Artificial Intelligence and Inequality in the Middle East: The Political Economy of Inclusion

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Abstract

The chapter explores the challenges, opportunities and tensions facing the equitable development of AI in the MENA region in the aftermath of the Arab Spring. While diverse in their natural and human resource endowments, countries of the region share a commonality in the predominance of a youthful population amidst complex political and economic contexts. The chapter sheds light on how rampant unemployment, especially amongst a growing young population together with informality, gender and digital inequalities will likely shape the impact of AI technologies, especially in the region's labour abundant resource poor countries. The chapter attempts to unpack issues related to data, legislative environment, infrastructure and human resources as key inputs to AI technologies which in their current state may exacerbate existing inequalities. The promise for AI technologies for inclusion and helping mitigate inequalities lies in harnessing grounds up youth entrepreneurship and innovation initiatives driven by data and AI, with a few hopeful signs coming from national policies. The chapter concludes that AI can concurrently serve to equalize and divide, underline the gap in focus between the economic and the political, and exemplify how investment in technology alone without developing human capital and an enabling environment would fail to achieve the desired objectives. With focus on political will, an awareness of these tensions informs the debate on AI and inclusion and helps mitigate the challenges and the threats that AI would exacerbate inequality in the region.

Keywords

Inequality, Middle East, MENA, Artificial Intelligence, data, unemployment, entrepreneurship, equity, inclusion, digital divide.

I. Introduction

In recent years, the Middle East has been plagued by persistent economic and political inequalities. Where some regimes have pushed the agenda of economic growth and technological advancement, they have paid less attention to economic development and inclusion, and less so to political engagement and participation. These, in turn, come amidst other divides based on religion, ethnicity and spatial disparities. Inequalities have also been manifested in the digital economies, where they have been exacerbated by power dynamics between highly concentrated businesses and smaller establishments trying to carve a niche for themselves. This in turn has its effect on artificial intelligence and divides associated with it.

Given this, the discourse over artificial intelligence (AI) and inequality tends to be an amplified version of the earlier conversations over digital technologies and inequality. On one end of the spectrum, digital technologies can aggravate the digital divide and knowledge inequalities and widen the developmental gap. Given the pervasiveness of the fourth industrial revolution and the power of AI technologies, these consequences are amplified if the technology and the data are monopolized in the hands of a powerful few.

Like electricity and information technology, AI qualifies as a “general purpose technology” (GPT) typically characterized by its “pervasiveness”, ability for “continuous improvement” to eventually reduce costs, and “spawning innovation”, making it “easier to invent and produce new

products or processes.[1] What makes this particular GPT unique is the scale, scope and capability of its components, its depth, capacity to self-educate, and potential for a "protracted aggregate impact".[2] Within each of AI's components – the data, the algorithm and the infrastructure, lies a trigger for potential inequalities. From a societal standpoint, biases in data, black boxes in algorithms, and the inaccessibility and inadequacy of infrastructure, can all serve to exclude and marginalize. The ones who are most agile and who are already well positioned to adapt while capitalizing on existing technologies will be able to reap the benefits from AI.

On the other end of the spectrum, and notwithstanding the above, the pervasive nature of AI itself can indeed be channelled towards inclusion, mitigating inequalities and empowerment of the marginalized. Examples are improving health services by generating systems that better predict disease, better education by tuning curricula to student's ability to assimilate and creating an encompassing ecosystem of entrepreneurship and small businesses built around open data and inclusive technologies.

The purpose of this chapter is to explore issues related to AI and inequality in the MENA region, within the larger global conversation of AI and ethics. It is important to investigate the potential of AI in its social and economic context and ask how these societies can utilize AI as a tool for democratizing knowledge and inclusion amidst the unique challenges they face. The chapter explores tensions, opportunities, and potential challenges to the equitable deployment of AI in the region. The dearth of information about AI use in the region has been a challenge in undertaking this work, especially given the timeliness of the topic. Accordingly, in addition to

[1] Boyan Jovanovic and Peter L. Rosseau, "General Purpose Technologies: 'Engines of Growth'?" *Journal of Econometrics*, 65 (1996): 83-108.
[2] Boyan Jovanovic and Peter L. Rosseau, "General Purpose Technologies: 'Engines of Growth'?" (1996).

published works, the author resorted to capturing knowledge from interviews, AI-related conversations by experts in the field, and talks at public conferences.

The chapter includes four sections. Following the introduction, section two offers context through background on the region, its inherent socio-economic challenges and facets of its inequality. Section three unpacks components of AI and their respective bearing on inequality in the region, discusses challenges and highlights rays of hope. Section four concludes and underlines specific tensions that shape the debate over AI and inclusion in the region.

2. Context: A Region in Flux

The Middle East and North Africa is not a homogenous region. While there are overall similarities in the political and cultural contexts of its countries, there is considerable variation in their economic landscape, specifically their natural and human resources. The size, qualifications and potential of the domestic workforce within a country is a key factor in considerations of the impact of technology on inequality and socioeconomic development. The uprisings in parts of the region over the last decade have shown that trickle-down economics have not worked to mitigate those inequalities and improve the livelihood of the marginalised.

2.1 A Diverse Region

Following the World Bank classification, the region can be clustered into groups according to the availability of natural resources, namely hydrocarbons, and also according to the size of their populations.[3] The first group includes high income Arab countries which tend to be resource-rich labour importers, with expatriates representing a significant portion of the population. The

[3] "Socio-Economic Context and Impact of the 2011 Events in the Middle East and North Africa Region," *MENA-OECD Investment Programme,* (2011): 9 http://www.oecd.org/mena/competitiveness/49171115.pdf. See Figure 1.

second is middle income Arab countries that are labour abundant - with some being resource rich such as Algeria and others being resource poor such as Egypt, Tunisia, Jordan, Lebanon and Morocco. Thirdly, low-income Arab countries include some which are resource rich and labour abundant but face political turmoil, such as Syria and Yemen, and some which are resource poor such as Palestine and Mauritania.[4] [5]

One commonality shared by countries of the region is the prevalence of youth. The region houses 100 million people between the age of 15 and 29[6] with more than half of the region's population under the age of 25.[7] These are the shapers of the region's future. By virtue of their young age, they offer the ideal potential recipients of learning, adapting, using and creating new technologies if given the right education and skill development training. This young population is unevenly distributed among countries with diverse economic landscapes, with pockets of youth unemployment witnessed in resource poor countries of the region. This has significant political nuances in environments that are already politically fluid.

The variation in countries' socio-economic conditions is also reflected in the diverse levels of technological development and use, in turn offering different contexts when it comes to AI and inequality. The oil rich countries have taken a lead in the Fourth Industrial Revolution, taking steps to encourage AI adoption in government and encouraging AI-based entrepreneurship. The UAE is positioning itself as a regional lead in AI, assigning a government minister dedicated to AI. The country has pioneered initiatives to retrain labour force and adopted policies that

[4] "Socio-Economic Context and Impact of the 2011 Events," *MENA-OECD Investment Programme,* (2011): 9 http://www.oecd.org/mena/competitiveness/49171115.pdf.
[5] The chapter does not cover non-Arab countries in the region, i.e. Iran and Israel.
[6] Arab Human Development Report: *Youth and the Prospects for Human Development in a Changing Reality*, UN Development Programme, 2016. http://arab-hdr.org/Reports/2016/2016.aspx.
[7] "Meeting the Needs of a Growing Youth Population in the Middle East," in The Report: Abu Dhabi 2016, *Oxford Business Group*, https://oxfordbusinessgroup.com/analysis/dividend-or-liability-meeting-needs-region%E2%80%99s-growing-youth-population-0.

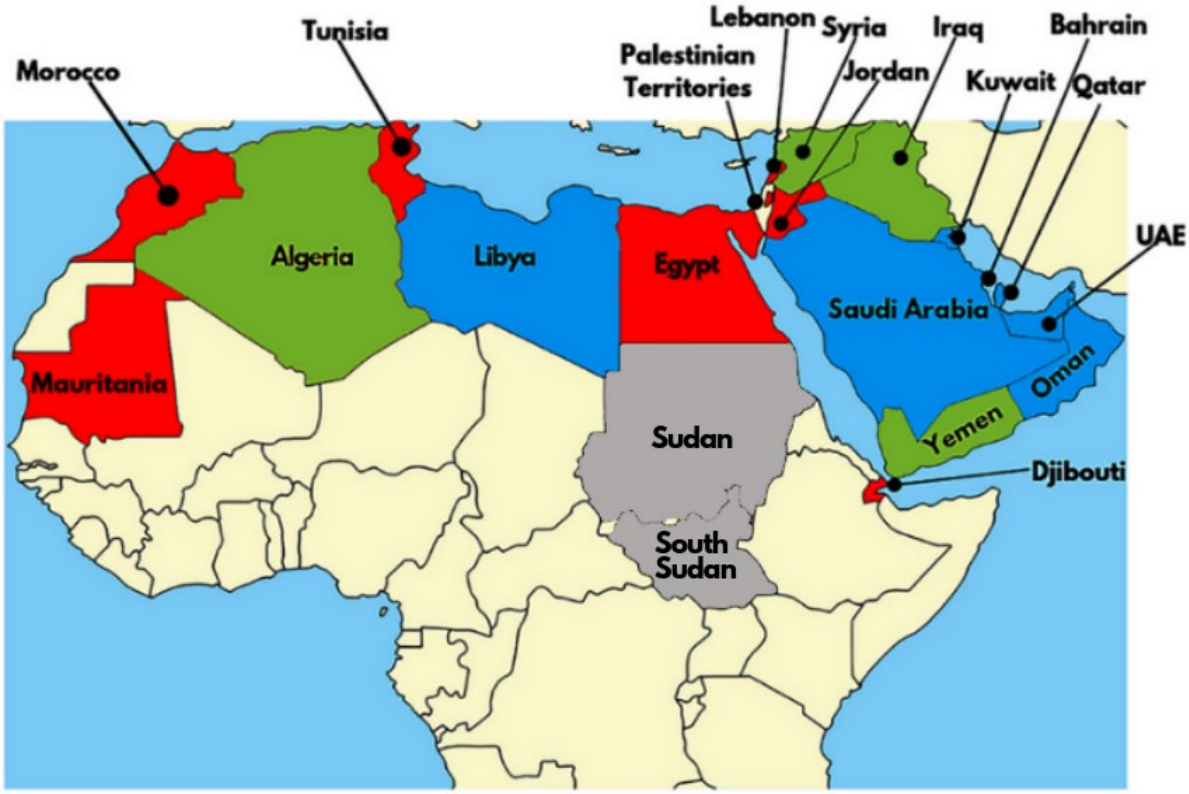
encourage AI and inclusion in areas such as health.[8] While these countries set the benchmark, they have relied on revenues from natural resources to fuel the development of new industries depending on imported technologies and human resources.

On the other hand, despite potential, labour abundant countries like Egypt and Tunisia relatively trail along. They face persisting economic difficulties, especially unemployment of the youth, of females, and in some cases, of the educated. Under such circumstances, talents remain underutilised, ascribed socio-economic statuses are sticky and social mobility is hard. Inequality then becomes one of opportunity and not just of wealth. At the same time, these countries have comparatively more diversified economies in terms of manufacturing and service industries than high income, resource rich countries.

Most of the analysis in this chapter pertains to the cluster of middle-income countries that are resource poor and labour abundant. While the inherent tensions and paradoxes related to AI and inequality are highest, the promise may be also the most. They face the challenge, and the opportunity, of relying on endogenous capacity. By leapfrogging, they could actually achieve significant successes in the use of AI for inclusion. Currently they face challenges at the level of data acquisition and the resilience of local infrastructure. When present, initiatives to incorporate AI into developmental goals are nascent. Initiatives to encourage budding start-ups that can push for more AI integration exist but are limited, and the challenges are ample.

[8] "Artificial Intelligence to be Used in 'Urgent' Fight against Tuberculosis, says UAE Minister," *The National*, 2018, https://www.thenational.ae/uae/health/artificial-intelligence-to-be-used-in-urgent-fight-against-tuberculosis-says-uae-minister-1.783316.

Figure 1: Map of Arab MENA Countries Classified by Natural and Human Resources



Source: Put together by author based on data from http://siteresources.worldbank.org/INTMENA/Resources/EDP07_OVERVIEW_APRIL12.pdf

Sudan and South Sudan are Classified within Sub-Saharan Africa by the World Bank.

2.2 The Arab Spring and Failure of Trickle Down

Despite positive macroeconomic indicators in the years preceding the Arab uprisings, underlying deeply rooted causes drove the region to fall into unrest with hardly any trickle down from the seemingly growing economies. On the eve of the January 2011 uprisings, both Egypt and Tunisia experienced relatively high rates of economic growth (5.1 percent and 3.5 percent respectively).[9] Indeed, Egypt experienced its highest growth rates in the years leading up to 2011, reaching 7 percent in 2007-2008. In the decades leading up to 2011, other socioeconomic indictors failed to shed light on underlying tensions, with the announced statistics on poverty, health and education showing considerable improvements.[10]

The case of the Arab uprisings illustrates the shortcomings of top-down, macro indicators of economic and social well-being and their failure to predict unrest. National policies have been concerned primarily, if not completely, with top down led growth while paying little attention to other key factors to promote sustainable development such as education, health and civil liberties. The uprisings demanded economic, social and political inclusion amidst an array of frustrations, and have highlighted how the economic and the political intertwined. On top of the structural socioeconomic ailments came the persistent unemployment and lack of opportunities

[9] World Bank, *World Bank Open Data*, 2019. https://data.worldbank.org.
[10] Michael Gordon, "Forecasting Instability: The Case of the Arab Spring and the Limitations of Socioeconomic Data," *Wilson Center,* last modified February 8th, 2018. https://www.wilsoncenter.org/article/forecasting-instability-the-case-the-arab-spring-and-the-limitations-socioeconomic-data.

especially of the youth, the highly educated, and the women. Socioeconomic grievances were coupled with discontent over corruption[11] and the limited or non-existent political freedoms.[12]

Neoliberal policies were reflected in technology policies and a fixation on connectivity for economic gains with little safeguards to citizen engagement and privacy. In Egypt, for example, the expansion of ICT infrastructure as the backbone for the economy was part of the neoliberal Economic Reform and Structural Adjustment Program (ERSAP) led by the World Bank and the International Monetary Fund in the 1990s. The objective was to draw foreign direct investment to feed the targeted economic growth. In that vein, technology and innovation policies within these countries have tended to favour larger, foreign corporations and Western centric development paradigms at the expense of supporting local, smaller scale entrepreneurial technology initiatives and a culture of openness and collaboration.

Nevertheless, the expansion in connectivity brought about two empowering outcomes related to the uprisings. First, the growth of an entrepreneurial scene fuelled by the energy of the youth. This scene continues to flourish despite less than ideal circumstances, which serves as a testament to the underlying potential in countries such as Egypt and Tunisia. Second, expanded connectivity paradoxically opened up the networked public sphere which engaged growing communities to utilise the digital communication technologies for mobilisation against the regime.[13] [14] The discussion over whether and how ICTs have served inclusion has been fuelled by the dual use of ICTs, first by the state to promote neoliberal policies and later to control the

[11] "Socio-Economic Context and Impact of the 2011 Events in the Middle East and North Africa Region," *MENA-OECD Investment Programme,* (2011): 9, and 13, http://www.oecd.org/mena/competitiveness/49171115.pdf.;
[12] Michael Gordon, "Forecasting Instability: The Case of the Arab Spring and the Limitations of Socioeconomic Data," *Wilson Center,* last modified February 8th, 2018. https://www.wilsoncenter.org/article/forecasting-instability-the-case-the-arab-spring-and-the-limitations-socioeconomic-data.
[13] Benkler, Yochai. *The wealth of networks: How social production transforms markets and freedom*. Yale University Press, 2006.
[14] Nagla Rizk, Lina Attalah and Nadine Weheba, "The Networked Public Sphere and Civic Engagement in Post-2011 Egypt: A Local Perspective," *Arab Networked Public Sphere,* 2016. http://www.arabnps.org/egypt/

masses, but also by the people to mobilise and engage. The uprisings thus called for revisiting the trajectory of technological advancement amidst a paradoxical state stance regarding liberties.

2.3 Multifaceted Inequality in MENA

Inequality in the region is complex, multi-layered and multidimensional. It extends beyond income inequity to inequality of opportunity rooted in disparities in access to education, health services, employment, living conditions and active citizenry. Inequalities also exist along gender, ethnic origins and social background,[15] with realities pertaining to minorities and under-privileged groups being excluded from opportunities for equal participation in political and economic processes. Examples are communities living in poverty in Cairo's city of the dead, ethnic minorities in Morocco's Western Sahara and religious minorities in Lebanon. These translate into exclusion and marginalisation with potential political unrest especially amongst the youth.

Such disparities are not captured by mainstream indicators of income inequality such as the Gini coefficient which only measures the distribution of wealth amongst a population, with the assumption that such wealth is properly registered and documented. Even there, Alvaredo, Assouad and Piketty point to a serious issue in income distribution in the region.[16] They highlight extreme inequality between and within countries, with "the share of total income

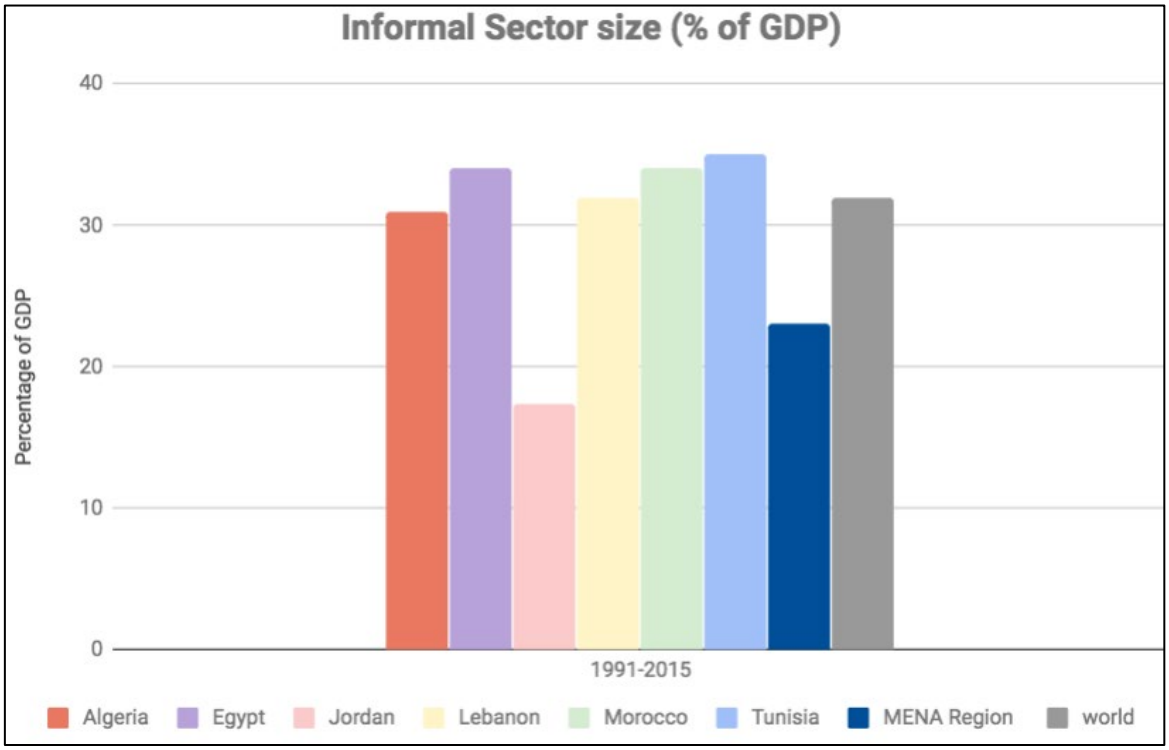
[15] Michael Gordon, "Forecasting Instability: The Case of the Arab Spring and the Limitations of Socioeconomic Data," *Wilson Center,* last modified February 8th, 2018. https://www.wilsoncenter.org/article/forecasting-instability-the-case-the-arab-spring-and-the-limitations-socioeconomic-data.
[16] Facundo Alvaredo, Lydia Assouad, and Thomas Piketty, "Measuring inequality in the Middle East 1990–2016: The World's Most Unequal Region?" *The Review of Income and Wealth* 65, no. 1 forthcoming (2019): https://onlinelibrary.wiley.com/doi/10.1111/roiw.12385.

accruing to the top 10% of income earners is about 64% in the Middle East" comparatively to 37% in Western Europe for example.[17]

The difficulty of measuring inequality by formal assessment methodologies is aggravated by the inherence of informality. Indeed, the region has some of the largest informal economies in the world.[18] Figure 2 below outlines the size of the informal sector (as a percentage of total GDP) for labour abundant countries in the region. While the MENA region as a whole remains under the world average, all labour abundant countries with the exception of Jordan are above the global average. These results indicate that about one third of total economic output in the region remains undeclared and therefore not registered for tax purposes. Additionally, the fact that informal employment constitutes 67 percent of the region's labour force[19] means that two thirds of the region's workers have no access to social security and work outside state-sanctioned laws and parameters, such as labour laws.

[17] Facundo Alvaredo, Lydia Assouad, and Thomas Piketty, "Measuring inequality in the Middle East 1990–2016" forthcoming (2019).
[18] Diego F. Angel-Urdinola and Kimie Tanabe, "Micro-Determinants of Informal Employment in the Middle East and North Africa Region," SP Discussion Paper No. 1201, *World Bank*, 2012. https://openknowledge.worldbank.org/handle/10986/26828.
[19] Diego F. Angel-Urdinola and Kimie Tanabe, "Micro-Determinants of Informal Employment," *World Bank, 2012.*

Figure 2: Informal Sector size (% of GDP)



Source: https://www.imf.org/en/Publications/WP/Issues/2018/01/25/Shadow-Economies-Around-the-World-What-Did-We-Learn-Over-the-Last-20-Years-45583

In line with the above, two particular facets of inequality in the region directly feed into potentials and challenges of AI and inclusion. The first is unemployment, with the AI conversation highly associated with its influence on labor; and the second is the digital divide, the digital being the main realm in which AI can thrive. Below is further analysis of these two aspects.

2.3.1. Unemployment

Youth unemployment is rampant in labour abundant countries of the region. In 2018, the regional average for youth unemployment in MENA stood at 34 percent in 2018,[20] which is

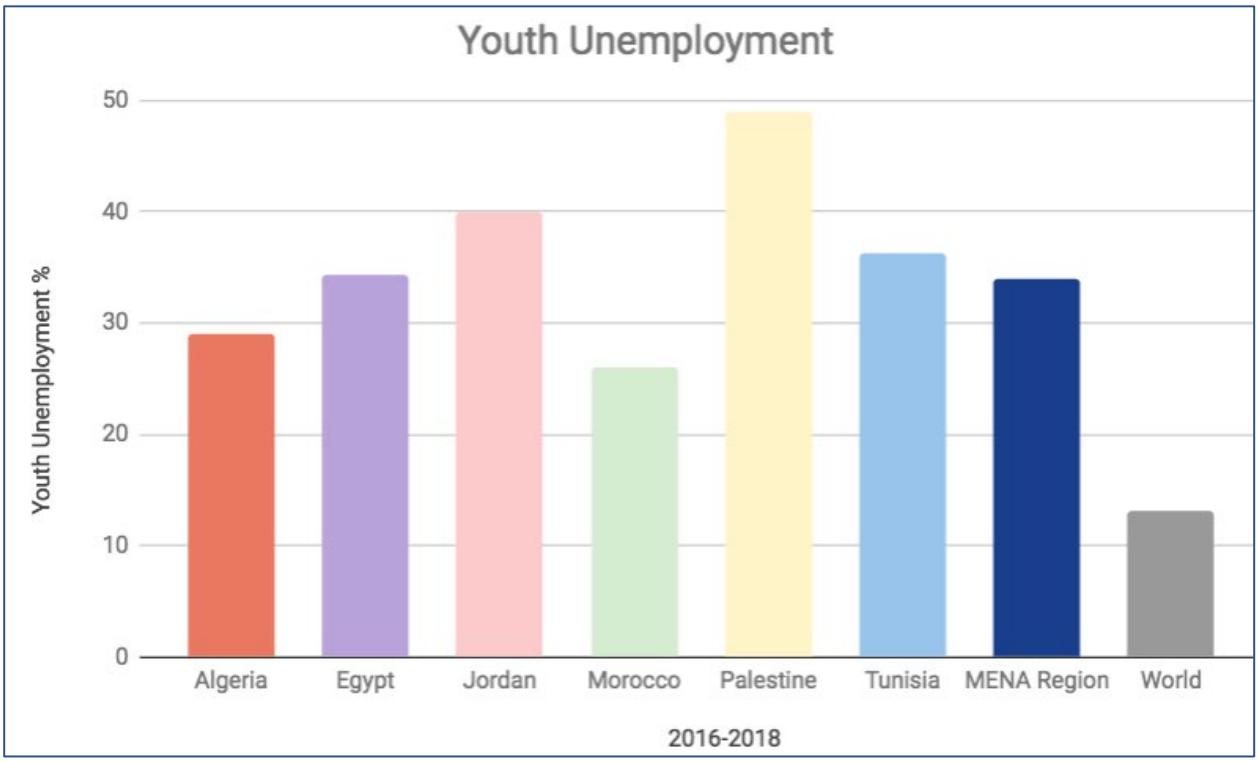
[20] World Bank. "Unemployment, youth total (% of total labor force ages 15-24) (national estimate)." The World Bank Group. Accessed April, 2019. https://data.worldbank.org/indicator/SL.UEM.1524.NE.ZS?end=2010&start=2003.

significantly higher than the world average of 13.23 percent. Current youth unemployment figures for Egypt and Tunisia (34.3 percent and 36.3 percent respectively) are higher than those witnessed on the eve of Arab Spring, then standing at 25 percent and 30 percent, respectively.[21] Youth unemployment continues to pose a serious threat in the near future given he demographic construct of the region, with those between the ages of 15 and 29 making up almost one third of the region's population, and those below the age of 15 making up another third.[22]

Figure 3: Youth Unemployment in Selected MENA countries (2016-2018)

[21] Michael Gordon, "Forecasting Instability: The Case of the Arab Spring and the Limitations of Socioeconomic Data," *Wilson Center,* last modified February 8th, 2018. https://www.wilsoncenter.org/article/forecasting-instability-the-case-the-arab-spring-and-the-limitations-socioeconomic-data.

[22] Arab Human Development Report: *Youth and the Prospects for Human Development in a Changing Reality*, UN Development Programme, 2016. http://arab-hdr.org/Reports/2016/2016.aspx.



Source: Compiled by author based on data from https://data.worldbank.org/indicator/SL.UEM.1524.NE.ZS?end=2010&start=2003.

Unemployment is also witnessed among the educated. In 2016, more than a quarter of holders of university degree or higher in Egypt were unemployed.[23] The comparative figure exceeded 30 percent in Tunisia, and 17 percent in Morocco in 2010.[24] Over the past two decades, unemployment rate in the region for men with advanced degree, has fluctuated between 15 and 35 percent. This is higher than the figures for fellow middle-income countries elsewhere (3.4 percent in Bulgaria, and 11.8 percent in Turkey for example).[25]

[23] "Egypt in Figures 2018." 2018. *Central Agency for Public Mobilisation and Statistics* . CAPMAS 2015. March. http://www.sis.gov.eg/UP/Egypt in Figures 2018/egypt-in-numbers2018.pdf.
[24] "Data." *Arab Development Portal*, 2019. http://www.arabdevelopmentportal.com/data.
[25] World Bank. "Unemployment, male (% of male labor force) (modeled ILO estimate)" The World Bank Group. Accessed April 2019. https://data.worldbank.org/indicator/sl.uem.totl.ma.zs.

Female unemployment is also witnessed in the region's middle-income countries. In 2016, female unemployment in Egypt stood at 23.6 percent.[26] In Jordan, Tunisia and Morocco the recorded rates have been 25 percent, 23.1 percent and 10 percent, respectively.[27] The employment gender gap reaches nearly 80 percent in Algeria and Jordan and 69 percent in Egypt.[28] Even though the share of women in informal employment is lower than men, there remains "gender segmentation" as women are more likely to be concentrated in lower quality jobs.[29] Furthermore, women are represented in invisible work that goes beyond the informal sector such as house and domestic work that they are unpaid for. This adds further layers on uncaptured inequality that takes place in informal employment.

2.3.2. Digital Inequality

Digital inequalities exist between the region and the world, as well as between and within countries of the region. Divides exist along indicators of connectivity, but also of use by age group, education, income, geographical distribution and gender. Since 2006, all countries of the region have witnessed exponentially increasing Internet and mobile connectivity.[30] As a percentage of the population, internet users have reached 76 percent in Lebanon and almost two-thirds in Morocco, Palestine and Jordan.[31] Egypt has almost 40 million internet users

[26] "Egypt in Figures 2018." CAPMAS. http://www.sis.gov.eg/UP/Egypt in Figures 2018/egypt-in-numbers2018.pdf
[27] World Bank. "Unemployment, female (% of female labor force) (modeled ILO estimate)" The World Bank Group. Accessed April 2019. https://data.worldbank.org/indicator/SL.UEM.TOTL.FE.ZS.
[28] "The Future of Jobs and Skills in the Middle East and North Africa: Preparing the Region for the Fourth Industrial Revolution,"*World Economic Forum,* (2017), https://www.weforum.org/reports/the-future-of-jobs-and-skills-in-the-middle-east-and-north-africa-preparing-the-region-for-the-fourth-industrial-revolution.
[29] "The Future of Jobs and Skills in the Middle East and North Africa" *World Economic Forum,* (2017); "The Informal Economy in Arab Nations: A Comparative Perspective," *Women in Informal Employment: Globalizing and Organizing* (WIEGO*)*, 2017. https://www.wiego.org/sites/default/files/resources/files/Informal-Economy-Arab-Countries-2017.pdf.
[30] World Bank. "Individuals using the Internet (% of population)" The World Bank Group. Accessed April 2019. https://data.worldbank.org/indicator/it.net.user.zs.
[31] "Data." *Arab Development Portal,* 2019. *http://www.arabdevelopmentportal.com/data.*

representing about 40 percent of the population in 2018.[32] Broadband subscription for mobile phones in countries of the region has ranged from around half to two-thirds of their populations, except for oil rich countries and Jordan where the figures exceeded 100 percent.[33]

Nevertheless, when compared to other regions, with the exception of the UAE, Qatar and Lebanon, mobile broadband speed in the region is below the global average[34]. The region is also characterised by high prices, a limited number of users with high-speed internet, and very high barriers to entry in the internet market for new service providers[35]. Additionally, although the region has seen expansion of basic voice service in mobile, the infrastructure for broadband is largely influenced by state-owned operators with outdated infrastructure and with most mobile operators banning VOIP apps.

Regional disparities exist in infrastructure for Internet speed. The UAE and Qatar lead the use of fibre optic systems to deliver Internet.[36] With the exception of a recent initiative by Egypt to replace 95 percent of its copper cables with fibre optic ones by 2020,[37] other middle-income countries still rely on copper wires.[38]

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[32] "ICT Indicators Quarterly Bulletin," *Ministry of Communications and Information Technology (MCIT),* 2019. http://mcit.gov.eg/Publication/Publication_Summary/6147/.
[33] "Data." *Arab Development Portal,* 2019.
[34] World Bank. "Individuals using the Internet (% of population)" The World Bank Group. Accessed April 2019. https://data.worldbank.org/indicator/it.net.user.zs.
[35] World Bank. "Individuals using the Internet (% of population)" The World Bank Group. Accessed April 2019. https://data.worldbank.org/indicator/it.net.user.zs.
[36] World Bank. "Individuals using the Internet (% of population)" The World Bank Group. Accessed April 2019. https://data.worldbank.org/indicator/it.net.user.zs.
[37] "95% of copper cables to be replaced with fiber ones by 2020," *Egypt Today*, 2018. http://www.egypttoday.com/Article/2/62602/95-of-copper-cables-to-be-replaced-with-fiber-ones
[38] Arezki et al., "A New Economy in Middle East and North Africa", *Middle East and North Africa Economic Monitor,* last modified 2018. https://openknowledge.worldbank.org/bitstream/handle/10986/30436/9781464813672.pdf?sequence=11&isAllowed=y.

Digital inequalities exist within countries of the region. Internal digital divides are evident by geographical disparities between urban and rural areas in Egypt[39] and Lebanon,[40] and between the relatively affluent coastal regions as opposed to the less fortunate rural western and southern parts in Tunisia. Evidence of digital divides by age and education has also been documented in Egypt,[41] Tunisia,[42] and Lebanon.[43]

The digital divide is also present by gender. While not evident in rates of Internet access, cultured gender roles in the region shape women's engagement with ICTs.[44] [45] In Tunisia, being exclusively responsible for domestic labour in addition to employment or education inhibits women from allocating more time than they would like to ICT usage, which limits their skills' development.[46] It is this socially constructed 'second shift' of domestic labour that reinforces the divide in digital competencies between men and women in the region.[47]A similar trend appears

[39] Mona Farid Badran, "Young People and the Digital Divide in Egypt: an Empirical Study," *Eurasian Economic Review* 4, no. 2 (2014): 223–250, https://link.springer.com/article/10.1007/s40822-014-0008-z.
[40] Antoine Harfouche and Alice Robbin, "115 Antecedents of the Digital Divide in Lebanon," *Mediterranean Conference on Information Systems 2010 Proceedings*: Paper 40, https://www.academia.edu/29840864/Antecedents_of_the_Digital_Divide_in_Lebanon.
[41] Badran, "Young People and the Digital Divide in Egypt: an Empirical Study," *Eurasian Economic Review* 4, no. 2 (2014): 223–250.
[42] Ikram Toumi, "Information and Computer Technology and the Digital Divide in the Post-Revolution Tunisia," PhD Diss. University of Texas, 2016.
[43] Antoine Harfouche and Alice Robbin, "115 Antecedents of the Digital Divide in Lebanon," *Mediterranean Conference on Information Systems 2010 Proceedings*: Paper 40, https://www.academia.edu/29840864/Antecedents_of_the_Digital_Divide_in_Lebanon.
[44] Oum Kalthoum Ben Hassine, "Personal expansion versus traditional gender stereotypes: Tunisian university women and ICT," in *Women, Gender and ICT in Africa and the Middle East: Changing Selves, Changing Societies*, eds. Ineke Buskens and Anne Webb (UK: Zed Books Radical International Publishing, 2014).
[45] Sangeeta Sinha, "Women's rights: Tunisian Women in the Workplace," *Journal of International Women's Studies* 12, no. 3 (2011): 185–200.
[46] Ben Hassine, "Personal expansion versus traditional gender stereotypes: Tunisian university women and ICT," in *Women, Gender and ICT in Africa and the Middle East,* eds. Ineke Buskens and Anne Webb 2014.
[47] Arlie Hochschild and Anne Machung, *The Second Shift: Working Families and the Revolution at Home* (New York: Penguin, 2012), https://books.google.com.eg/books?id=St_6kWcPJS8C&printsec=frontcover#v=onepage&q&f=false.

in Lebanon, where inequalities in work opportunities and socially constructed gender roles mean that at the same occupational level men have more e-skills than women.[48]

3. AI in MENA – Data, Infrastructure and People

The advent of AI to the context of MENA comes with multiple challenges, notably in the present context as pertaining to inclusion and inequality. This section attempts to unpack this conundrum by a discussion of data and the enabling environment, infrastructure and human capital.

3.1. Data – The Mine

Data is at the heart of the discourse over AI and inequalities in the region. While better data sets enable tuning algorithms to give better results, biased data can cause or amplify inequalities and marginalisation. Quality data is lacking in the region, and the data that is available is subject to challenges. These can themselves create or amplify biases that cause harmful consequences, especially to marginalized groups.

3.1.1. Data Asymmetry in Markets

Data asymmetry is innate in power dynamics. Given that data is a differentiating market factor, data becomes a source of authority and an impediment to levelling the playing field for the less powerful. This holds even more in a context of limited local data to start with. Data

[48] Antoine Harfouche and Alice Robbin, "115 Antecedents of the Digital Divide in Lebanon," *Mediterranean Conference on Information Systems 2010 Proceedings*: Paper 40, https://www.academia.edu/29840864/Antecedents_of_the_Digital_Divide_in_Lebanon.

inequality manifests in the underlying forces in the AI market and in the competition that exists between large international companies and local small to medium enterprises.

As large data sets are a prerequisite for developing AI, utilising AI is limited to those who can afford to either buy them from data brokers, research institutions or consultants, or those who have the capacity, be it technical, infrastructural or financial, to gather and analyse large amounts of data. It is companies, like Google, Uber, Facebook, and Amazon that have massive amounts of annotated data that will see the best results from their AI systems.

Lack of access to data may actually inhibit the very access to the market, which would limit competition, lessen innovation and "stifle the energy and fresh ideas that start-ups and SMEs bring."[49] This puts smaller companies at a disadvantage, and feeds into market concentration. In Egypt, for example, a few large laboratories who control the market own 70 percent of the country's health data sets, but do not necessarily know how to make the best use of them.[50] This data mine offers a huge potential for small agile companies to deploy AI for health services like predicting epidemics and future responses to particular medications. The concentration of these data sets in the market is a barrier to innovation, specifically the inclusion of small companies in the market for a development-related objective.

Data crowdsourcing has offered an alternative towards mitigating data asymmetry. For example, smaller, local initiatives like Bey2ollak, a crowdsourced road-traffic monitoring application founded in Egypt, collect their own data via crowdsourcing, and hence build large data sets, albeit on a much smaller scale than larger multinationals. The application collects a considerable amount of data from its 1.3 million users.

[49] Olivier Thereaux, "Using Artificial Intelligence and Open Data for Innovation and Accountability," *Open Data Institute*, 2017, https://theodi.org/article/using-artificial-intelligence-and-open-data-for-innovation-and-accountability/.
[50] Abaza, Ahmed. "AI and Inequalities." Interview by Nagla Rizk. April 20, 2019.

3.1.2. Data Lock by the State

Data lock amplifies the power asymmetry originating from data ownership and gating by the state. Data is typically housed with National Statistics Offices (NSOs). Clear asymmetry exists between the state as owner of national statistics and the citizen. Data lock takes place when the data is not easily accessed by citizens, not released in a timely manner, and the data collection methodologies are not disclosed. Data may be politicized, filtered, incomplete or censored.

The data lock in the region is seen in the lack of published high-quality data that is machine readable, and the cumbersome regulations and need for licenses to allow for reuse.[51] The Open Data Barometer produced by the World Wide Web Foundation shows in 2015 that only an estimated 1.48 percent of data in the Arab World is open. Even though the Barometer suggests that 71 percent of surveyed government information was available on the internet, there remains technical and/or legal barriers to accessing this as machine readable data.[52] For example, while there is increased availability of data on the website of Egypt's Central Agency for Public Mobilisation and Statistics (CAPMAS), the data is in PDF format.

Some countries in the region have made some progress towards open government data. One example is Tunisia, where the Ministry of Energy, in an effort with partner international organisations promoting open government principles, created a website for publishing hydrocarbon investment contracts and associated documents in 2014. This data was made available in machine-readable format, in addition to meta-data on country, company name,

[51] "MENA Data Platform: Open Knowledge for Development in MENA," 2015. http://menadata.net/public/index.
[52] Hatem Ben Yacoub, "Why OKF Global Open Data Index 2015 Is a Failure," *HBY Consultancy*, 2015. http://www.hbyconsultancy.com/blog/why-okf-global-open-data-index-2015-is-a-failur.

resource being extracted, signature date, and contract type.[53]

3.1.3. Data Inaccuracy – Blur, Myopia and Blindness

Another main challenge with data in the region is the inaccuracies that end up clouding out realities on the ground. One possible source of inaccuracy is the *data blur* as aggregates cloud out granulations which can only be captured by the disaggregation of the data. An example can be found in the failure of Egypt's aggregate official data to capture the nuanced effects of currency floatation in 2016 and subsequent inflation on inequality for different groups, especially women and female led households.[54]

A related source of data inaccuracy is the short sightedness coming from a single dimensional lens that looks at economic and social variables from the top down – data *myopia*. This contention extends to data that makes up national statistics such as indicators of income, inequality, education, health and others. A case in point is the failure of national data as they are defined and collected to reflect lived realities and anticipate the Arab Spring. Indeed, multifaceted inequality sits at the heart of this contention around macroeconomic indicators and the statistics that inform them, especially those of growth, being inadequate reflections of economic well-being.

Such shortcomings of quantitative macro data put in question the ability of the collection *methodologies* to reflect the complex realties on the ground, including informality for example.[55]

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[53] Heni et al., "Tunisians Can Now Access Hydrocarbon Contracts in Open Data Format," *Natural Resource Governance Institute*, 2016. https://resourcegovernance.org/blog/tunisians-can-now-access-hydrocarbon-contracts-open-data-format.

[54] Maye Kabil, "How to Cover a Post-Shock Economy?" *Mada Masr,* last modified 2017. https://madamirror10.appspot.com/madamasr.com/en/2017/12/29/feature/economy/how-to-cover-a-post-shock-economy/.

[55] Elena Ianchovichina, "Eruptions of Popular Anger: The Economics of the Arab Spring and Its Aftermath," *World Bank,* 2018.

Nobel Laureate Angus Deaton has provided a wealth of evidence on the limited efficacy of aggregate level data and its methodology of collection.[56] His work calls for a move away from national, aggregate level methodologies to ones that are more bottom up and better reflect individual human behaviour and realities.[57]

Data inaccuracy also comes from *blindness* due to selectivity in data collection, excluding communities that are outside the radar of the formal establishment. This applies to informal employees who are absent from the national employment statistics. Also invisible from the national statistical radar are residents of informal dwellings. These account for almost a third of housing in Cairo and 23 percent in Morocco, and are seen in several peri-urban areas around Greater Tunis and in Jordan.[58] Informal housing can also be observed, also at a lower rate, richer countries in the region such as Saudi Arabia.[59] Exclusion of informal communities from national income and other market censuses immediately translates to further marginalization and exclusion from policies related to subsidies, social safety nets, housing and broader policy making.

3.2 An Enabling Environment?

Closely linked to the discussion of data is the enabling environment that governs the potential for democratizing access and use of data for inclusive AI in the region. Such environment is necessary to promote a comprehensive paradigm of openness and a culture of sharing with data

https://openknowledge.worldbank.org/bitstream/handle/10986/28961/9781464811524.pdf?sequence=5&isAllowed=y.

[56] "The Prize in Economic Sciences 2015," *The Royal Swedish Academy of Sciences* (2015), https://www.nobelprize.org/uploads/2018/06/press-33.pdf.

[57] "The Prize in Economic Sciences 2015," *The Royal Swedish Academy of Sciences*.

[58] David Sims, "The Arab Housing Paradox," *The Cairo Review*, last modified Fall 2013, https://www.thecairoreview.com/essays/the-arab-housing-paradox/.

[59] David Sims, "The Arab Housing Paradox," *The Cairo Review*.

at its core. Data inequalities are compounded by a subpar environment which complicates the interplay between AI and inclusion in the region. Specifically, an appropriate environment entails an ecosystem of legislation that supports innovation, access to markets, open data, and building human capacity and technology development.

Freedom of information frameworks are scarce in the region. Tunisia and Jordan have adopted FOI legislation and made official declarations in this regard.[60] Tunisia established an Access to Information Authority, one of the only such bodies in the MENA region. Jordan joined the Open Government Partnership in 2011 and has announced some ambitious reforms and national plans regarding freedom of information and access to information.[61]

Legislation is also needed to safeguard citizen and consumer rights to privacy and data protection. Laws and regulations pertaining to data and data protection are scarce in the region. An existing framework to which many countries in the region are signatory is the Arab Convention on Combating Information Technology Offences.[62] The convention only offers an "overview of general provisions on privacy and data protection" but does not provide "explicit stipulations on legal protection and regulation of data and privacy."[63]

Tunisia, Morocco and Jordan have some form of reified or draft laws on data protection.[64] Tunisia is a pioneer in the MENA region in terms of data privacy and protection legislation, with most of the data privacy and protection legal provisions set out in the 2004 Organic Act on the

[60] "Participants," *Open Government Partnership,* 2018. https://www.opengovpartnership.org/participants.
[61] "Participants," *Open Government Partnership,* 2018. https://www.opengovpartnership.org/participants.
[62] Including Algeria, Egypt, Morocco, Tunisia, Jordan, Palestine, Lebanon.
[63] Nagla Rizk, Youmna Hashem and Nancy Salem. "Open Data Management Plan Middle East and North Africa: A Guide," *MENA Data Platform,* October 2018. http://menadata.net/resources/datasets/1539516976_Open%20Data%20Management%20Plan.pdf.
[64] Nagla Rizk, Youmna Hashem and Nancy Salem. "Open Data Management Plan Middle East and North Africa," *MENA Data Platform,* 2018.

Protection of Personal Data.[65] By setting a high standard of data protection, the Tunisian Act gives a range of rights to individuals whose data is processed and sets out certain obligations for organisations and individuals in charge of the data processing.

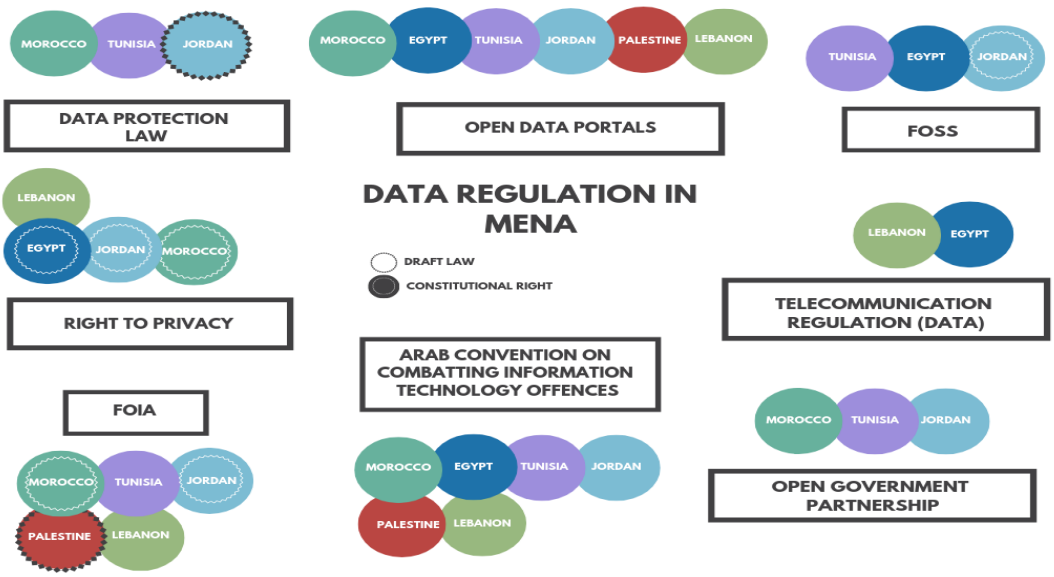
Other countries in the region have also taken some steps in terms of data legislation. For example, Qatar enacted the Law Concerning Personal Data Protection (DPL) in 2016.[66] In the UAE, specific data protection provisions exist only in free zones, such as the UAE's Abu Dhabi Global Market (ADGM) and Dubai International Financial Centre.[67] Bahrain's latest Personal Data Protection Law, which will come into effect in August 2019 is a step to encourage technology related business while guaranteeing data protection.[68] Investors are to follow data protection legislation of their home country. While this offers data protection to foreign investors, it remains to be seen how this legislation serves to protect the data of the country's homegrown businesses.

This said, there is a challenge to access to data coming from the absence of political will, and when regimes serve to block or filter data, and further, use data for citizen surveillance. Clearly, issues of privacy feature here, with possible collateral damage when data is monitored by third parties. Conflict can exist over user data between the state and the private sector. In drafting ride sharing legislation in Egypt in 2018, a major point of contention between ride sharing companies such as Uber and the Egyptian government revolved around data regulations. Authorities

[65] Republic of Tunisia, *Organic Act n°2004-63 of July 27th, 2004 on the Protection of Personal Data*. https://tinyurl.com/y8o76eau.
[66] "Law No. 13 of 2016 Promulgating the Protection of the Privacy of Personal Data Law." *Sultan Al-Abdulla and Partners*. https://qatarlaw.com/wp-content/uploads/2017/05/Personal-Data-Privacy-Law-No.-13-of-2016.pdf.
[67] Andrada Coos, "Data Protection Regulations in the Middle East", *Endpoint Protector,* 2018. https://www.endpointprotector.com/blog/data-protection-regulations-middle-east/.
[68] Mohamed Toorani and Eamon Holley, "Bahrain Publishes Personal Data Protection Law," *DLA Piper*, 2018. https://www.dlapiper.com/en/qatar/insights/publications/2018/09/bahrain-publishes-personal-data-protection-la.

requests pertaining to access and storage of data collected by Uber were met by objections and resulted in a delay in the passing of legislation.[69]

Figure 4: Data regulation in MENA 2018



Source: Compiled by author in 2018 from different sources

As well, an enabling environment for AI for inclusion would benefit from clearly defined AI strategies with a clear vision for inclusion and equality. The strategy would include a clear stipulation of the safety nets for those potentially harmed by AI biases, as well as the anticipated disruptions in the labour market. This would be part of the "social contract" that comes along the

[69] Ahmed Megahid, "Egyptian parliament approves bill regulating ride-sharing apps," *The Arab Weekly*, last modified 2018, https://thearabweekly.com/egyptian-parliament-approves-bill-regulating-ride-sharing-apps.

fourth industrial revolution.[70] Only UAE has an AI Strategy; Tunisia and Egypt have drafted strategies to be announced later in 2019.

3.2. Infrastructure Issues

An integral component of the discussion of AI and inequality is infrastructure. Infrastructure plays out along several axes. Among these are the uneven access to data storage and computing capacity, the limited internet connectivity and the host of issues related to how algorithms are intertwined with the human context.

First, AI applications necessitate a massive volume of data, hundreds of terabytes that need to be accommodated, stored, processed and managed via technical infrastructures, computing power and resources.[71] Access to massive data storage and computing power infrastructure, such as Amazon's Cloud Computing Software or NASA's Open Stack,[72] can be a barrier and contribute to market inequality. While these are available on a rent or pay per use basis, the cost may be prohibitive to those at the lower end of the scale.[73] Additionally, the cloud service may restrict the user to the vendor's specific packages. As well, clients object to their data being stored on the cloud.[74] Indeed, there have been complaints from start-ups in the region that their need for data storage and computer power capacity is not well met.[75] The availability of massive

[70] "Dialogue Series on New Economic and Social Frontiers Shaping the New Economy in the Fourth Industrial Revolution," *World Economic Forum*, 2019, www3.weforum.org/docs/WEF_Dialogue_Series_on_New_Economic_and_Social_Frontiers.pdf.
[71] "Open Data Management Plan for the MENA Region," *MENA Data Platform*, 2018. http://menadata.net/public/dataset/81539516969.
[72] William Bryan, "OpenStack Cloud Computing Platform," *NASA,* 2016. https://www.nasa.gov/offices/oct/40-years-of-nasa-spinoff/openstack-cloud-computing-platform/.
[73] El Kassas, Sherif. "AI and Inequalities." Interview by Nagla Rizk. March 30, 2019.
[74] Abaza, Ahmed. "AI and Inequalities." Interview by Nagla Rizk. April 20, 2019.
[75] Abaza interview by Nagla Rizk, 2019.

data centres and computing power capacity in the richer countries of the region like UAE, could widen the regional divide.

However, some argue that the availability of the cloud option for data storage and computing mitigates inequality. This is because it provides an affordable alternative for start-ups "to scale their services as they grow rather than requiring an upfront investment in infrastructure as a sunk cost."[76] As well, the cloud offers a platform for only the Internet required components of the process, as the development of AI itself can be done offline.[77]

Still, usage of the cloud necessitates strong connectivity for data upload, training of the machine, and for the dissemination of AI enabled applications and services, especially on a national scale.[78] As well, a stronger internet connection will certainly ensure more efficient and seamless synchronisation between the data upload, the development of algorithms and AI applications. Countries with the stronger connectivity stand to lead in the race of AI deployment.

In addition to the above, a succinct unpacking of AI infrastructures and their impact on inclusion looks beyond the algorithm into the human context that surrounds it. The different layers of AI infrastructures unleash aspects of social and political contexts, cleverly termed "black boxes within black boxes." These include the organizational structures, trade secrecy, all the way to "labor practices and untraceable global supply chains for rare earth minerals used to build consumer AI devices."[79]

Inequality inherent in algorithms can be more dangerous as they are invisible and dormant, serving to amplify biases in the data, in humans and on the ground. Like elsewhere, in the

[76] Abdelwahab, Ashraf and Hossam Sharara. "AI and Inequalities." Interview by Nagla Rizk. April 1 and 13, 2019.
[77] Sadek, Nouri. "AI and Inequalities." Interview by Nagla Rizk. April 14, 2019.
[78] Sadek and Abdelwahab interviews by Nagla Rizk. April 2019.
[79] AI Now Report 2018. *AI Now Institute, New York University*, *2018. https://ainowinstitute.org/AI_Now_2018_Report.pdf.*

MENA region, algorithms are likely to be developed and implemented by "experts" who will have "ethical agency and decision making" over the rest of the "subjects" including marginalized groups or to the subjects to which the algorithms are 'applied'.[80] In this regard, the inclusion of at least a "domain expert", e.g. health, is crucial in the process of developing the algorithm. The gap is even larger when the algorithm is taken from an open source platform, like Google open source algorithms, as a product coming out from completely different contexts is to be applied generically to a local context with existing multilayered and multifaceted inequality.[81]

Additionally, AI algorithms can magnify the bias by missing a significant portion of the population. This can cause "allocative harms"[82] where some people are denied services or opportunities. For example MerQ, an Egyptian start up, launched a chatbot through Facebook named Sally, that introduces people to credit card systems in Arabic ("MerQ closes its seed funding round").[83] While the chatbot is in Arabic and may seem more context specific, it is still exclusive as only 10-15% of Egyptians have bank accounts, reflecting a social reality of a historical mistrust of banks, and 60 percent of Egyptians do not have access to the Internet or Facebook. Credit rating algorithms that may include alternative data such as neighborhoods, can magnify socio economic differences embedded in the data bias.[84]

Another lock is inherent in the trade secrets of the algorithm usually held by corporates and third-party vendors. This is another black box of intellectual content saved for the privileged few.

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[80] AI Now Report 2018. *AI Now Institute, New York University*, *2018. https://ainowinstitute.org/AI_Now_2018_Report.pdf.*
[81] Abaza, Ahmed. "AI and Inequalities." Interview by Nagla Rizk. April 20, 2019.
[82] AI Now Report 2018. *AI Now Institute, New York University*, *2018. https://ainowinstitute.org/AI_Now_2018_Report.pdf.*
[83] Zubair Naeem Paracha, "Egypt's Merq Raises Six-Figure Seed for Sally, its Facebook Chatbot that Lets Users Compare Credit Cards," *Menabytes*, last modified 2019. https://www.menabytes.com/egypt-merq-see.
[84] Abaza, Ahmed. "AI and Inequalities." Interview by Nagla Rizk. April 20, 2019.

The MENA region is more likely to be users than producers of this content, and hence will be denied access to the secrets of this opaque part of the AI supply chain.

Algorithms are also part of a bigger political context. Even if the algorithm may be technically sound or fair, it can be used as a means for harmful ends.[85] The biases inherent in facial recognition algorithms, for example, are likely to exacerbate discrimination. These tools may offer yet more clout to regimes and new forms of surveillance. For example, Israeli security forces' use of facial recognition software to control entry into the Al-Aqsa mosque is less favored by Palestinians to metal detectors, on the back of fears that the technology is likely be used against them.[86]

3.3. The Human Resource Challenge

The region is rich in human resources with an abundance of young and formally educated youth. Nevertheless, structural market imbalances coupled with inadequate skill development shape the human resources challenges faced by the region with the advent of AI technologies. Job losses are likely to amplify already existing labour market imbalances, specifically, structural unemployment caused by insufficient job opportunities. Local decisions to use "labour-enabling" rather than "labour-replacing"[87] technologies may be subject to political and social factors, especially in countries where youth unemployment and political instability are rampant.[88]

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[85] AI Now Report 2018. *AI Now Institute, New York University*, *2018. https://ainowinstitute.org/AI_Now_2018_Report.pdf.*
[86] Amjad Iraqi. "Palestinians are reviving their agency in Jerusalem." *+927 Magazine,* 2017; Rebecca Stead. "Remembering Israel's Move to Install Metal Detectors at Al-Aqsa." *Middle East Monitor*, 2018.
[87] Lay Chuah, Norman Loayza and Achim Schmillen, "The Future of Work: Race with-Not against-the Machine," 2018. fowigs.net/future-work-race-not-machine/.
[88] The public sector accounted for 25% of employment in Egypt from 2006 to 2012: Ragui Assaad and Caroline Krafft.. "The Structure and Evolution of Employment in Egypt: 1998-2012." *Economic Research Forum (ERF)*, 2013. https://erf.org.eg/wp-content/uploads/2014/07/805.pdf.

As elsewhere in the world, the risk of job loss due to automation is most likely to occur at the medium skill level. The skill structure of employment in countries of the region show the middle skill cohort to be the highest. Almost half (48.7 percent) of work activities in Egypt are susceptible to automation by adapting currently available technologies.[89] These typically include outsourcing and call centres, currently accounting for 90,000 direct jobs[90]. This is also true for high income countries in the region like the UAE which is 47 percent susceptible.[91]

The very job loss or lack of jobs in an environment of unemployment of the youth and the educated has resulted in many of the educated youth considering new technology-based work opportunities such as ride sharing. This becomes an example where technology-based labour opportunities respond positively to unemployment, counter to the usual concern of technology contributing to the labour crisis through automation. While far from ideal, research has shown that ride sharing in Egypt allows for a more favourable option to prevalent informal work or even formal counterparts that offer little true health or pension benefits.[92] Respondents indicated that ride sharing has allowed for livelihood, flexibility, and offered opportunities to engage with new technologies adding to skill sets and potential. For women, work with ride sharing has offered new opportunities for livelihood along with safety and empowerment.[93]

More so for the demand of the AI economy, there will be a dire need for the acquisition of new skills. Skill retraining on data science, problem-solving, and digital skills will be needed for

[89] Michael Chui, James Manyika, and Mehdi Miremadi, "The Countries Most (and Least) Likely to be Affected by Automation," *Harvard Business Review*, 2017.
[90] "The Future of Jobs and Skills in the Middle East and North Africa: Preparing the Region for the Fourth Industrial Revolution,"World Economic Forum, (2017), https://www.weforum.org/reports/the-future-of-jobs-and-skills-in-the-middle-east-and-north-africa-preparing-the-region-for-the-fourth-industrial-revolution.
[91] "The Future of Jobs and Skills in the Middle East and North Africa," World Economic Forum, (2017).
[92] Nagla Rizk, "A Glimpse into the Sharing Economy: An Analysis of Uber Driver-Partners in Egypt," *Social Science Research Network,* 2017, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2946083.
[93] CIPPEC, "Urban Transport in the Sharing Economy Era: Collaborative Cities," 2018. http://www.cippec.org/wp-content/uploads/2018/09/UrbanTransport-completo-web_CIPPEC.pdf

workers who are expected to be displaced as AI becomes prevalent.[94] Such skills are also needed in education as general data capacities were found to be lacking in the region's school curricula, with specific data science courses outside of business contexts found also scarce.[95]

Middle income countries within the region are not homogenous with regards to workers' skill sets. Egypt, UAE, Jordan, and Saudi Arabia are leading the way for high-skilled employment, with over 20% of their labour force considered as high-skilled.[96] Additionally, these countries are also high on the digital skills such as computer skills, basic coding and digital reading, albeit superseded by Saudi Arabia and including Tunisia.[97] Indeed those five countries were the top source countries for the 100 start-ups chosen by the World Economic Forum in 2019 to lead the fourth industrial revolution in the region.

A final challenge facing human capital in the region is labour retention. On the local level, labour turnover from start-ups to join lucrative work with larger companies is a source of inequality between smaller start-ups and bigger players.[98] [99] Big corporations in the information technology sector attract top tier talent with better pay and promises of reallocation and exposure to global markets. Internally, this widens the market gap between large companies and start-ups.

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[94] "Artificial Intelligence for Africa: An Opportunity for Growth, Development, and Democratisation," *Access Partnership*, 2019. https://www.accesspartnership.com/artificial-intelligence-for-africa-an-opportunity-for-growth-development-and-democratisation/.

[95] Abed Khooli, "Harnessing the Economic Power of Data in the Middle East and North Africa (MENA)," *Birzeit University Centre for Continuing Education,* 2015.

[96] "The Future of Jobs and Skills in the Middle East and North Africa: Preparing the Region for the Fourth Industrial Revolution,"*World Economic Forum,* (2017), https://www.weforum.org/reports/the-future-of-jobs-and-skills-in-the-middle-east-and-north-africa-preparing-the-region-for-the-fourth-industrial-revolution.

[97] Global Competitiveness Report, *World Economic Forum,* October 2018. https://www.weforum.org/reports/the-global-competitveness-report-2018.

[98] Abaza, Ahmed. "AI and Inequalities." Interview by Nagla Rizk. April 20, 2019.

[99] Saleh, Sameh."AI and Inequalities." Interview by Nagla Rizk. April, 2019.

This can also take place on the regional and international level,[100] where local capacities migrate from labour abundant middle income countries like Egypt and Tunisia to the Global North or to oil rich countries like UAE and Saudi Arabia.[101] [102] A few of the migrating businesses, however, have managed to keep their back offices in the region given the low labour and operating costs, which helps retain skills and train young employees (Abaza, interview)

3.4. Rays of Hope

Despite the above challenges which threaten to widen inequalities in the region, there remains some rays of hope. The first comes from the growing youth entrepreneurial scene where many homegrown start-ups and businesses have flourished since the uprisings. Local, organic grounds up initiatives, including small businesses and start-ups, carry a promise for human development and empowerment through the use, and possibly production, of digital technologies, AI being no exception. Their entrepreneurial mindset carries a potential for novel ways of data collection and deploying AI solutions and linkages to serve developmental purposes, that target inclusion and mitigating inequality.

Within the hope in youth, the region's human capital portrays some promise in its foundation of basic educational attainment. In some countries, tertiary degree holders meet the global average of 17% (Bahrain, Saudi Arabia and Egypt); other countries like Jordan have achieved near universal basic education.[103] As well, almost half of tertiary-educated individuals in the

[100] *Diego F. Angel-Urdinola and Kimie Tanabe, "Micro-Determinants of Informal Employment in the Middle East and North Africa Region." SP Discussion Paper No. 1201, World Bank, 2012. https://openknowledge.worldbank.org/handle/10986/26828.*
[101] Jazem, Halioui. "AI and Inequalities." Interview by Nagla Rizk. February 10, 2019.
[102] El Kassas, Sherif. "AI and Inequalities." Interview by Nagla Rizk. March 30, 2019.
[103] "The Future of Jobs and Skills in the Middle East and North Africa: Preparing the Region for the Fourth Industrial Revolution,"*World Economic Forum,* (2017), https://www.weforum.org/reports/the-future-of-jobs-and-skills-in-the-middle-east-and-north-africa-preparing-the-region-for-the-fourth-industrial-revolution.

region, hold degrees in science, technology engineering and mathematics (STEM). These specialise in engineering, manufacturing and construction, and to a lesser extent in information and communication technologies, natural sciences, mathematics and statistics.[104] It is also estimated that by 2030, the region will expand its tertiary talent pool by 50%.[105] If managed wisely, the region's human capital can serve as an asset in this next new phase

The second ray of hope comes from the focus on novel data collection methodologies that result in more accurate reflections of realities and provide a new data source for AI. This way, data sets will no longer be controlled by a select few, and there will be increased availability of open data. Data driven innovation in particular, for profit and non-profit, using different technologies such a data layering, is cause for hope.

There are notable examples from business, civil society and academia across the region collecting and making use of innovative sources of data. Innova Tunisia[106], a Tunisian based start-up, uses sentiment analysis of data gathered from social media and online platforms to analyse media portrayals of gender inequalities. HarassMap is an Egyptian non-profit online application, which allows people, mainly women, to share incidents of harassment, then triangulates this crowd sourced data, making it readily accessible.[107] [108]

Research initiatives undertaken within the MENA node for Open Data for Development have utilized innovative data collection using affordable censors to assemble data in combination with open-sourced, crowd-sourced, and existing government data. One initiative assessed the level of

[104] "The Future of Jobs and Skills in the Middle East and North Africa *World Economic Forum,* (2017).
[105] Ibid.
[106] "Who We Are," *Webradar*, last modified 2016, http://webradar.me/who-we-are/.

[107] "Sexual Harassment in Greater Cairo: Effectiveness of Crowdsourced Data," *IDRC* and *HarassMap,* 2014. https://s3-eu-west-1.amazonaws.com/harassmap/media/HarassMap%20Egypt/Towards%20a%20Safer%20City_full%20report_EN.pdf
[108] Jeff Howe, "The Rise of Crowdsourcing", Wired Magazine, 2006. https://www.wired.com/2006/06/crowds/

safety, mobility, accessibility, and reliability of transport in Cairo, while the second created a heat map of black carbon pollution in Cairo.[109] Another was undertaken in Lebanon, where researchers created 'Health SystemEye' an online platform that disseminates and visualizes health data and information to policymakers[110]. As well, researchers in Palestine developed data literacy and capacity building modules, collecting data sets via pollution sensors in Ramallah to monitor air quality around schools[111].

The third ray of hope comes from the initiatives taken by some governments in the region use AI for inclusion and building human capital, albeit still modest. Examples are UAE using AI in tuberculosis diagnosis, training and educating students and government employees on AI.[112] [113] In Egypt, data is being collected within the initiative at 100 Million Healthy Lives, an initiative aimed "at screening citizens above the age of 18 to determine the prevalence of Hepatitis C, obesity, and chronic diseases like diabetes and hypertension." Such data is crucial with hepatitis disease being pervasive with 22 percent of the population diagnosed with hepatitis C in 2015[114]. Linked with national ID, insurance and possibly other health data, this national data set can provide better health services to the country's nationals. It is hoped that such data will set the foundation for better health services using inclusive AI.

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[109] "Developing Air Quality Heat Map for Cairo: A Citizen-Centric Approach," *MENA Data Platform*, 2018. http://menadata.net/public/dataset/21539400046.
[110] "Health SytemEye," *Knowledge to Policy Centre at the American University in Beirut*, accessed April 2019, http://www.healthsystemeye.com/.
[111] Abed Khooli, BirZeit Univeristiy Center for Continuing Education, *Github*, last modified 2019, https://github.com/abedkhooli?tab=repositories
[112] Samer Abu Ltaif, "AI Readiness in 2019 and Beyond: Empowering our People to Achieve More," M*icrosoft News Center Middle East & Africa*, 2019, https://news.microsoft.com/en-xm/2019/02/01/ai-readiness-in-2019-and-beyond-empowering-our-people-to-achieve-more/.
[113] Ismail Sebugwaawo, "Include Artificial Intelligence in School Curricula, Say Experts," *Khaleej Times*, 2018, https://www.khaleejtimes.com/nation/abu-dhabi/include-artificial-intelligence-in-school-curricula-say-experts.
[114] "30 Million Egyptians Screened for Hepatitis C as Part of New Campaign," *Ahram Online,* last modified 2019. http://english.ahram.org.eg/NewsContent/1/64/326024/Egypt/Politics-/-million-Egyptians-screened-for-hepatitis-C-as-par.aspx.

4. Conclusion: AI in MENA - inclusion or inequality?

The discourse over AI and inequality in the region is intertwined with its unique political, economic and social context. The dynamics of AI and its impact on inclusion or inequality are embedded in the region's complexities. They also sit at the heart of a set of inherent tensions.

Like elsewhere, a major tension in the region lies in the paradox of the capacity of the technology itself to concurrently produce conflicting trends triggering opposite outcomes. Like other digital technologies, AI has the potential of producing dynamics that push power away from the centre to the periphery. These centrifugal forces function on both the economic and political fronts and serve to empower small players and mitigate inequality. Paradoxically, the opposite force can also, and simultaneously, be triggered by AI to further empower the already established hierarchies. Such centripetal forces come at the expense of the small players and clearly widen inequalities. While this tension is global, it becomes more pronounced in the region in light of its weak institutions and nascent legislative machinery.

Top down hierarchies in technology creation and dissemination mean ownership of data and opaque black boxes of technology, locked up by large companies who are typically large multinational corporations, or who import technology directly from them. This comes in tension with inclusive locally developed technologies with solutions adapted to local cultures and responsive to marginalised communities. The divide in the creation and ownership of technology widens the internal divide between large and small entities in the region. It also allows for large companies to acquire smaller ones, which enhances market concentration. An example is the recent acquisition of the local ride sharing company Careem by Uber in early 2019.

A similar scenario occurs on the political scene, where tensions persist between established political regimes versus opposing citizen voices and organic movements seeking inclusion and

democracy. While AI technologies and grounds up data collection have the potential to serve as means for citizen empowerment, control over data and AI can be a tool for furthering the power of the already established regimes. Examples include the use of citizen data for surveillance and facial recognition technologies for oppressive purposes.

This relates to a tension that has been well noted for Arab countries as early as in 2009 in the first Arab Knowledge Report.[115] With focus on promoting economic growth at the expense of political inclusion, if at all, the region is characterised by expanding economic freedoms more generously than civil liberties. Concentrating solely on economic "openness" is typically intended to attract foreign direct investment and targets multinational and other large corporations which ends up feeding into the centripetal forces referred to earlier.

This shows clearly in the debate over open data, access to information and promoting the inclusion of citizens in decision making. An enabling environment for using data and AI for good necessitates an integrated set of freedoms so as to promote a comprehensive paradigm of openness and a culture of sharing with data at its core. Expanding civil liberties is related to the enabling environment for data openness which is inclusive to the citizen in general and small companies in particular.

A focus on the economy alone has also meant a condition of technological determinism and its accompanying threat of de-contextualisation. In the present context, this would translate to investing solely in the AI technologies and the belief that they will provide the solutions to all ills. Related to this is the blind belief in the algorithm and disregard for the socio-political context surrounding the technology.

[115] "Towards Productive Intercommunication for Knowledge," *Arab Knowledge Report,* 2009. https://www.undp.org/content/dam/rbas/report/ahdr/AKR2009-Eng-Full-Report.pdf.

Context is part of "fairness". Solutions should not be solely technical, and technical solutions should not be decontextualized. A sound and unbiased AI system may, after all, not be appropriate in a particular socio-economic and political context.[116] Political issues should not be framed as solely technical ones. According to AI Now Report 2018, "When framed as technical 'fixes' debiasing solutions rarely allow for questions about the appropriateness or efficacy of an AI system altogether, or for an interrogation of the institutional context into which the 'fixed' AI system will ultimately be applied."[117]

Investing in technology may be necessary, but it is not sufficient to achieve inclusion. Indeed, investment solely in technology can serve to exacerbate divides if not matched by investment in organisational change including human resources.[118] More broadly, for AI to be inclusive, there needs to be a wholistic approach[119] to AI technology and development to ensure inclusion of the region's human capital as active participants in the new economy, which is also an investment in the region's political stability.

The above inter-related tensions highlight that AI can serve both concurrent trends in the economy empowering the established as well as new entrants, underline the gap in focus between the economic and the political, and exemplify how investment in technology alone without an enabling environment would fail to achieve the desired objectives. More specifically,

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[116] AI Now Report 2018. *AI Now Institute, New York University*, *2018. https://ainowinstitute.org/AI_Now_2018_Report.pdf.*
[117] AI Now Report 2018. *AI Now Institute, New York University*, *2018. https://ainowinstitute.org/AI_Now_2018_Report.pdf.*
[118] Erik Brynjolfsson and Andrew McAfee, "Creative Destruction: The Economics of Accelerating Technology and Disappearing Jobs," in *Race Against the Machine: How the Digital Revolution is Accelerating Innovation, Driving Productivity, and Irreversibly Transforming Employment and the Economy*, (Digital Frontier Press, 2011), 28-52.
[119] Erik Brynjolfsson et al. "Artificial Intelligence and the Modern Productivity Paradox: A Clash of Expectations and Statistics." *National Bureau of Economic Research*, National Bureau of Economic Research, 2017, www.nber.org/chapters/c14007.pdf.

a top down approach that focuses on expert technocratic solutions to issues that affect human lives, and ones that do not involve participatory approaches can aggravate divides and the exclusion of the underprivileged and the marginalised. Together, the above tensions inform the debate on AI and inequality, and an awareness of them helps us mitigate the challenges and the threats that AI would exacerbate inequality in the region.

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