2016). https://www.mckinsey.com/~/media/mckinsey/featured%20insights/middle%20east%20and%20africa/digital%20middle%20east%20transforming%20the%20region%20into%20a%20leading%20digital%20economy/digital-middle-east-final-updated.ashx

Figure 11: Contribution of digital economy to GDP



Source: McKinsey (2016). https://www.mckinsey.com/~/media/mckinsey/featured%20insights/middle%20east%20and%20africa/digital%20middle%20east%20transforming%20the%20region%20into%20a%20leading%20digital%20economy/digital-middle-east-final-updated.ashx

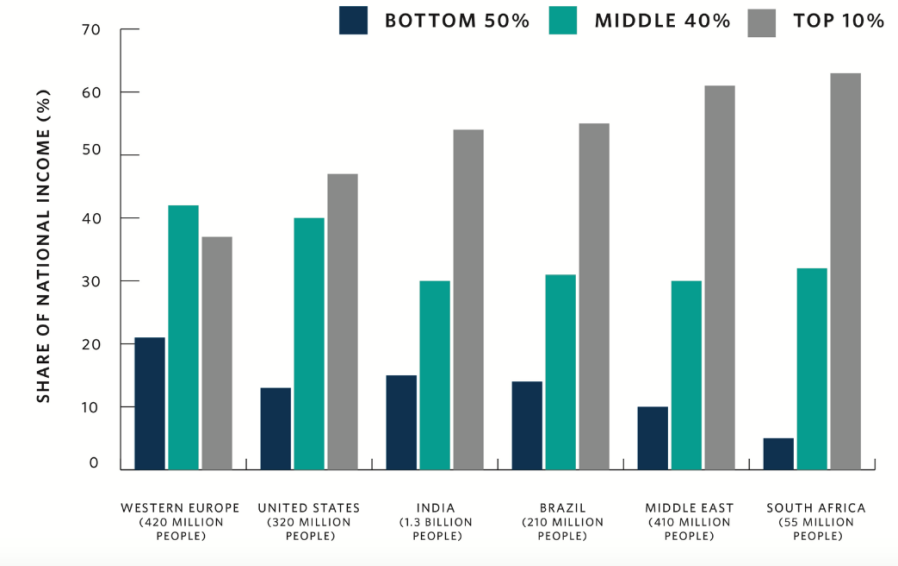
The diffusion of digital technology is greatest in the GCC countries and declines in the low-income countries least exposed to digitalization and the inequality arising therefrom. This provides a snapshot of digitalization in a subset of the Arab countries excluding all the low-income ones.

How digital technology, which gained momentum from the turn of the century, has affected inequality in Arab countries is not easy to disentangle from other factors. Only economies higher up the income ladder may have experienced any change. Hassine (2017) observes that "inequality has been prominent in the debates surrounding the events in the Arab region…[and] the demand for more equity and inclusion has [been the focus of] Arab governments' attentions. Although a number of studies have investigated inequality and its determinants for some Arab countries, the literature on this issue remains limited."[70] Gender inequality has also received considerable attention. This affects workforce participation by women with equivalent or better qualifications than men. However, (patriarchal) social norms and institutions have slowed progress.[71] The average Gini coefficient for the Arab countries was 36 percent[72] below the global average of 38.5 percent (Shaban 2016; Ianchovichina 2015; Figure 12).[73] However, when measured by the share of income accruing to the top ten percent of earners in 2015, inequality in Arab countries (undoubtedly skewed upwards by the inclusion of the GCC countries) is the highest for any region, with 64 percent of the pre-tax national income accruing to the top ten percent.[74] Thirty percent accrues to the middle 40 percent while the bottom 50 percent capture ten percent (ESCWA 2019 and Figure 13).[75] Country-level data present a somewhat different picture (muddied by varying estimates and questions raised regarding the quality of the statistics). Income accruing to the top ten percent of income earners in Egypt was 27 percent in 2004 and was unchanged in 2017, with a dip in between. It was 28 percent in Jordan in 2006 and the same in 2015. Tunisia saw the share of the top ten percent fall from 29 percent in 2005 to 26 percent in 2015. The 32 percent share of the top earners in Morocco remained the same between 2000 and 2013.[76] Among the GCC countries, the wealthiest in the Arab world, inequality is highest in Qatar and lowest in Bahrain (Figure 14). It is important to note that this regionwide distribution (with all relevant qualifications pertaining to sample bias and data quality) appears to have remained relatively stable between 2000 and 2016.[77]

Figure 12. Inequality in Arab countries measured by Gini coefficient

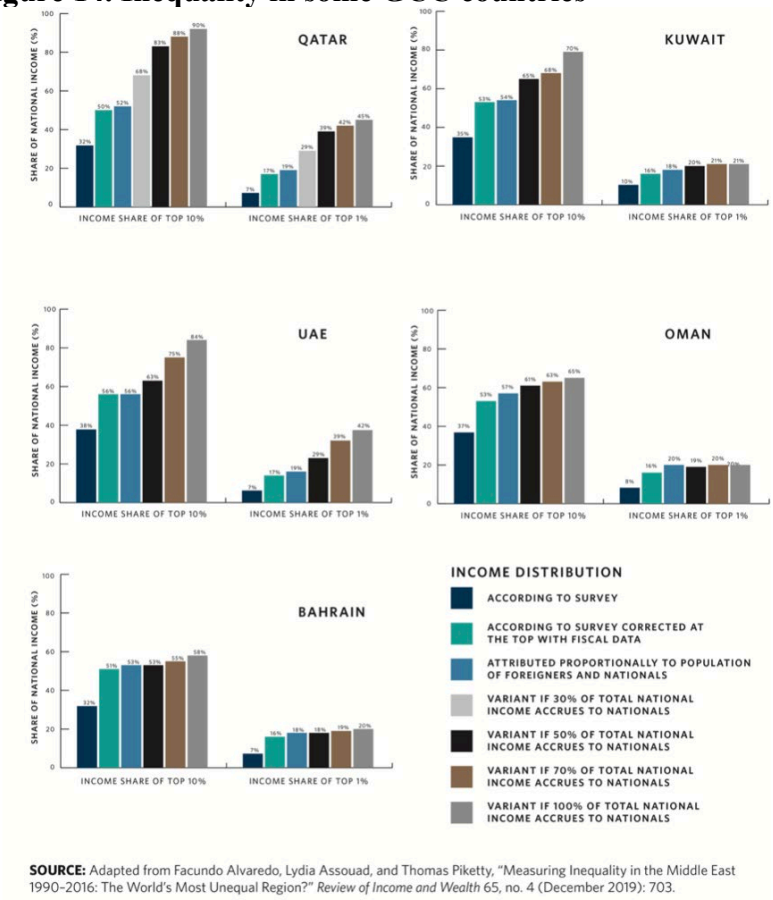
Source: UN ESCWA (2019). Rethinking Inequality in Arab Countries. https://www.unescwa.org/sites/www.unescwa.org/files/uploads/rethinking-inequality-arab-countries-summary-english.pdf

Figure 13. Income inequality in the Middle East compared with other unequal countries



Source: L. Assouad (2020). https://carnegie-mec.org/2020/03/12/inequality-and-its-discontents-in-middle-east-pub-81266

Figure 14. Inequality in some GCC countries



SOURCE: Adapted from Facundo Alvaredo, Lydia Assouad, and Thomas Piketty, "Measuring Inequality in the Middle East 1990–2016: The World's Most Unequal Region?" *Review of Income and Wealth* 65, no. 4 (December 2019): 703.

Source L. Assouad (2020). https://carnegie-mec.org/2020/03/12/inequality-and-its-discontents-in-middle-east-pub-81266

High and persistent inequality can be socially disruptive and damaging for the economy. Social justice, solidarity, and social cooperation suffer; weakening the glue and the bonds that holds societies together.[78] The emergence of a narrow plutocracy[79] risks deepening social divisions, leading to the accumulation of political tensions and a socially fissured society.[80]

2.2. Causes of inequality

What accounts for the persistence and, in some countries, the upward creep of inequality? The point of departure of current theorizing and empirical work is a paper by Kuznets (1955)[81] positing an inverted U-shaped relationship between development and income inequality. Kuznets hypothesized that, as countries developed, inequality would at first increase, and – after peaking at a middle-income level – begin to decline as countries enter the upper middle-income classification. This is broadly what has been observed in Asia, with growth rates approximately tracking the U shared relationship (Ota 2017).[82] The inverted U was eclipsed by the increasing inequality in advanced economies and superseded by other hypotheses.[83] Milanovic (2016)[84] maintains that a second Kuznets wave began gathering strength from the turn of the century, propelled by a number of factors affecting both developed and developing countries.

The factors adduced to explain global and intra-country trends inequality include:

- Globalization of trade and capital flows.[85]
- Technological change:[86] skill biased automation, diffusion of AI, and other cost-reducing digital technologies.[87]
- Financialization:[88] Rent-earning opportunities, high salaries, and bonuses accruing to a minority of managers and partners.
- Business concentration, emergence of winner-take-all superstar firms.
- Decline or repression of unionization and labor's bargaining power.[89]
- Political influence of finance and business interest groups that leads to manipulation of tax and trade policies favoring particular industries and individuals.[90]
- Unequal access to education and the poor quality of education, as well as inadequate public services and social safety nets.[91]

2.3. Is digital technology the principal driver of inequality in MENA countries?

The evolution and spread of IC/digital technologies facilitating the management, coordination, and monitoring of dispersed operations promoted the global operations of multinational corporations and the entrenching of GVCs. It contributed to the efficiency of logistics and to trade facilitation.[92] Online access enabled firm-level participation in e-commerce. This has transferred jobs from industrialized countries to emerging economies, with some of the Arab countries profiting from wage arbitrage. Countries such as Egypt, Morocco, Tunisia, and Oman have been among the recipients of investment in manufacturing and tradable services, which has raised exports and buoyed wages in these sectors.[93] However, these countries have not succeeded in entering into the export-led growth spiral that was responsible for the relatively inclusive prosperity achieved by East Asian economies. The modest and declining share of manufacturing in these countries (14-16 percent of GDP) and the pressure exerted by globalization has largely dampened an increase in wages – as these are set in Bangladesh, Vietnam, and China. The ratio of exports to GDP range from 19 percent (Egypt) to 50 percent (Tunisia), with only Morocco (39 percent) on a rising trend. In comparison, East Asian countries integrated with GVCs have higher ratios, such as Vietnam (107 percent), Thailand (60 percent), and Malaysia (65 percent).[94]

Digital technologies are among the factors – but by no means the only one – contributing to income and wealth inequality during the past two decades. By facilitating the globalization of trade and capital flows, digital technologies have further exposed firms worldwide and in Arab countries to competitive pressures, forcing some to exit the market and discouraging new entry. This has resulted in the slower growth of the non-energy sector and greater market concentration, with larger, sheltered public and private firms surviving. One consequence is that the formal sector is generating fewer jobs, therefore forcing the unemployed and newcomers to seek low paid informal work. Another consequence is that the weakening demand for labor limits the ability to bargain for higher wages. A third consequence is that poor job prospects also erode the incentive to invest

in education and skills; compounding the skill deficit resulting from the unequal access to education and the poor quality of the training imparted.

Meanwhile, the most talented, highly-skilled, and mobile individuals in these countries enjoy global reach, thanks to ICT, and can command salaries comparable to those earned by their peers in the advanced economies. In other words, while the wages of the industrial workforce are being compressed by overseas competition and the march of automation, top income earners are at no such disadvantage. Their geographical mobility and the ease with which they can telecommute allows them access to the global marketplace and their earnings are close to international norms. Furthermore, by raising the share of capital, technological change has also increased the income and wealth of holders of capital (Lakner 2017).[95] Together, these forces account for the high shares of income and wealth of the top ten percent (and one percent) in Arab countries.

Digital technologies and AI are beginning to overshadow employment prospects and incomes in a number of tradable services which are a source of mid- and high-level white-collar jobs. The financial sector, which is a big employer in the GCC countries and Lebanon, [96] arguably leads the way.[97] Mobile and online banking, aided by the diffusion of cellphones (mobile subscriptions are close to universal in Arab countries) and access to the Internet (averaging 52 per 100 individuals in 2018)[98] and to ATMs and online trading, is beginning to winnow routine tasks, but only in the high-income Arab economies. Looking a decade or more ahead, the advent of fintech, blockchain, the widespread use of automated trading, ease of credit scoring, multiplication of financial instruments, and the spread of robo advisers…etc. could begin to erode middle-level jobs in both high- and middle-income Arab countries.[99] However, those holding managerial positions or engaged in operations requiring technical skills of a higher order will continue to enjoy job security and rising incomes. An increasing salience of financial and other professional services that can readily exploit digital technologies could further polarize the distribution of income; putting middle class jobs at risk in the high- and middle-income Arab countries. This process could be accelerated by the COVID-19 crisis. By putting pressure on bank balance sheets, it may compel them to accelerate the adoption of digital technology and trim costs by laying off excess staff as institutions are doing in European countries and North America.

There are other developments with implications for the distribution of income on the horizon. By magnifying scale and network economies, digital technology has facilitated concentration, most notably in the services sector (also in manufacturing), for example: providers of financial,[100] construction, transport, accounting, legal, IT, and other professional services. In advanced economies, and also in emerging ones such as China, Mexico, and Brazil, it is leading to a reallocation of resources favoring a smaller number of superstar firms that are more productive than the average. Providers of IT services such as Google, Alibaba, Tencent, and Baidu – with access to a growing storehouse of information on users of their services – are diversifying into finance and insurance, which over time could lead to fewer larger firms dominating the industry.

Concentration goes hand in hand with an increased scale of operation and higher markups, which are contributing to a decline in labor's share of GDP (noted above) and increasing the numbers engaged in gig/contract work.[101]

There is little evidence thus far that such trends are surfacing, even in the high-income Arab countries. The data on labor market efficiency, business sophistication, technological readiness, and innovation suggest that the gap between the OECD average and Arab countries has widened between 2007-2008 and 2017-2018 (Figure 15). One implication is that neither public nor private firms are taking full advantage of digital technologies, starting with GCC countries. This is possibly because of managerial inertia, a shortage of skills, or because they are not being compelled by competition. This is also signaled by the slow pace of diversification into higher value, more complex activities between 1970 and 2015 (Figure 16). Another and related implication is that Arab countries may not be experiencing the job displacing and income polarizing effects of digital technologies to the same extent as advanced economies. A partial explanation is that state-owned enterprises are dominant in many sectors throughout the Arab world, absorb a significant fraction of the workforce, are slow to assimilate technology, and rarely lay off workers when they do.[102] This is consistent with the apparent stability in the distribution of incomes noted earlier.

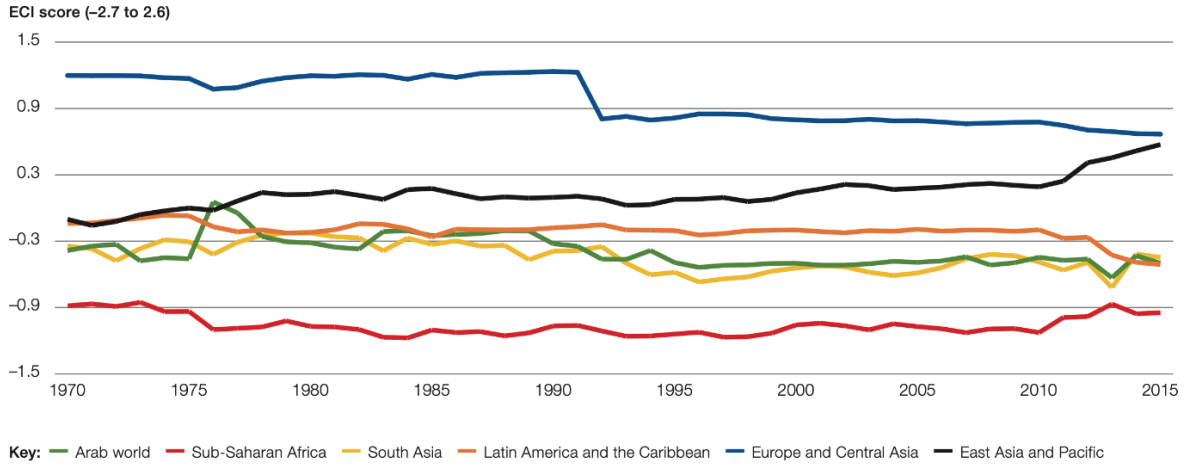
Arab countries are behind the curve in adopting digital technologies – with the possible exception of the UAE. One can speculate that, in the interests of competitiveness and growth, governments and private firms will be under pressure to adopt the new technologies. How soon this will happen is open to conjecture and, undoubtedly, low-income countries and those beset with sociopolitical problems will lag behind the rest. Once these technologies diffuse through the system, organizational restructuring and the displacement of labor by smart machines will occur at a faster pace. This has the potential to increase inequality as it has in mature economies, unless it is offset by the emergence of new occupations that command high wages and can absorb laid-off workers.[103] There is considerable uncertainty regarding the changes to come and, as of now, the only window on the future that one has is the limited experience from high-income countries.

Figure 15. Comparative strengths of Arab countries versus the OECD average

Pillar	Comparative strength vs OECD (percent) 2007–2008	2017–2018
Institutions	–7.8	–2.8
Infrastructure	–18.6	–10.4
Macroeconomic environment	4.3	–14.1
Health and primary education	–9.1	–7.4
Higher education and training	–22.1	–18.9
Goods market efficiency	–11.5	–6.6
Labor market efficiency	–10.6	–14.4
Financial market development	–16.5	–10.4
Technological readiness	–28.8	–20.6
Market size	–21.4	–5.9
Business sophistication	–16.0	–13.3
Innovation	–25.5	–21.9

Source: WEF (2018) http://www3.weforum.org/docs/Arab-World-Competitiveness-Report-2018/AWCR%202018.0724_1342.pdf

Figure 16. Diversification by region



Source: WEF (2018) http://www3.weforum.org/docs/Arab-World-Competitiveness-Report-2018/AWCR%202018.0724_1342.pdf

3. The future of jobs and wage shares in Arab countries

There are projections galore as stated in section 1.2, but, so far, we do not have a clear sense of how deep the inroads digital technology will make into the workplace are and which jobs will be most seriously affected. Factory automation has been ongoing since the 1950s and is well advanced in the automobile, electronic, metals, pharmaceutical, chemical, and food-processing industries, for example. Advances in robotics and the Internet of Things point to a possible acceleration of automation and the use of AI within the next decade not just in relatively labor-intensive processing industries such as garments and footwear, but also in agriculture, transportation, warehousing,[104] retail, and hospitality. Companies such as Google and Facebook are using machine learning to analyze information to take the guesswork out of marketing and meet consumer wants.[105] Balin et al. (2019)[106] observe that "online platforms have acquired a central role as intermediaries between service providers and consumers in industries such as personal transport, accommodation, retail trade, food services finance, personal services and

entertainment." Whether these platforms enhance labor productivity – or displace workers – has yet to be established. Across industrial families in the United States, the potential of automation and movements in productivity vary substantially, with the automation potential ranging from a low 27 percent in education to 73 percent in accommodation and food services. The average potential is 46 percent (Figure 17). Services have a prominent presence in the Arab economies with the share of services on the rise; already accounting for more than half of GDP on average and substantially higher in the UAE.

To date, the impact on jobs has been relatively modest, even in advanced countries, and opinion is divided on how the COVID-19 pandemic will affect automation.It is being argued that the pandemic could speed it up, and a survey of firms by the World Bank has uncovered evidence supporting this view.[107] By the same token, uncertainty, the indebtedness of firms, and a reluctance to invest in fixed assets could slow things down.[108] What we have learnt from recessions during the past three decades is that the automation of low- and mid-skilled routine jobs is prioritized with younger workers and women facing the hardest hit.[109] Following the Great Recession, firms based in the metro areas in the United States replaced many of the workers laid off with technology and skilled workers.[110]

Figure 16: Potential for automation in industrial families

Industrial family	Annual labor productivity growth, 2000-16	Automation potential
Accommodation and Food Services	-0.8%	73%
Manufacturing	2.9%	59%
Transportation and Warehousing	0.2%	58%
Agriculture, Forestry, Fishing and Hunting	3.3%	57%
Retail Trade	0.9%	53%
Mining, Quarrying, and Oil and Gas Extraction	3.2%	51%
Other Services (except Public Administration)	-1.6%	49%
Construction	-1.0%	47%
Wholesale Trade	1.7%	44%
Utilities	-0.2%	43%
Finance and Insurance	1.1%	42%
Arts, Entertainment, and Recreation	0.4%	41%
Administrative and Support and Waste Management and Remediation Services	2.1%	41%
Real Estate and Rental and Leasing	2.1%	40%
Government	-0.1%	37%
Health Care and Social Assistance	0.2%	36%
Information	6.2%	35%
Management of Companies and Enterprises	0.1%	34%
Professional, Scientific, and Technical Services	0.9%	34%
Educational Services	-0.7%	27%
U.S. total	**0.8%**	**46%**

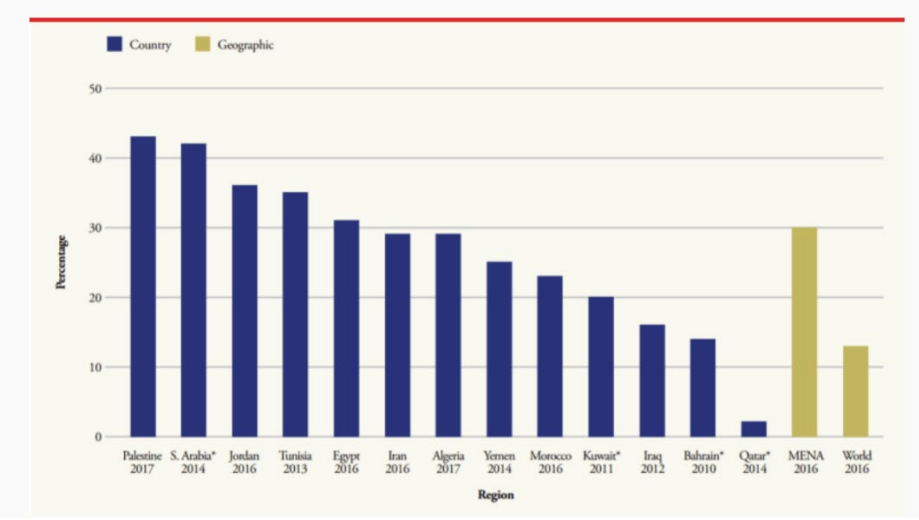
Source: M. Muro et al. (2020). https://www.brookings.edu/blog/the-avenue/2020/03/24/the-robots-are-ready-as-the-covid-19-recession-spreads/

Hospitality, food services, and retail are major urban employers in many – if not most – of the middle- and high-income Arab countries. A majority of the workers are low skilled and with high school education or less. Some are migrant workers. Partial automation and use of digital technologies could, in principle, sharply reduce employment in these activities at relatively modest costs to providers – costs that could be recouped in a few years.[111] A kiosk in a fast food restaurant

can instantaneously transfer an order to the cooking staff and dispense with servers. As AI/machine learning and computer processing improves, some higher order professional and technical jobs could be taken over by smart machines. In other words, starting with blue-collar unskilled and semi-skilled production line jobs done by workers with high school education or less, including many young and female workers[112] (these may have been subject to deskilling, making it harder to find alternative employment),[113] digital technologies and robotics could begin to eat away at routine white-collar jobs done by workers with some college level education. The jobs remaining are likely to be skill biased and high-touch, favoring those with technical/soft skills and tertiary level training. Some of these could also be lost to AI.[114]

How rapidly this process could unfold will rely on many factors, including: public policies incentivizing the use of digital technologies; labor laws limiting the freedom of companies to lay off workers and requiring costly severance payments; relative factor prices (an elastic supply of low wage labor potentially deterring automation or leading to selective automation as is occurring in garments manufacturing); cost of robots and digital hardware; ease of use and maintenance, adaptability of machine learning for a variety of tasks; availability of skills to utilize digital technology (when there is a dearth of skills, the technology can be adjusted downwards so as to match the capabilities of the workers); organizational changes to make productive use of automated technologies (which is largely driven by management and influenced by competitive pressure);[115] and the fixed and operating costs of capital-intensive production processes – workers can be fired, but not robots.[116] Social pressures could also constrain the use of technologies displacing workers. This could be a significant factor in Arab countries with growing populations and high unemployment among youth (Figure 18)[117] and particularly among female workers (already twice as high as male unemployment at 16 percent).[118] In addition, demand for products and services that are digital technology and skill intensive would be a factor.[119]

Figure 18. Youth unemployment by country

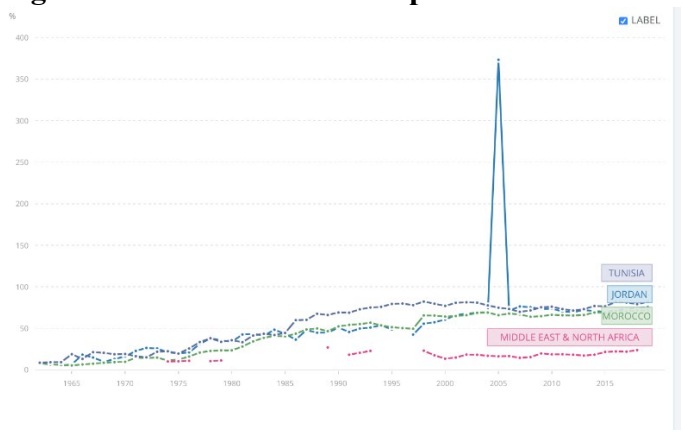


Source: N. Kabbani (2019). https://www.brookings.edu/research/youth-employment-in-the-middle-east-and-north-africa-revisiting-and-reframing-the-challenge/

Among EMDEs, the ones that are automating manufacturing most rapidly – i.e. installing more robots than would seem to be justified by their productivity adjusted wage costs – are countries like Indonesia, Taiwan, Korea, and Thailand. Rising wages partly explain the pace of automation in Korea and Taiwan. Automation by producers in Thailand and Indonesia is driven by the need to meet the quality, volume, and delivery requirements of buyers from Europe and Japan and to diversify into an activity with good growth prospects.[120] Additive manufacturing will permit not only product diversification, but also customization. The share of manufacturing in both Thailand and Indonesia is over 20 percent of GDP, with a majority of the largest firms competing in the global marketplace. The share of manufactured products is lower in Arab countries such as Egypt, Tunisia, and Morocco – the average is 24 percent and the pressure from this quarter to automate is weaker. However, exports of manufactures from Jordan, Morocco, and Tunisia are in the 70 percent to 82 percent range and this might accelerate automation (Figure 19). Although the vision documents (Saudi Arabia Vision 2030; UAE Vision 2021; Egypt Vison 2030) all envisage an increase in 4.0 type industrialization, this remains a work in progress. In Saudi Arabia, for example, the petrochemical industry and firms producing plastics, metal, rubber, and food products are already highly automated. The COVID-19 pandemic and the exodus of migrant workers from Arab countries could lead to a quickening of automation in the GCC countries, with a number of services activities likely to be most affected. Construction, transportation, warehousing, IT-related, and retail services, as well as services provided by the hospitality sector, are among the ones that could most easily take advantage of commercially available digital technologies. According to a McKinsey study (2018),[121] 45 percent of the work activities in the six Arab countries surveyed could potentially be automated, with Egypt at the higher end (48 percent) and Saudi Arabia at the lower end (41 percent).

Figure 20 shows that Egypt would bear the brunt of automation with 12 million workers affected, followed by Saudi Arabia with wages in Saudi Arabi and the UAE taking a bigger hit. Sectors most exposed to automation are the same across all the countries, with Egyptian labor-intensive manufacturing and its transportation, wholesale, and construction industries squarely in the path of automation. The ones least exposed are the same everywhere: education, health, and the arts (Figure 21). The jobs most at risk are also the ones that are being shed by industries in advanced countries. These are jobs performed by workers with high school education or less (Figure 22). The majority are blue-collar jobs in both manufacturing and services that lend themselves to automation. Again, larger countries such as Egypt, Saudi Arabia, Algeria, and Morocco – with a higher percentage of the workforce engaged in manufacturing and construction – could be faced with more redundancy than the average Arab economy. In advanced countries, post-COVID-19 pandemic, low wage, low skill jobs might become scarcer.[122] The average automation potential is 55 percent for those with only high school education and a still high 44 percent for workers with some post-secondary education.

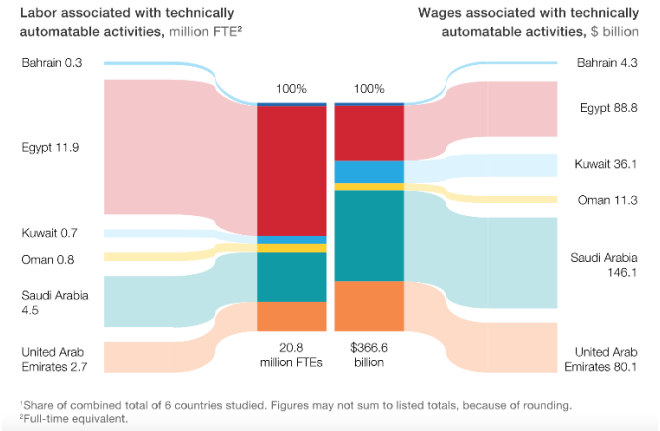
Figure 19. Manufactures as a percent of merchandize exports



Source: WDI https://data.worldbank.org/indicator/TX.VAL.MANF.ZS.UN?locations=JO-MA-TN-ZQ

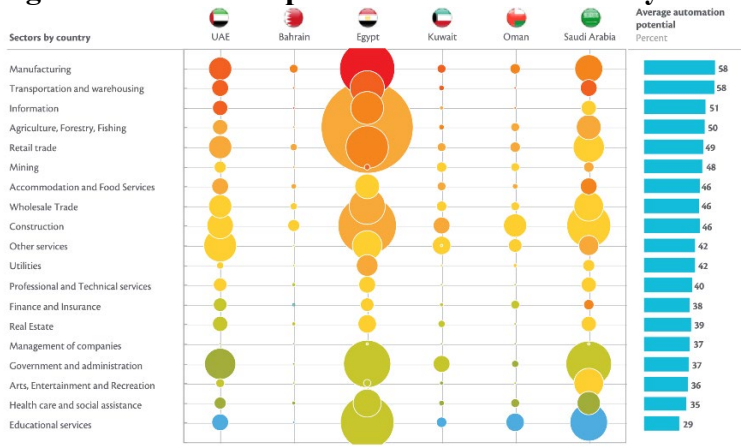
In the GCC countries – but not elsewhere in the Arab world – more than 90 percent of the jobs which could potentially be automated are currently performed by expatriates (Figure 23). The only exception is administration and government, where nationals do about two fifths of the work. Thus, automation would mainly displace expatriates who could be required to return to their home countries.

Figure 20. Labor and wages associated with automatable activities



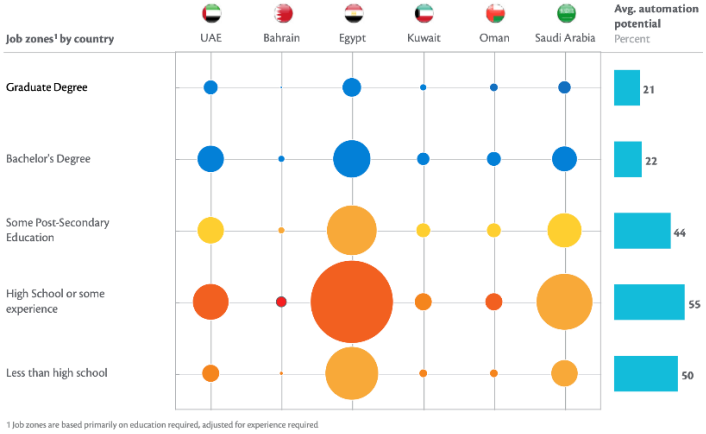
Source: McKinsey (2018). https://www.mckinsey.com/featured-insights/middle-east-and-africa/are-middle-east-workers-ready-for-the-impact-of-automation

Figure 21. Technical potential for automation by sector



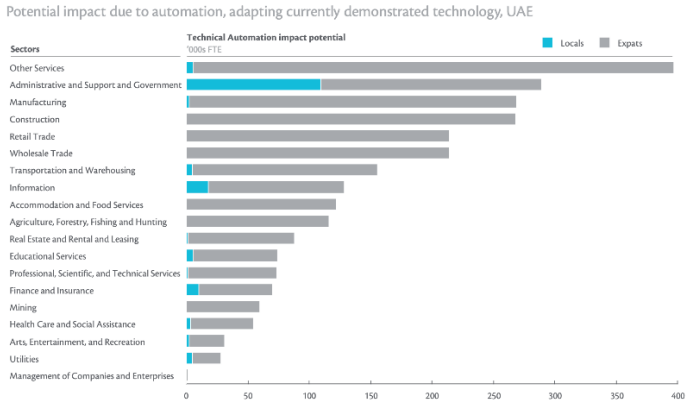
Source: McKinsey (2018). The size of each bubble indicates fulltime employment in 2016. https://www.mckinsey.com/~/media/mckinsey/featured%20insights/middle%20east%20and%20africa/are%20middle%20east%20workers%20ready%20for%20the%20impact%20of%20automation/the-future-of-jobs-in-the-middle-east.pdf

Figure 22. Technical potential for automation by job zones



Source: McKinsey (2018). The size of each bubble indicates fulltime employment in 2016. https://www.mckinsey.com/~/media/mckinsey/featured%20insights/middle%20east%20and%20africa/are%20middle%20east%20workers%20ready%20for%20the%20impact%20of%20automation/the-future-of-jobs-in-the-middle-east.pdf

Figure 23. Automation potential by sector and share of expatriates



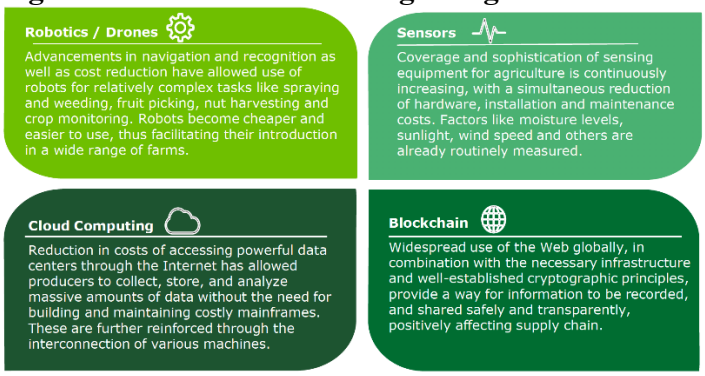
Source: McKinsey (2018). https://www.mckinsey.com/~/media/mckinsey/featured%20insights/middle%20east%20and%20africa/are%20middle%20east%20workers%20ready%20for%20the%20impact%20of%20automation/the-future-of-jobs-in-the-middle-east.pdf

4. How digital technology affects inequality

Whether, and to what degree, digital technology causes inequality will depend on several factors:

i) The speed with which technologies diffuse and are adopted – not just by a few leading firms but by a large majority of formal market participants. In the OECD countries, a minority of firms (less than 30 percent) are the lead adopters and contribute the lion's share of productivity gains. The majority in the long tail are slow to absorb new technologies and smaller firms are most likely to drag their feet.[123] Adoption calls for investment, organizational change, and training – intangible capital - with the payoff accruing over several years. For many firms, the risk is too high and firms in Arab countries are more likely to be constrained by the managerial shortcomings[124] and the availability of financing. Nevertheless, as capabilities, functionalities, and applications of digital technology increase, prices (of robots, for example)[125] continue heading downwards, and the infrastructure capacity is enhanced by 5G and higher communications systems, the rate of adoption could quicken (OECD (2019).[126] If the uptake of digitization remains concentrated in larger firms, an increasing divergence of productivity is in the cards. Leading firms could enlarge their share of the market and wages could also become more polarized, as those employed by the larger firms are likely to be better paid than workers at SMEs. In high- and upper middle-income countries, agriculture is also undergoing a sea change caused by automation and digital technologies displacing labor (Figure 24).[127] For the Arab countries as a whole, agriculture accounts for less than five percent of GDP and for 11-12 percent of GDP for countries such as Egypt and Algeria. However, almost a quarter of the Egyptian labor force is engaged in agricultural pursuits and a third of Moroccan workers are in the rural sector. As digital technologies diffuse, large numbers of agricultural workers will become redundant – especially if smaller holdings are consolidated into larger commercial operations – and migrate to the cities and either become a part of the unemployed or be absorbed by the informal sector. The effect on income distribution is ambiguous, with a possibility that inequality could increase by depressing wages in the urban economy.

Figure 24: Transformative digital agricultural technologies



Source: Deloitte (2020). Transforming agriculture through digital technologies https://www2.deloitte.com/gr/en/pages/consumer-business/articles/transforming-agriculture-through-digital-technologies.html

ii) The characteristics of digital technologies and their implications for the labor market. The trend to date and the anticipated direction that technological evolution could take is that technology will be labor-displacing and skill biased (Kanbur 2020; D. Acemoglu and D. Autor 2011),[128] but that need not be a given. Technological change can be managed up to a point to minimize disruption, as discussed in the final section.[129]

iii) Whether technology augments productivity and how the benefits are shared throughout the economy. Digital technologies have considerable potential and the expectation from the outset was that it would contribute significantly to gains in productivity,[130] but even the United States and the European economies have not thus far capitalized on the potential. Many industries, such as medical and business services, remain at some distance from the technology frontier defined by leading firms; with the average for industries as a whole being 24 percent. Only travel and retail are at or close to the halfway mark (Figure 25).[131] The productivity boost delivered by digital technologies has fallen far short of expectations. Only the United States experienced a marked acceleration in TFP growth for a decade (1995-2005), and that too has petered out.[132] Labor productivity growth in Arab countries averaged less than one percent during the first decade of the 2000s and there has been virtually no increase from 2010 to 2019. The annual increase in TFP growth was slightly negative during 2000-2010 and productivity declined at a faster rate, approaching two percent per annum in the following decade (Conference Board, 2019).[133] According to these numbers, digital technology has left productivity untouched; with high-income countries such as Saudi Arabia, Qatar, Kuwait, and Oman experiencing a significant erosion of TFP while middle income ones such as Egypt, Morocco, Algeria, and Tunisia also dipped into negative territory but to a lesser extent (Conference Board, 2019).

iv) Innovations to come, which could create new jobs replacing those that are on the way out such as those of telephone operators, typesetters, lift operators, word processors, travel agents…etc.[134] In the United States for example, seven out of ten of the fastest growing jobs

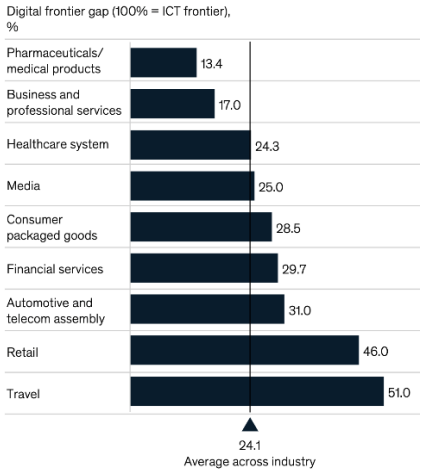
– such as in e-commerce and search engine optimization and those of wind turbine technicians and solar photovoltaic installers – either did not exist or employed an insignificant number of people.[135] Others gaining in number include data analysts and blockchain engineers. In the not too distant future, one can imagine jobs for quantum programmers and designers of advanced AVs (Figure 26). A study for Dell Technologies by the Institute for the Future[136] forecasts that 85 percent of the jobs that will exist in 2030 have yet to be invented.[137] There is an abundance of speculation and happy talk, but the key issue for Arab countries is how many of the new jobs will emerge particularly for middle-income Egypt, Morocco, Tunisia, and Jordan, which could be subject to a hollowing out of industrial employment. Job growth may be higher in a few of the GCC countries that have transitioned to a service-intensive economy paced by the demand for tourism and transport services that comprise a large share of the exports of smaller nations such as Dubai.

v) Whether new jobs are equally, less, or more remunerative compared to the ones that are lost. Many of the gig type jobs created by digital technology do not offer high wages, job security or benefits. Managerial, professional, technical, and customer-facing, high-touch jobs[138] could be more rewarding and create openings for women. However, the additions to the pool of such jobs will be dictated by the speed with which AI is able to displace jobs requiring cognitive skills as distinct from the human touch – and the pace of adoption in Arab countries.

vi) The ease with which displaced workers and new entrants to the workforce can take up these new jobs. This would be a function of labor market efficiency in matching skills aided by passive and active labor market policies (for example, job placement services),[139] digital platforms (Glassdoor, Linkedin, Career Builder…etc.) and the geographical mobility of workers. OECD countries have utilized active labor market policies to tackle their labor market issues with placement services, training programs, and wage insurance; proving to be more successful than employer subsidies and public works (Bown and Freund 2019).[140] Although high levels of unemployment[141] – particularly the lack of jobs for young people – has been a priority for Arab countries, progress has been limited with the educational deficiencies of workers compounded by the inadequacy of labor market information systems and a shortage of the well-paid and prestigious jobs that young people are searching for (Kabbani 2019).[142] This longstanding dearth of "good" jobs could very well be exacerbated by the adoption of digital technology, with many workers displaced from overstaffed public agencies, SOEs, and the larger private firms. More workers are likely to end up in the informal sector that already absorbs the majority (two thirds) of the workforce in Egypt, Tunisia, Jordan, and Morocco. Only Jordan, Saudi Arabia, Iraq, and the UAE have employment programs in place. These are struggling to cope with current mismatches between supply and demand and the mismatch of skills. A more widespread adoption of digital technologies will make their task much harder.

vii) The quality of education, STEM, and learning skills of the workforce and the availability of training programs, which can equip new entrants and those already in the workforce to acquire new skills as market demand evolves. Moreover, for training to deliver results, it would need to be on a large scale, sufficiently well resourced, attuned to the emerging needs of the labor market, and accessible to the majority of workers in the informal sector. In several of the Arab countries, these conditions are not being met (ESCWA 2012).[143] Perhaps the greatest challenge for Arab countries as they harness digital technologies in manufacturing and services is how to upgrade the skills of the current, relatively youthful workforce so as to fill the jobs that may appear. The majority of workers have limited schooling and only a small minority are equipped with the skills that could be in demand – which is an unknown in itself.[144] If digital technology is going to make jobs even more scarce and the skills needed to fill the ones that do emerge are not forthcoming, the implications for income distribution could be problematic.[145]

Figure 25: Distance of industries from the digital frontier



Source: McKinsey (2019).
https://www.mckinsey.com/~/media/mckinsey/business%20functions/mckinsey%20digital/our%20insights/twenty-five%20years%20of%20digitization%20ten%20insights%20into%20how%20to%20play%20it%20right/mgi-briefing-note-twenty-five-years-of-digitization-may-2019.ashx

Figure 26: Jobs disappearing and jobs appearing

Jobs that existed 12 years ago but are now gone or disappearing	*Jobs that weren't around 12 years ago but here today*	*Jobs we can only image being around 12 years from now*
Meter Reader	Blockchain Engineer	Quantum Programmer
Switch Board Operator	Mobile App Developer	Climate Change Scientist
TV/VCR Repairman	Sustainability Manager	Rocket Design Architects
Electronics Assemblers	Cloud Computing Specialist	Spacecraft Pilots
Assembly Line Workers	AI/Big Data Analyst	Autonomous Vehicle Designers
Video Store Manager/Clerks	Autonomous Vehicle Designer	Blockchain Crypto Specialist
Dictaphone Operators	VDC-BIM Consultant	Cultured Meat Farmers
Film Projectionist	YouTube Content Creator	Hazardous Waste Engineers

Source: https://www.linkedin.com/pulse/85-jobs-exist-2030-havent-been-invented-yet-leo-salemi

viii) The growth of global trade in digitally-enabled services and easy access to VoIP infrastructure will be a factor determining the opportunities for diversification and growth that Arab countries can tap into.[146] Digital technology facilitates the outsourcing of both low- and high-skill services,[147] while e-commerce platforms can promote entry and increase the competition in the goods market.[148] Trade in professional services and telework is on the rise and could increase even more rapidly because of the COVID-19 pandemic. There could be opportunities for Arab countries that are accumulating capabilities and where, on average, e-commerce is at an early stage of development with imports from overseas dominating purchases from local suppliers. Digital platforms can connect buyers with sellers, lowering search and coordination costs. Micro-multinationals are taking root with the help of eBay, Alibaba, Amazon, and Jumia. A boom in e-commerce mediated trade in goods and services[149] could stimulate job and income growth, with the benefits more widely shared if it stimulates the entry of firms and expansion of SME activity.[150] Low-end IT-enabled services (ITES), such as call centers and outsourced back office budgetary, accounting, and HR services – while providing employment in South and Southeast Asian countries to workers mostly with more than high school education (including large numbers of women) – are relatively low paid and have not measurably affected the distribution of income. Many of these will be automated out of existence and opportunities for Arab countries may be limited.

ix) Last but not least, the COVID-19 pandemic has injected an additional dose of uncertainty. Much depends on how long the effects persist and the speed with which global GDP and trade growth rebound. With respect to digital technology adoption in Arab countries, it is by no means obvious that firms will seize this opportunity to automate their operations and dispense with workers, as might be the case in some advanced economies. Industry 4.0 technology could begin to make deeper inroads in high-income economies, but the pandemic shock need not spur the automation of light manufacturing in middle- and low-income countries, as relative costs will still favor labor use (Seric and Winkler 2020).[151] Because key sectors of Arab economies have been hard hit – in particular the energy, tourism, and transport sectors – governments have less fiscal headroom and surviving firms are faced – at least in the near term – with shrinking markets and saddled with heavier debt burdens; investment in digital technologies and in associated intangible capital might be of low priority. The limited integration of the majority of Arab countries in manufacturing Global Value Chains (GVCs) also minimizes the pressure to engage in technological upgrading in the interests of competitiveness and to stave off a reshoring of production to higher-income countries.[152] The near-term impact on income distribution will have little to do with digital technology. Incomes could diverge because more of the employed workers will be concentrated in larger firms as many smaller ones exit. Some of the laid-off workers will find low paid jobs in the informal sector while others join the ranks of the unemployed. Younger workers and women are at greater risk of being laid off than older workers. Over the longer run, incomes could become more unequal if there is a substantial loss of intangible capital, and the erosion of workforce

capital could make incomes less equal.[153] However, if productivity and growth do in fact rebound and new occupations materialize that absorb the displaced workers and the unemployed in "good" jobs instead, inequality could diminish.

In summing up these findings and forecasts, it appears that, thus far, digital technology is not the major determinant of income distribution in the Arab region – although in the GCC countries there is ample evidence that the technology is in widespread use (as noted in section 2, the distribution of income has remained stable for almost two decades). Smartphones are ubiquitous, many transactions can be conducted online, and the cities are seeded with sensors, which permit monitoring infrastructure and people – the latter has made it easier to track COVID-19 infections. However, labor and TFP trends indicate that the diffusion and depth of usage are at an early stage.[154] Rankings of Arab countries on the Global Innovation Index and the Networked Readiness Index, which declined between 2011 and 2017, also suggest that technology assimilation is making slow headway (Figure 27). That digital technology has yet to permeate deeply into the economy is supported by Mostafa's observations (2019): "Only six percent of the Middle East public lives under digitized smart government…Countries in the region lag far behind in business digitization, with low availability of venture capital funding for start-ups and low shares of the workforce employed in digital careers and industries."[155]

The distribution of income and wealth in the Arab countries is determined largely by: (i) the resource base of the majority – "14 members of the Arab League are producers of oil and natural gas – representing between 30 and 60 percent of GDP" and a major share of fiscal revenues; (ii) the persistence of autocratic rentier states[156] that exert extensive control over economic activities,[157] employment, and the distribution of oil revenues;[158] (iii) the scale of state institutions, their role as employers, and the fact that their wage policies establish benchmarks for other firms in the formal sector; (iv) transfers, subsidies and income support provided by the state to nationals of the country; and (v) the safety valve of migration from the poorer economies to the oil-rich states and the flow of remittances from migrants, which ease the unemployment problem in countries such as Egypt,[159] Jordan, and Tunisia and augment household incomes, but also yoke these economies to those of oil producers.

Figure 27: NRI and GII rankings and trends

Country	NRI 2010-2011	NRI 2016	GII 2011	GII 2017
United Arab Emirates	24	26 ↓	34	36 ↓
Qatar	25	27 ↓	26	49 ↓
Bahrain	30	28	46	66 ↓
Saudi Arabia	33	33 ↓	54	55 ↓
Tunisia	35	81 ↓	66	74 ↓
Oman	41	52 ↓	57	77 ↓
Jordan	50	60 ↓	41	83 ↓
Egypt	74	96 ↓	87	105 ↓
Kuwait	75	61	52	56 ↓
Morocco	83	78	94	72
Lebanon	95	88	49	81 ↓
Algeria	117	117	125	108
Mauritania	130	138 ↓	NA	NA
Yemen	NA	NA	123	127 ↓

Source: ESCWA (2017). Arab Horizon 2030: Digital Technologies and Development.

Given the modest share of the manufacturing sector in even the larger, resource-poor economies (Egypt, for example), employment in this sector plays a limited role in the distribution of income. The services sector, public agencies, and informal employment are what possess a decisive influence on incomes earned by the working population.

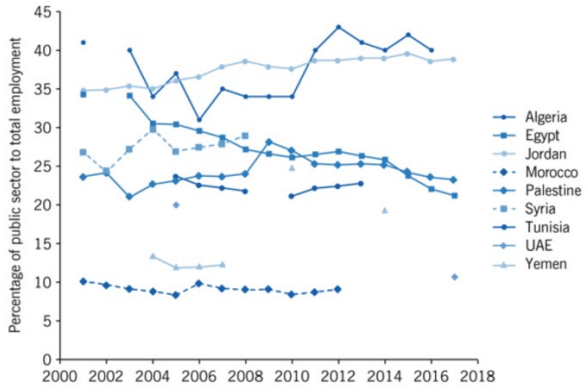
The available evidence suggests that it is the factors listed earlier, and not digital technology, that have defined income distribution in the Arab countries to date. The industrialized economies have experienced a decline in manufacturing sector employment because of globalization and automation. In addition, mid-level jobs in services have been displaced by computerization and offshoring, with further advances in digital technologies now beginning to threaten non-routine cognitive tasks as well. The depletion of well-paid blue-collar jobs and stagnation of mid-level white collar ones are plausibly a cause of increased inequality in the industrialized countries, but this has not occurred in Arab countries.

Looking ahead, a hollowing of the Arab middle class could result in greater inequality but, as stated earlier, much depends on the rate at which existing jobs are made redundant by digital technologies, how many new jobs spring up in their place, and whether these prove to be more productive. Thus far, automation has not displaced significant numbers of workers in the labor-intensive assembly and processing activities in Arab countries, although more automated equipment is undoubtedly in use to produce items such as garments and footwear. The petrochemical and metal industries were highly automated from the very outset. The public sector is a large employer in Arab countries; absorbing between a fifth to over 90 percent of the national workforce in some of the GCC countries (Figures 28 and 29). Adoption of digital technology does not appear to have caused a cutback in public sector employment. The slowdown in the hiring of new entrants in recent years is because of fiscal constraints and because many agencies are already overstaffed.

Evidence of retrenchment by parastatals and large private firms that can be traced to digital technologies is elusive. In the GCC countries, retrenchment usually targets expatriates (as in 2020).

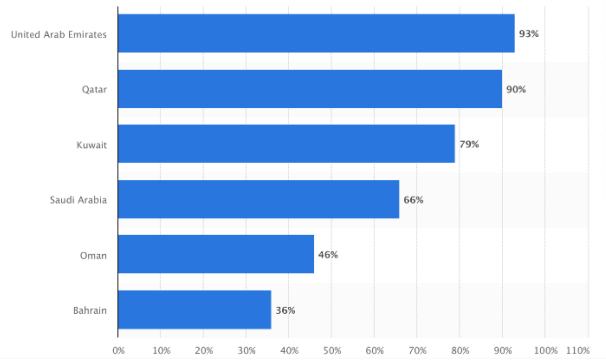
They serve as a buffer absorbing the demand shocks. The nationals are sheltered, and their incomes are seemingly unaffected by the ups and downs of demand. They are more vulnerable to a decline in oil prices, which tightens budget constraints. In resource-poor countries such as Egypt, the public sector and state-connected companies provide secure employment opportunities. These are the sought-after, mostly white-collar jobs that hitherto have remained largely untouched by digital technology.

Figure 28. Public sector employment in Arab countries as a share of total employment



Source: R. Assaad and G. Barsoum (2019). Public employment in MENA. IZA. https://wol.iza.org/articles/public-employment-in-the-middle-east-and-north-africa/long

Figure 29: Share of the (national) workforce employed by the public sector in GCC countries in 2106



Source: Statista. https://www.statista.com/statistics/944703/gcc-workforce-share-in-public-sector-by-country/

The stability of income distribution in Arab countries over the past two decades, even as digital technology has gained momentum, would lead one to conclude that technology is not contributing to a divergence in incomes as it does in a few advanced economies with much greater technological and absorptive capacities than Arab countries.

4.1 Arab digital-inequality scenarios

What of the future beyond the current decade? How might digital technology affect inequality? The experience of and forecasts for North American and European countries can serve as a guide but, undoubtedly, digitalization will not follow the same course in Arab countries for at least three reasons:

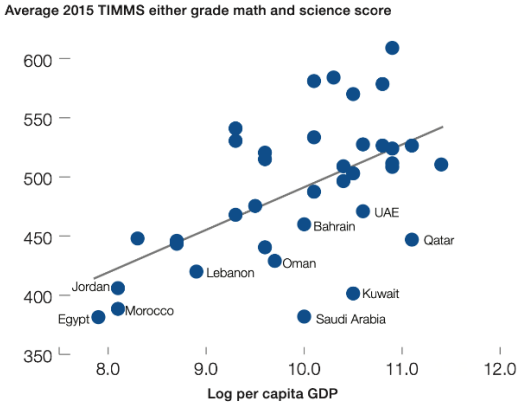
1) The oil-rich countries could use digital technologies to selectively automate services and manufacturing activities currently conducted by expatriates and lay off these workers. Nationals would be minimally affected, if at all. Digital technology could also continue to be absorbed into activities conducted by nationals without workers being displaced because they are protected by the social contract with the state and the latter has the revenue to sustain jobs that machines can easily perform. This process would leave the income (and wealth) distribution (of nationals) largely unchanged. Whether digital technology does displace expatriate workers who comprise a majority in some of the GCC countries depends on the types of work they perform, what happens to wage rates for these workers, and social considerations that could hinder laying off large numbers. If many of the migrant workers are compelled to return to their home countries and remittances received by Egypt, Tunisia, Jordan, Morocco, and others slump, this would have consequences for household consumption, and, depending on the numbers involved, could depress wages. Digitization in the GCC countries could displace workers without necessarily much impact on income distribution, although return migration could widen income disparities in Egypt, for example, and deter automation.

2) The resource-poor, middle-income Arab countries such as Egypt, Tunisia, and Morocco could automate light manufacturing and the hospitality, retail, transport, and other services sectors could potentially lay off workers, but low wages and an elastic labor supply would slow the process, as would social pressures to retain workers and generate jobs for new entrants. The economic calculus underlying the decision to automate a particular task focuses on a comparison of current and future worker productivity with that of machines. The latter come with fixed costs, but, unlike the former, are not prey to viruses, can perform their tasks 24/7 if needed, and are never absent from the job. If firms do automate in order to meet quality and delivery specifications, as they are in Southeast Asia, the number of workers affected may not be large and some of those, as in Jordan, are expatriates who would return to their home countries. Public agencies, SOEs, and major private firms could continue investing selectively in digital technology but without laying off workers, although, they could slow the process of hiring. If jobs in the state sector become scarce and more workers end up doing “gig” and informal jobs, the incomes of the fortunate ten percent could begin pulling away from the rest. The problem for Arab countries is the high rate of youth unemployment coupled with rapidly increasing populations. Finding jobs for the youth and the many women who are currently excluded from the workforce is a high priority in the interests of social and political stability. The January 2021 outbreak of unrest in Tunisia is a reminder of social pressures generated by

unemployment. Under the circumstances, the demand for labor displacing digitization could be weak for some time, even if this technology continues spreading in the industrialized countries. The demand for digital technologies in the workplace is likely to be especially weak in the low-income Arab countries.

3) A third factor that could slow the march of digital technology in Arab countries is the paucity and low quality of workforce skills. Education quality and STEM education in particular is a long-standing weakness as is apparent from the performance of Arab countries on international tests (Figure 30). Arab countries are also among the lowest ranked in Coursera's Global Skill Index in three critical skills: business, tech, and data.[160] Low investment in Science Technology and Innovation (STI) (less than one percent of GDP) further inhibits technology assimilation. This is a constraint that cannot be quickly remedied. Even if countries invest in digital hardware and software, the productivity gains are likely to be meager because a number of complementary changes in management, organization, and work practices (intangible capital) would be needed, and these are slow to accrue.[161] European economies and the United States failed to enhance productivity with the help of digital technologies after almost four decades.[162] It could take Arab countries a lot longer to benefit from digital technology.

Figure 30. Arab student performance on international tests



Source: Source: WEF (2018). http://www3.weforum.org/docs/Arab-World-Competitiveness-Report-2018/AWCR%202018.0724_1342.pdf

5. How might policies ameliorate inequality?[163]

Digitization may be slow to penetrate into the Arab economies, however, penetrate it will. Down the road, as more and more manufacturing activities and services are automated, the Arab countries will begin to be exposed to the pressures that have surfaced in industrialized economies. The relatively low share of manufacturing in Arab countries in GDP and total formal employment as well as the limited prospects of diversification into medium-tech, large-scale activities means that this sector will not be a major source of well-paid jobs for unskilled and semi-skilled workers as was the case in the industrialized countries through the 1980s. It is the loss of such jobs, mostly

by men, that partly accounts for the widening inequality in Europe and North America.[164] If the technology remains on its current trajectory, which is labor displacing and skill intensive, workers with high school education or less, many in low wage occupations, will be the first to feel the full brunt of technological change.[165] By then, however, AI and other digital technologies will have advanced to a point where it will be possible to automate not just the routine activities but also many of the higher cognitive and non-cognitive functions performed by humans. Jobs requiring human creativity, dexterity, social skills, empathy, and decision-making capacity would remain, as would a number of manual jobs that machines will not be equipped to perform. According to the US Bureau of Labor Statistics, aging populations will require the services of nurses, physical therapists, home health aides, and physician assistants.[166] Data scientists and statisticians will also be in greater demand. But, how many high-end well-paid jobs there will be – whether in existing occupations or in entirely new ones – is unknown. Also unknown is the likely future profile of jobs in Arab countries in a much more digitized world.

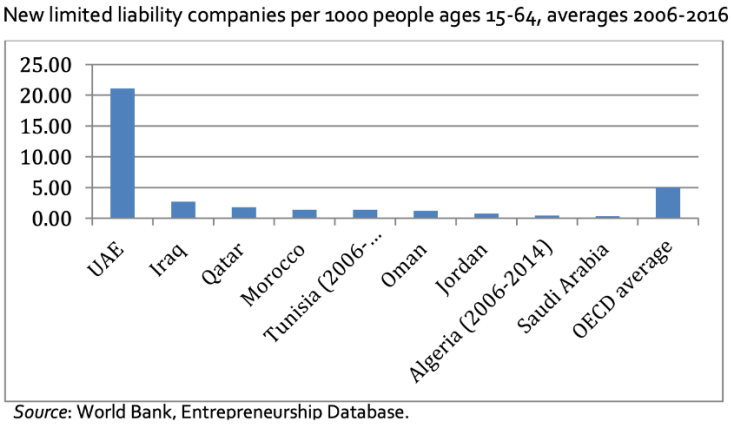
The standard recommendation for all countries – industrialized or developing – is to put their money in deepening skills. More and better quality education[167] with greater emphasis on STEM skills and the soft skills that AI-enabled computers will struggle to master is the message for all. Although the future jobs are difficult to discern, governments are urged to increase spending on education that builds foundational skills, more training that equips people with marketable capabilities, and lifelong education that brings workers up to speed as the job market evolves.[168] By enlarging the pool of human capital, narrowing health/education and gender inequalities,[169] and enhancing capabilities more broadly,[170] countries could, in principle, achieve the much needed productivity growth which, in turn, would help reduce income inequality in a digitizing world.[171]

More years of schooling, an increase in tertiary education, subsidies and incentives for vocational training, and calls to promote lifelong learning have been voiced for decades. However, education as currently conducted does not appear to improve productivity, enhance the flow of innovation, or drive growth. This is apparent from the recent track record of Arab countries and industrialized ones as well. Ricardo Hausmann (2015)[172] observes that between 1960 and 2010, the average years of schooling for the global workforce rose from 2.8 years to 8.3 years. In 1960, countries with 8.3 years of schooling were 5.5 times richer than ones with 2.8 years of schooling. Fast forward to 2010. Countries that had increased their level of schooling from 2.8 to 8.3 were only 167 percent richer, with much of this increased prosperity due to technological advances during the intervening years. Undoubtedly, the quality of education for those currently being schooled and the generations to come needs to be improved. A wealth of research suggests that of greater importance than the outlay on education and class size is the quality, motivation, and remuneration of teachers. Persuading some of the most talented graduates to become teachers, as Nordic and East Asian countries have done, will be key.[173] The payoff from improvement in student quality will be far in the 2030s. Korean students score high on standardized tests and their average years of schooling are among the highest in the OECD, but the problem of skills mismatches remains a chronic

problem with less than one-half of all Korean youth between the ages of 15-29 holding a job.[174] Over the next two decades, Arab countries must enhance the productivity of those already in the workforce. They are the ones that are directly affected by digital technologies and other technologies to come. They are the ones who risk being displaced and becoming part of the structurally unemployed.[175]

Larger firms are the early adopters of digital technologies and they are the ones that will help drive the revival from the COVID-19 pandemic shock, but much of the employment generated will rest on the SMEs and MSMEs. How rapidly they recover and how effectively they exploit digital technologies and e-commerce to expand their market footprint will determine the future pace of growth and its inclusivity. Service, retail, and wholesale sectors are especially well-positioned to take advantage of digital technology. The formal sector attracts far too few new entrants each year – only 1.3 per 1,000 people between the ages of 15 and 64 (Figure 31) – compared with five per 1,000 people in the OECD countries. This needs to increase if growth is to be inclusive and incomes more equally distributed. Furthermore, Arab countries are lagging in the spheres of innovation and adoption of ICTs according to the 2017 SDG Index and Dashboard report.[176] As noted by Christine Lagarde (2019): "In the Arab region, SMEs represent 96 percent of registered companies. They also employ half of the labor force." She went on to state that the SME sector is stunted because it receives only seven percent of bank financing. In addition, if the financing gap could be closed by improving access to bank finance and diversifying the sources of financing with the help of fintech, SOEs curbed from crowding out the smaller firms, and a stronger legal framework is put in place,[177] it could "boost annual economic growth by up to one percent, potentially leading to about 15 million new jobs by 2025 in the Arab region."[178]

Figure 31: New businesses in Arab countries



Source: OECD (2018). Small firms and start-ups http://www.oecd.org/mena/competitiveness/201803-MENA-SMEs-Flyer-EN.pdf

Arab countries faced a daunting challenge prior to the COVID-19 pandemic. Now, to achieve results, they must try harder. They need to diversify their economies and engage in activities with

good growth and employment prospects. This involves harnessing digital technologies. Some will be new activities requiring a yet unknown set of skills. Industrial diversification has proven to be as difficult for virtually all the Arab economies as has upgrading their workforces. Slowing the process of digitization and overinvestment in technology by state agencies and SOEs so as to minimize the displacement of labor and taxing automation (robots)[179] by the private sector is an option, but it could be self-defeating.[180] Growth rates and productivity would suffer and, very likely, incomes would become more unequal. Tony Atkinson,[181] Daren Acemoglu, Dani Rodrik, and others have suggested that governments should take a more active role in directing technological change so as to enhance the employability of workers. However, Arab countries are mostly users of technology and not the ones that can influence its course.

If the transformation of the workforce and active labor market policies that improve the access to labor market information fail to produce results, structural unemployment could become entrenched with more people engaged in informal activities. In this scenario, income inequality would rise with the fortunate ten or one percent pulling further away from the rest, assuming that the elites can control the rest.

In the best of all possible worlds, the continuing diffusion of digital technology in Arab countries will stimulate productivity, promote the entry of new firms and the growth of the gazelles among SMEs, increase per capita incomes, and create jobs in the formal sector. If that is what actually transpires, income inequality in Arab countries could diminish. The experience of industrialized countries urges caution. Digital technologies are not delivering the productivity and employment benefits conferred after a few decades by earlier GPTs. Robert Gordon (2014)[182] may be right that technological change has entered a drier season. Arab countries may have to prepare for a less positive scenario, one in which an inexorable spread of AI-enabled automation narrows employment opportunities to the few with requisite higher order skills; productivity rises are little, if at all, and the boost to growth does not materialize. In this scenario, informality and joblessness could rise to serious levels with only the major oil exporters spared depending on the state and duration of global demand for fossil fuels.

Active labor market policies and skill deepening could provide a partial fix if new jobs do proliferate and if globalization is sustained,[183] but these are big ifs. “Good” jobs have not multiplied in advanced economies. There is increased demand for web administrators, data warehousing specialists, software developers, biostatisticians, energy engineers, and nanosystems engineers requiring programming and/or math, engineering and analytical skills.[184] However, the number of such jobs will inevitably be limited, especially in Arab countries, and the skills will be beyond the reach of most workers – even ones that can learn from YouTube videos, online courses, or augmented reality systems. Moreover, the opportunities presented by globalization may be ebbing as globalization appears to have peaked and there is a risk that the barriers to trade will

rise. Under these circumstances, the relative stability of the income distribution in Arab countries would be imperiled with the bottom 90 percent losing out. This grim outcome has already begun to attract a great deal of attention in OECD countries that are also having to confront the burden posed by aging populations. While education and training receive the most emphasis, countries are also banking on another wave of technological change that lifts all boats. However, for OECD and Arab countries, a strengthening of the social safety net is emerging as a necessity.

Digital technology or a new GPT might enable countries to enhance productivity and lessen income inequality, but there is a high likelihood that Arab countries will be faced with a widening gap between the number of available jobs, including in the public sector, and the number seeking employment.[185] To avert a rise in poverty, countries may have to consider introducing some form of income guarantee. If a universal basic income scheme, versions of which have been widely discussed (and tested on a pilot basis), is too costly, a more targeted scheme may prove to be more appropriate.[186]

6. Concluding remarks

Income inequality across Arab countries, as measured by the Gini coefficient, has remained broadly stable since the turn of the century. The share of the top ten percent of income earners in individual countries has also remained stable. During this time, digital technologies have diffused throughout the region though the depth of penetration has been low in most.[187] The technology does not appear to have caused much displacement of labor in manufacturing or formal services as has occurred in some of the OECD economies, nor has it improved productivity and growth. It also does not appear to have affected the distribution of income.

The COVID-19 pandemic has darkened the economic picture for all the Arab countries.[188] They have experienced a drop in rates of growth (down by 4.7 percent) and of employment.[189] The non GCC countries that have encountered greater difficulty in coping with the spread of the virus are experiencing an increase in poverty, and political unrest has surfaced in some. This could widen income disparities between those with jobs in the public sector and in the surviving private sector firms. GCC countries with deeper pockets have cushioned the shock on nationals and minimized hardship – and a widening of income differentials – but they too have been hard hit by the drop in oil prices, and, for those dependent on travel, tourism, hospitality, and logistics, by the steep decline of these activities.[190] Whether the pandemic has longer-term effects will depend on how rapidly the global economy rebounds, the capacity of governments to control infections and ensure that future waves are speedily checked, and on the fiscal/debt headroom to help revive domestic economic activity.

Going forward, the continuing penetration of digital technologies may begin displacing larger numbers of workers and if these cannot be absorbed by the state sector or into new occupations

because they lack the skills, unemployment, wage compression, and inequality could increase. The heterogeneity of Arab countries means that no one-size-fits-all approach will be appropriate. The relatively resource-poor countries, including those in North Africa as well as Jordan and Lebanon, could face a more severe challenge. If digital technology continues making inroads in industry and services, inequality could widen. In order to avoid this, the governments of these countries will have three principal options (in addition to measures that bolster productivity and sustain adequate rates of growth): they can redouble the effort to inculcate the skills that will be in demand using all the instruments at their disposal, complementing other actions to stimulate growth. A second option is to support start-up activity by making more risk capital available to firms with promising innovations. The third is to ensure that all those who risk falling below the poverty line are guaranteed a basic income by means of tax and transfer mechanisms.[191] UBI – targeted or not – could be an option for governments with the requisite fiscal capacity and political support for redistribution. The GCC countries with a better educated population and the buffer provided by immigrants are in a stronger position; they can absorb the technology without necessarily widening disparities beyond what exist today by ensuring that the remaining jobs and new jobs that emerge are preserved for nationals. So long as their finances are supported by adequate oil revenues, they can also continue using transfers and subsidies to provide nationals with middleclass living standards. However, even the GCC countries might have to upgrade the skills of the national workforce and engage in economic diversification in order to take full advantage of digital technology. The impact of technology on income distribution in the low-income Arab countries is probably a decade or more in the future and it is difficult to anticipate likely outcomes.

The oil-exporting GCC countries need to factor in the longer-term implications of climate change that could lead to a rapid phasing out of fossil fuels, leaving them with stranded assets and few alternative sources of revenue and growth. This could be compounded by rising temperatures and sea levels that could imperil the habitability of coastal areas in Dubai, Qatar, Abu Dhabi, and Kuwait. Writing on the impact of climate change on the Arab countries, Dan Rabinowitz (2020, p.119)[192] states: "Climate change has no expiry date. It is here to stay and offers no coherent strategy for exit." The GCC countries and other Arab countries as well are at the epicenter of global warming. Coping with climate change will complicate their efforts to achieve sustainable and equitable growth.

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[1] Gallardo-Albarran and Inklaar (2020) estimate that in 1913, physical and human capital explained 29 percent and 24 percent of the cross-country differences in income, with productivity accounting for the balance. By 2011, the share of productivity had risen to 72 percent, with that of physical capital having fallen to 11 percent. Role of capital and productivity. Journal of Economic Surveys. https://onlinelibrary.wiley.com/doi/full/10.1111/joes.12374

[2] This insight earned Paul Romer the Nobel Prize in 2018. The endogenous growth theory, which was Romer's contribution, maintains that technological change is derived from the efforts of researchers and entrepreneurs motivated by economic incentives, and – in the case of researchers – also by curiosity and the desire to extend the boundaries of knowledge. Charles Jones (2019). Paul Romer. https://web.stanford.edu/~chadj/RomerNobel.pdf

[3] S. Athey (2020) provides a succinct overview. Machines, AI and the Workforce. https://hai.stanford.edu/sites/default/files/2020-09/08.10.20Truth-in-Testimony-Form-SA-rev.pdf

[4] M. Spence and L. Tyson (2017, p.172) pose the problem starkly. "As smart machines…challenge a fundamental feature of market systems: where most people gain their income by selling their labor…what happens when a large share of the working-age population, regardless of their education, are rendered technologically redundant or no longer command an income adequate to provide a minimally decent or socially acceptable standard of living." Effects of Technology on Inequality. In H. Boushey et.al. *After Piketty*. HUP.

[5] M.J. Andrews, A. Chatterji, and S. Stern (2020) remark: "We live in an era in which innovation and entrepreneurship seem ubiquitous, particularly in regions like Silicon Valley, Boston, and the Research Triangle Park, yet simultaneously many metrics of economic growth have been, at best, modest over recent years. We are currently struggling with a global pandemic that seems to be outpacing our ability to create and scale solutions." Beyond 140 characters. https://www.nber.org/chapters/c14372.pdf

[6] Technology absorption notwithstanding, P. Johnson and C. Papageorgiou (2020) conclude that since 1960, developing countries have not closed the gap in per capita incomes. What remains of cross-country convergence. https://www.aeaweb.org/articles?id=10.1257/jel.20181207; D. Patel et al. (2018) contend that, on average, developing countries have been growing faster than high income ones since 1990, but there is plenty of variation among the developers and Patel et al. cannot account for the causes of the acceleration. The research on past growth accelerations suggests that they tend to peter out; with a tendency for countries to regress to the mean growth rate. R. Hausmann et al (2005); L. Pritchett and L. Summers (2015). Everything you know about cross country convergence. ;https://www.cgdev.org/blog/everything-you-know-about-cross-country-convergence-now-wrong; https://growthecon.com/blog/Convergence/;

https://link.springer.com/article/10.1007/s10887-005-4712-0;

https://www.frbsf.org/economic-research/files/Pritchett-Summers-AEPC2013.pdf

[7] https://fredblog.stlouisfed.org/2020/06/how-fast-can-the-u-s-economy-recover-v-shape-vs-swoosh/; https://fas.org/sgp/crs/misc/IN10520.pdf

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[15] J. Cohen (2020). Good jobs. https://workofthefuture.mit.edu/research-post/good-jobs/

[16] N. Craft and C. Mills (1992, 2017). https://www.jstor.org/stable/2597415?seq=; https://academic.oup.com/ereh/article/21/2/141/3044162

[17] https://www.smithsonianmag.com/history/what-the-luddites-really-fought-against-264412/ The uprising was short lived, did little damage, and was firmly quashed.

[18] C. Frey and Osborne (2017). https://econpapers.repec.org/article/eeetefoso/v_3a114_3ay_3a2017_3ai_3ac_3ap_3a254-280.htm; The warning is echoed by Martin Ford (2009). *The Lights in the Tunnel*. CreateSpace.

[19] https://www.brookings.edu/wp-content/uploads/2019/01/2019.01_BrookingsMetro_Automation-AI_Report_Muro-Maxim-Whiton-FINAL-version.pdf

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[21] https://www.mckinsey.com/~/media/mckinsey/featured%20insights/Future%20of%20Organizations/What%20the%20future%20of%20work%20will%20mean%20for%20jobs%20skills%20and%20wages/MGI-Jobs-Lost-Jobs-Gained-Report-December-6-2017.ashx

[22] https://www.pewresearch.org/internet/2017/05/03/the-future-of-jobs-and-jobs-training/

[23] https://www.oecd.org/newsroom/job-automation-risks-vary-widely-across-different-regions-within-countries.htm

[24] India faces a job problem even though the absorption of digital technologies and factory automation is at a relatively early stage. The economy, which averaged a six percent per annum growth rate during 2011-2019, is not creating enough jobs to absorb the 12 million new entrants each year and has not done so for many years. Youth unemployment is close to 20 percent and the participation rate has been declining and was 37 percent in 2017. https://www.washingtonpost.com/world/2019/02/01/indias-job-crisis-is-worse-than-people-thought-its-government-tried-squelch-data/; https://www.bbc.com/news/world-asia-india-47068223; Nageswaran and Natarajan (2019). https://carnegieindia.org/2019/10/03/india-s-quest-for-jobs-policy-agenda-pub-79967

[25] Oxford Economics (2019) went on to add: "More than half the workers who left production jobs in the past two decades (in the United States) were absorbed into just three occupational categories: transport, construction and maintenance, and office and administration work. Ominously, our analysis found that these three occupational areas are among the most vulnerable to automation over the next decade." https://cdn2.hubspot.net/hubfs/2240363/Report%20%20How%20Robots%20Change%20the%20World.pdf?utm_medium=email&_hsenc=p2ANqtz--S_yv5LZTWzdC5IER_NtSl3PcknlmRKCRLWkiY7DXoc24tLeHNQmxbfIluLCA4PrkWMen4_J_hWSH49WG3OQvHF61Jlg&_hsmi=74013545&utm_content=74013545&utm_source=hs_automation&hsCtaTracking=07b1855a-24f4-4b99-bcb8-b0d2a13b715e%7C53b7a48e-9591-4179-8eab-694443190b4f. Between 1993 and 2007, one new robot was added per thousand workers in the United States and 1.6 per thousand in Western Europe. "The increase in the stock of robots (approximately one additional robot per thousand workers from 1993 to 2007) reduced the average employment to population ratio in a commuting zone by 0.39 percentage points and average wages by 0.77 percent (relative to a commuting zone with no exposure to robots)." Acemoglu and Restrepo (2019). https://economics.mit.edu/files/17106

[26] W. Dauth et al. (2017). German Robots. https://ideas.repec.org/p/cpr/ceprdp/12306.html

[27] While the majority of jobs lost to automation are of the unskilled, jobs of skilled craftsmen have also felt the edge of the automation axe. D. Kunst (2019). https://papers.tinbergen.nl/19050.pdf; D. Kunst (2019b). https://papers.tinbergen.nl/19033.pdf

[28] L. Wolters (2020) critically assesses the methodology and findings of the various studies and offers a reading on what their projections are worth. Robots, Automation and Work. https://workofthefuture.mit.edu/wp-content/uploads/2020/08/WotF-Working-Paper-05-2020.pdf

[29] https://www.ft.com/content/84bcb90c-2588-11ea-9305-4234e74b0ef3

[30] The likelihood of a trend decline in professional jobs was also spelled out in R. Susskind and D. Susskind (2018). The Future of the Professions. https://www.amphilsoc.org/sites/default/files/2018-11/attachments/Susskind%20and%20Susskind.pdf; Susan Athey believes that "off-the-shelf ML methods, for tasks such as prediction, classification and clustering, will become pervasive. There have already been a number of successful policy applications. Examples by Harvard economist Sendhil Mullainathan and coauthors include predicting whether an elderly patient will die within a year to determine whether to do a hip operation. Harvard economists Edward Glaeser, Andrew Hillis, Scott Kominers, and Michael Luca have helped cities to predict health code violations in restaurants, in order to better allocate inspector resources. Using ML together with satellite imagery and street maps can predict economic quantities such as poverty, safety, and home values." Machine Learning methods. https://arxiv.org/abs/1903.10075

[31] See also H. Holzer (2018). The robots are coming. Brookings. https://www.brookings.edu/blog/up-front/2018/12/13/the-robots-are-coming-lets-help-the-middle-class-get-ready/

[32] https://voxeu.org/article/how-different-technologies-affect-different-workers; https://www.rieti.go.jp/en/publications/summary/17050007.html

[33] A. Berg et al. (2018). Should we fear the Robot Revolution? IMF. https://www.imf.org/en/Publications/WP/Issues/2018/05/21/Should-We-Fear-the-Robot-Revolution-The-Correct-Answer-is-Yes-44923

[34] D. Autor et al. (2017). Concentrating on the fall of the labor share. NBER. https://www.nber.org/papers/w23108 and L. Karabarbounis and B. Nieman (2017) Trends in factor shares. NBER. https://www.nber.org/reporter/2017number4/karabarbounis.html offer as explanations the increasing shares of industries that are relatively capital intensive and the substitution of capital for labor as its relative price (automation, robots) has declined.

[35] R. Dekle (2020). http://econbrowser.com/archives/2020/09/guest-contribution-robots-and-labor-demand-evidence-from-japan. The adoption of robots/automation in Japan is subject to less resistance because, with its workforce shrinking, the country will need to rely more on these technologies – as will China, over the longer term. W. Dauth et al (2017). German Robots. https://ideas.repec.org/p/cpr/ceprdp/12306.html

[36] https://ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-research-reports/do-robots-really-destroy-jobs-evidence-europe

[37] M. Arntz et al. (2016). The risk of automation of jobs in OECD countries. https://www.oecd-ilibrary.org/docserver/5jlz9h56dvq7-en.pdf?expires=1600370372&id=id&accname=guest&checksum=A79A23DF36365B5B44126B15253E9B0B

[38] K. Mann and L. Puttmann (2017). Benign effects of automation. VoxEu. https://voxeu.org/article/benign-effects-automation-new-evidence

[39] PwC (2018). The Net impact of AI and related technologies on jobs in China. https://www.pwc.com/gx/en/issues/data-and-analytics/artificial-intelligence/technologies-on-jobs-in-china.html

[40] Bughin (2018). https://voxeu.org/article/how-future-work-may-unfold-demand-side-perspective

[41] For example, social media, smart devices and cloud computing have created an abundance of new jobs. T. Malone et al. (2020). AI and the future of work. MIT https://workofthefuture.mit.edu/research-post/artificial-intelligence-and-the-future-of-work/

[42] OECD (2016). Future of work. https://www.oecd.org/els/emp/Policy%20brief%20-%20Automation%20and%20Independent%20Work%20in%20a%20Digital%20Economy.pdf

[43] https://voxeu.org/article/automation-and-jobs-when-technology-boosts-employment; Frictional or more likely structural unemployment will also lead to a fall in demand that could slow the emergence of new job opportunities.

[44] C. Erhart (2009). The effects of inequality on growth. https://core.ac.uk/reader/6713990

[45] This is by no means a universal finding. Other research does not uncover a negative relationship.

[46] E. Dabla-Norris et al. (2015). Causes and Consequences of Income Inequality. IMF. https://www.imf.org/external/pubs/ft/sdn/2015/sdn1513.pdf

[47] https://blogs.imf.org/2017/02/22/the-imfs-work-on-inequality-bridging-research-and-reality/

[48] https://www.oecd.org/social/Focus-Inequality-and-Growth-2014.pdf

[49] R. van der Weide and B. Milanovic (2018). Inequality is Bad for Growth of the Poor. J. Ostry et al (2014). Redistribution, Inequality and Growth. IMF. https://www.imf.org/external/pubs/ft/sdn/2014/sdn1402.pdf; A.V. Banerjee and E. Duflo (2003). Inequality and Growth: What can the data say. https://economics.mit.edu/files/753; F. Cingano (2014). Trends in Income Inequality and its Impact on Growth. OECD. http://www.oecd.org/els/soc/trends-in-income-inequality-and-its-impact-on-economic-growth-SEM-WP163.pdf; U. Panizza (2002). Income Inequality and Growth. Journal of Economic Growth. http://dept.ku.edu/~empirics/Courses/Econ915/papers/income-inequality-growth_jeg02.pdf; S. Aiyar and C. Ebeke (2019). The Missing Link between Income Inequality and Economic Growth. VoxEu. https://voxeu.org/article/inequality-opportunity-income-inequality-and-economic-growth

[50] R. Barro (2000). Inequality, growth and investment. NBER. https://www.nber.org/digest/aug99/w7038.html shows that inequality can retard growth at lower levels of income but not when incomes are higher.

[51] F. Grigoli et al. (2016). Inequality and growth. IMF. survey the literature and offer new findings. https://www.imf.org/external/pubs/ft/wp/2016/wp16244.pdf

[52] S. Morelli (2017). Rising inequality and economic stability. In H. Boushey et al. *After Piketty*. HUP.

[53] According to the work of P. Lindert (1986) and W. Ryckbosch (2016). https://inequality.stanford.edu/sites/default/files/media/_media/pdf/Classic_Media/Lindert_1986_History%20of%20Inequality.pdf https://academic.oup.com/ereh/article/20/1/1/2465267 The divergence has been especially marked in the United States. D. Autor et al (2020). Work of the Future. https://workofthefuture.mit.edu/wp-content/uploads/2021/01/2020-Final-Report4.pdf

[54] Companies such as Uber, Lyft, TaskRabbit, Talkspace and Wag have created modestly compensated, "gig" type jobs for millions. M. Totty (2020) Technology and Industrialization. https://anderson-review.ucla.edu/service-industrialization/; Between nine percent and 22 percent of workers in European countries are engaged in temporary,

casual, and contract type jobs either part time or fulltime. U. Huws et al (2017). Work in the European Gig Economy. https://euagenda.eu/upload/publications/untitled-131669-ea.pdf; McKinsey (2016) conclude that between 20-30 percent of the working age population do independent "gig" work in the United States and the EU. *Independent Work.* https://www.mckinsey.com/~/media/mckinsey/featured%20insights/Employment%20and%20Growth/Independent%20work%20Choice%20necessity%20and%20the%20gig%20economy/Independent-Work-Choice-necessity-and-the-gig-economy-Executive-Summary.ashx; L. Katz and A. Krueger (2019) find that about a tenth of the American workforce were in gig type arrangements in 2016. ILO (2019). Digital Labor platforms and the future of work. https://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/---publ/documents/publication/wcms_645934.pdf

[55] OECD (2019). Under Pressure - The squeezed middle class. Over the past three decades, middle class incomes have either stagnated or declined. https://www.oecd.org/els/soc/OECD-middle-class-2019-main-findings.pdf

[56] B. Nolan et al. (2017) observe a decline in global inequality since the late 1980s and more rapidly since 2008. They highlight the role of globalization and the transition of East European economies among others. *Inequality and prosperity in the industrialized world*. https://www.citivelocity.com/citigps/inequality-prosperity/

[57] F. Bourguignon (2015). *The Globalization of Inequality*. Princeton University Press. B. Milanovic (2020) After the Financial Crisis. https://stonecenter.gc.cuny.edu/research/after-the-financial-crisis-the-evolution-of-the-global-income-distribution-between-2008-and-2013/; UN (2013). *Inequality Matters.* https://www.un.org/esa/socdev/documents/reports/InequalityMatters.pdf; C. Lankner (2017). Global Inequality. In H. Boushey et.al. *After Piketty*. HUP.

[58] UNDESA (2020). World Social Report 2020. https://www.un.org/development/desa/dspd/wp-content/uploads/sites/22/2020/02/World-Social-Report2020-FullReport.pdf

[59] Z. Qureshi (2017) summarizes the experience: "The story of income inequality over the past three decades (through 2013) is that the world as a whole is becoming modestly more equal but most countries, especially the high-income ones, are becoming less equal." Trends in Income Inequality. Brookings. https://www.brookings.edu/wp-content/uploads/2017/12/global-inequality.pdf

[60] Our World in Data. https://ourworldindata.org/income-inequality-since-1990

[61] World Inequality Report (2018). https://wir2018.wid.world/executive-summary.html

[62] J. Stiglitz (2020) fears that the pandemic could accelerate automation and worsen inequality. Conquering the great divide. https://www.imf.org/external/pubs/ft/fandd/2020/09/COVID19-and-global-inequality-joseph-stiglitz.htm That the pandemic is adversely affecting low paid workers in some of the services sectors such as hospitality and retail and also exposing healthcare workers to infection could also lead to greater inequality. WEF (2020) https://www.weforum.org/agenda/2020/10/covid-19-is-increasing-multiple-kinds-of-inequality-here-s-what-we-can-do-about-it/; https://www.wider.unu.edu/publication/five-ways-coronavirus-deepening-global-inequality

[63] The World Bank (2021) estimates that between 119 and124 million people will have been pushed below the poverty line in 2020, the majority of which are in in South Asia and SSA. https://blogs.worldbank.org/opendata/updated-estimates-impact-covid-19-global-poverty-looking-back-2020-and-outlook-2021; Milanovic (2020) elaborates: "The shock of the coronavirus crisis…might come as a second dramatic shock to the position of rich counties within the past 15 years….[almost] a replay of the Global Financial Crisis: the deterioration in the relative income position of the West, increasing inequalities within rich countries (as low-wage and more vulnerable workers lose out), and stagnation of middle-class incomes." https://glineq.blogspot.com/2020/03/the-world-after-corona.html

[64] T.M. Yousef et al. (2020). MENA over the next decade: Key challenges and policy options. Brookings. https://www.brookings.edu/opinions/the-middle-east-and-north-africa-over-the-next-decade-key-challenges-and-policy-options/; Inequality of income and wealth is compounded by inequality tied to gender, healthcare, education, and employment.

[65] World Bank (2020). Productivity Growth. https://openknowledge.worldbank.org/handle/10986/34015 . p. i.36

[66] Digital Middle East. https://www.mckinsey.com/~/media/mckinsey/featured%20insights/middle%20east%20and%20africa/digital%20middle%20east%20transforming%20the%20region%20into%20a%20leading%20digital%20economy/digital-middle-east-final-updated.pdf

[67] Empowering the GCC Digital workforce. https://www.strategyand.pwc.com/m1/en/reports/empowering-the-gcc-digital-workforce-full-report.pdf

[68] Firms might also view the crisis as a signal to accelerate the adoption of digital technologies, thereby boosting productivity. F. di Mauro and C. Syverson (2020). https://voxeu.org/article/covid-crisis-and-productivity-growth

[69] See also OECD (2017). https://read.oecd-ilibrary.org/governance/benchmarking-digital-government-strategies-in-mena-countries_9789264268012-en#page2

[70] According Hassine (2017) "Inequality, measured by the Gini coefficient for the distribution of household monthly real per capita total consumption expenditures, is found to range between 31 percent in Libya and Egypt to more than 40 percent in Mauritania, Tunisia, and Yemen. Arab Spring countries exhibit varying patterns of income and inequality, with low income and low inequality in Egypt, low income and high inequality in Yemen, medium income and low inequality in Libya, medium income and medium inequality in Syria, and relatively high income and inequality in Tunisia."

http://www.ecineq.org/ecineq_nyc17/FILESx2017/CR2/p426.pdf; https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2895368

[71] Arab countries have the dubious distinction of occupying the lowest rank in the Gender Gap Index. "Only four of the region's 19 countries have managed to close at least 50 percent of their gender gaps on the Economic Participation and Opportunity subindex, whereas a further nine countries have closed between 40 percent and 50 percent of their economic gender gap, and another six countries have closed less than 40 percent... the region's best-performing countries this year are Tunisia, the United Arab Emirates, and Kuwait, having closed 65 percent, 64 percent, and 63 percent, respectively, of their overall gender gaps. The lower end of the regional table is made up of Syria, Iraq and Yemen, which have closed 57 percent, 55 percent and 50 percent of their overall gender gaps, respectively." https://reports.weforum.org/global-gender-gap-report-2018/middle-east-and-north-africa/

N. Yassine Hamdan and N. Strate (2020). Gender Inequality in the Arab World. https://online.ucpress.edu/caa/article/13/3/25/111565/Gender-Inequality-in-the-Arab-WorldA-Comparative; H. Ei-Laithy (2016). Gender Inequality. https://www.ide.go.jp/library/Japanese/Publish/Download/Report/2015/pdf/C11_ch2.pdf

[72] One reason for this moderate reading is that top incomes are mismeasured, resulting in a downward bias. P. Verme and V. Hlasny (2016). Top incomes, inequality and the Egyptian case. https://blogs.worldbank.org/developmenttalk/top-incomes-inequality-and-egyptian-case; "Using data on house prices to estimate the top tail of the income [and also using] the relationship between the house price and household income using the household survey. [When] the two are then combined to obtain an estimate of the top tail of the income distribution, which in turn is combined with an estimate of the rest of the income distribution, we find evidence that inequality is indeed being underestimated in Egypt by a considerable margin. The Gini coefficient of household consumption expenditure for urban Egypt is found to increase from 0.36 to 0.47 after correcting for the missing top tail. When using household per capita income, which tends to show higher levels of inequality, the Gini increases from 0.39 to 0.52…Looking more closely at the top part of the Egypt's income distribution, we find that the income share of the richest one percent in urban Egypt increases from 8.9 percent to 15.1 percent." R. van der Weide, C. Lakner and E. Ianchovichina (2018). Is inequality underestimated in Egypt? https://voxdev.org/topic/methods-measurement/inequality-underestimated-egypt-evidence-house-prices; https://onlinelibrary.wiley.com/doi/abs/10.1111/roiw.12338 The estimates of moderate inequality in Arab countries have received considerable pushback from others who claim that the actual extent of inequality is being downplayed. The case is made at length by G. Achcar (2019) On the Arab inequality puzzle: The case of Egypt. *Development and Change.* https://onlinelibrary.wiley.com/doi/full/10.1111/dech.12585

[73] R.A. Shaban (2016). Inequality in Arab countries. https://link.springer.com/chapter/10.1057%2F9781137554598_6; E. Ianchovichina (2015) observes that consumption inequality is lower than income inequality. How Unequal are Arab countries. https://www.brookings.edu/blog/future-development/2015/02/04/how-unequal-are-arab-countries-2/

[74] This finding is corroborated by other recent research. L Assouad (2020) Inequality and its Discontents in the ME. Carnegie. https://carnegie-mec.org/2020/03/12/inequality-and-its-discontents-in-middle-east-pub-81266; F. Alvaredo, L. Assouad, and T. Piketty (2018) Inequality in the ME. VoxEu. https://voxeu.org/article/inequality-middle-east

[75] UN ESCWA (2019). Rethinking Inequality in Arab Countries. https://www.unescwa.org/sites/www.unescwa.org/files/uploads/rethinking-inequality-arab-countries-summary-english.pdf

[76] All data from WDI. https://data.worldbank.org/indicator/SI.DST.10TH.10?locations=MA; It is interesting that the percentage bounces around in the intervening years in some of the countries, such as Egypt and Morocco, which suspends a question over the reliability of the data.

[77] Shares of the top ten percent rose in Qatar, Oman, and Lebanon. UN ESCWA (2019) Rethinking Inequality in Arab Countries. https://www.unescwa.org/sites/www.unescwa.org/files/uploads/rethinking-inequality-arab-countries-summary-english.pdf; Wealth inequality in the Arab countries is predictably high. E. Ianchovichina (2015). How Unequal are Arab countries. https://www.brookings.edu/blog/future-development/2015/02/04/how-unequal-are-arab-countries-2/

[78] P. Turchin (2013). http://peterturchin.com/cliodynamica/strange-disappearance/

[79] UNDP (2019). *Human Development Report*. http://hdr.undp.org/sites/default/files/hdr2019.pdf; P. Krugman (2019). Notes on excessive wealth disorder. NYT. https://www.nytimes.com/2019/06/22/opinion/notes-on-excessive-wealth-disorder.html

[80] R. van der Weide et al. (2018) observe: "In Egypt, there is a sense that economic success is reserved for the privileged, and that opportunities for the majority are largely missing. [According to one] estimate…a child from a disadvantaged family has a one-in-ten chance of enrolling into university, while a child from a privileged family is virtually guaranteed to make it to university." https://voxdev.org/topic/methods-measurement/inequality-underestimated-egypt-evidence-house-prices; B. Jackson and P. Segal (2004). *Why Inequality Matters.* https://www.researchgate.net/publication/265205109_Why_Inequality_Matters

[81] S. Kuznets (1955). Economic growth and income inequality. *American Economic Review*. https://www.jstor.org/stable/1811581; He based his hypothesis on data from the US, the UK, and Germany, and was cautious in his claim. Kuznets was doubtful that increasing income inequality in developing countries would lead to greater capital accumulation and higher growth. S. Sumner (2014). Piketty on Kuznets. https://www.econlib.org/archives/2014/06/pikitty_on_kuzn.html

[82] T. Ota (2017). Economic growth, income inequality and environment. https://www.nature.com/articles/palcomms201769

[83] The Kuznets hypothesis was challenged among others by T. Piketty (2014). *Capital in the 21st century*. HUP. "Inequalities increase in the early phases of industrialization, because only a minority is prepared to benefit from the new wealth that industrialization brings…In more advanced phases of development, inequality automatically decreases as a larger and larger fraction of the population partakes of the fruits of economic growth… the magical Kuznets curve theory was formulated, in large part, for the wrong reasons, and its empirical underpinnings were extremely fragile. The sharp reduction in income inequality…in almost all the rich countries between 1914 and 1945 was due above all to the world wars and the violent economic and political shocks they entailed (especially for people with large fortunes). It had little to do with the tranquil process of intersectoral mobility described by Kuznets… Since the 1970s, income inequality has increased significantly in the rich countries, especially the United States." https://www.hup.harvard.edu/features/capital-in-the-twenty-first-century-introduction.html; D. Acemoglu and J. Robinson (2002). The political economy of the Kuznets curve. https://wcfia.harvard.edu/files/wcfia/files/908_jr_kuznets.pdf

[84] B. Milanovic (2016). Introducing Kuznets waves. VoxEu. https://voxeu.org/article/introducing-kuznets-waves-income-inequality

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[102] A. Amico (2017) presents the following estimates of state ownership. "Currently, 62 percent of market capitalization of Arab stock exchanges relates to firms in which sovereign shareholders have 'blockholdings' (10 percent and above). In fact, of the 600 largest listed firms, accounting for 97 percent of the region's market capitalization, close to 40 percent have a sizeable number of their shares held by the state. Government ownership is even more prevalent in larger firms, with governments having a considerable stake in 89 of the 100 largest listed firms in the region. While these figures are telling, they exclude the majority of state-owned enterprises, especially in strategic sectors such as petrochemicals, network industries, and utilities, as they remain unlisted. Arab governments are significant owners of both listed and unlisted commercial companies, not only in strategic sectors such as hydrocarbons, mining and minerals, and aviation, but also in other less strategic sectors." Arab states as shareholders. https://journals.openedition.org/poldev/2282

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[135] https://www.bls.gov/ooh/fastest-growing.htm; CIT GPS Technology at Work 4.0 https://ir.citi.com/MRt7C1Ze4%2F%2F8VAvTGXLIlIrDz7o6%2B6R9as2YbTgXP9bQc%2BRDOGaviVyY9QIzz5QK

[136] https://www.linkedin.com/pulse/85-jobs-exist-2030-havent-been-invented-yet-leo-salemi

[137] The fact is that no one has a clear idea of what the future job market will look like. "Researchers and policy makers are underequipped to forecast the labor trends resulting from specific cognitive technologies, such as AI. Typically, technology is designed to perform a specific task which alters demand for specific workplace skills. The resulting alterations to skill demands diffuse throughout the economy, influencing occupational skill requirements, career

mobility, and societal well-being (e.g. impacts to workers' social identity). Identifying the specific pathways of these dynamics has been constrained by coarse historical data and limited tools for modeling resilience."

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[147] R. Baldwin (2019). *Globotics.* Oxford University Press.

[148] E-commerce is flourishing in GCC countries but is much less prevalent in other Arab states. Total monthly spending in 2017 was USD 7.3 billion. UNESCWA (2019). https://www.unescwa.org/sites/www.unescwa.org/files/publications/files/arab-digital-development-report-2019-english.pdf

[149] Very low latency 5G could make it possible to deliver medical and other services as well, such as remote surgery. S. Lund and J. Bughin (2019). Next Generation technologies and the future of trade. VoxEu. https://voxeu.org/article/next-generation-technologies-and-future-trade

[150] A report on digital technologies for Saudi Arabia states: "Services activities have already become major global sources of growth for employment; and access to talent has become key to the competitiveness of services firms. Various policy actions can enhance the outcomes for the digital economy by building the required human capital assets. These include openness to mode 4 (movement of natural persons), education reforms both for re-skilling and future jobs, openness to trade and investment in education services, and sharing of best practice….Digital transformation with automation of many activities…has led to a shift in the demand toward high-skilled workers and growing income inequality in the past. As services are increasingly drawn into the digital realm, however, new jobs are emerging that present opportunities for middle-skilled workers. While jobs that create digital tools tend to be technical and cognitive skills-intensive, many complementary jobs are intensive in interdisciplinary and interpersonal skills, and empathy. The digital economy will offer new opportunities in these areas, not least for women." https://t20saudiarabia.github.io/PolicyBriefs/T20_TF1_PB4.pdf

[151] A. Seric and D. Winkler (2020). Covid 19 could spur innovation. VoxEu. https://voxeu.org/article/covid-19-could-spur-automation-and-reverse-globalisation-some-extent

[152] A telescoping of GVCs and some reshoring is a post pandemic possibility with possibly longer-term implications for FDI and growth of tradable activities in Arab countries. A. Seric and D. Winkler (2020). Covid 19 could spur Automation and reverse Globalization. VoxEu. https://voxeu.org/article/covid-19-could-spur-automation-and-reverse-globalisation-some-extent

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[155] https://arabdevelopmentportal.com/blog/how-measure-digital-transformation-arab-countries

[156] With incomes of rentiers not usually captured by statistics on income distribution.

[157] H. Chekir and I. Diwan (2013). Crony capitalism in Egypt. Harvard Kennedy School. https://www.hks.harvard.edu/sites/default/files/centers/cid/files/publications/faculty-working-papers/250_Diwan_EGX+paper.pdf

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[159] Among African countries, Egypt received the highest remittances in 2019 (USD 27 billion) equal to almost nine percent of GDP. http://english.ahram.org.eg/NewsContent/3/12/368363/Business/Economy/Egypt-is-the-highest-recipient-of-remittances-in-A.aspx; https://data.worldbank.org/indicator/BX.TRF.PWKR.DT.GD.ZS?locations=EG

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[161] E. Brynjolfsson et al. (2017). AI and the Modern Productivity Paradox. https://www.nber.org/papers/w24001; E. Brynjolfsson et al. (2020). Understanding and Addressing the Productivity Paradox. https://workofthefuture.mit.edu/research-post/understanding-and-addressing-the-modern-productivity-paradox/

[162] In the race between education and technology, education is falling behind.

[163] A. Atkinson (2015). *Inequality: What can be done?* Harvard University Press.

[164] R. Hernandez (2018). The Fall of employment in Manufacturing. https://www.bls.gov/opub/mlr/2018/beyond-bls/the-fall-of-employment-in-the-manufacturing-sector.htm

[165] A. J. Binder and J. Bound (2019). The declining labor market prospects of less-educated men. NBER. https://www.nber.org/papers/w25577 D. Autor and E. Reynolds (2020) speculate that the COVID-19 pandemic will hasten the introduction of labor-saving methods, resulting in leaner staffing in retail stores, restaurants, meat packing facilities, and others. Along with a decline in retail – and continuing increase in online purchasing - the number of jobs for median workers with limited schooling will shrink. The nature of work after the Covid crisis: Too few low paid jobs. Brookings. https://www.brookings.edu/research/the-nature-of-work-after-the-covid-crisis-too-few-low-wage-jobs/

[166] https://www.bls.gov/ooh/fastest-growing.htm

[167] As shown by Eric Hanushek and his co-authors, there is a strong relationship between education quality proxied by test scores and GDP growth. Arab countries have a lot of ground to make up. Math and science scores for eighth graders fell below minimum proficiency levels as measured by TIMMS scores. UNESCWA (2019). Rethinking Inequality in Arab Countries. https://www.unescwa.org/sites/www.unescwa.org/files/uploads/rethinking-inequality-arab-countries-summary-english.pdf

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[169] UNESCWA (2019). Arab Digital Development Report 2019. https://www.unescwa.org/sites/www.unescwa.org/files/publications/files/arab-digital-development-report-2019-english.pdf

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