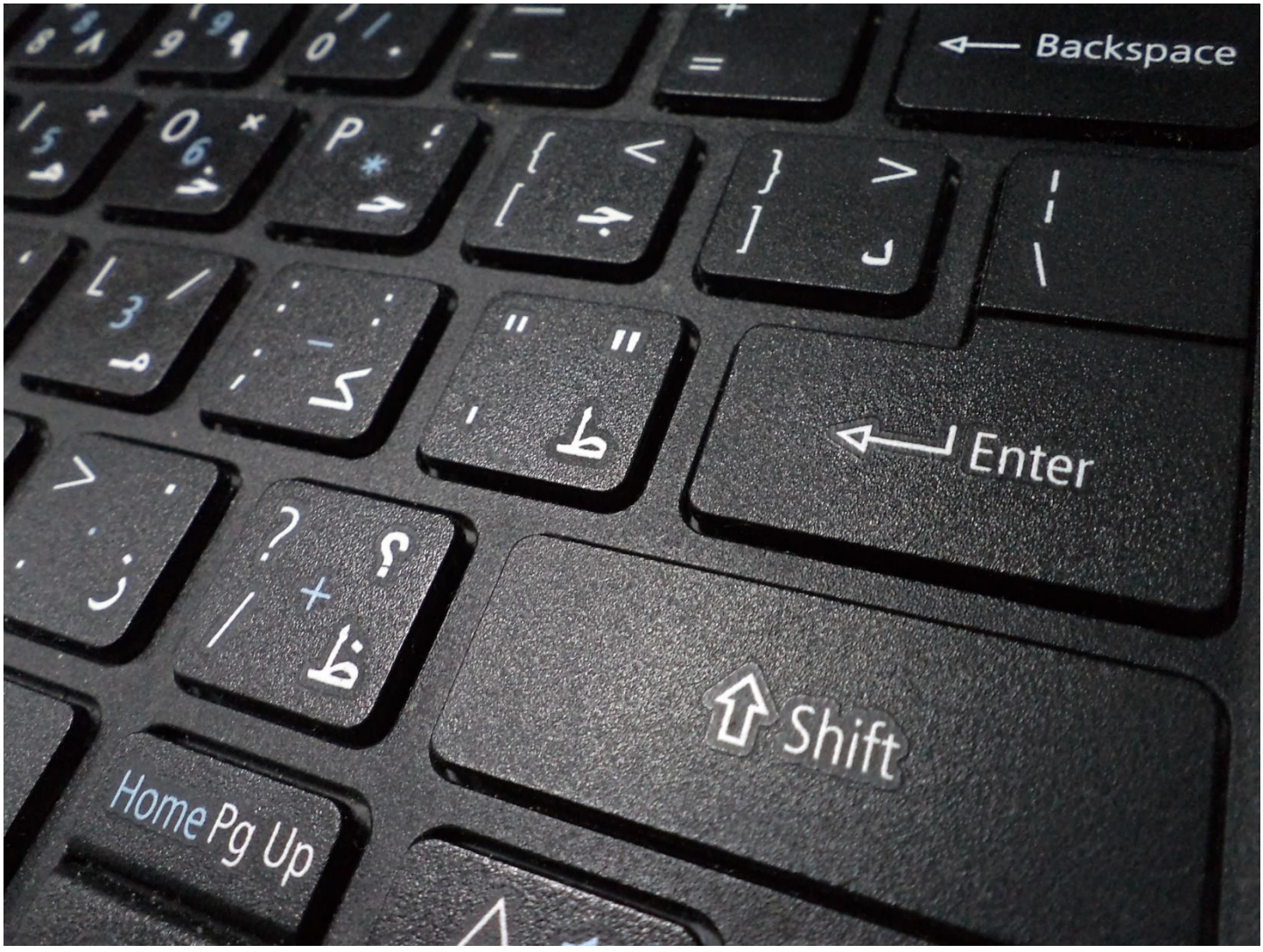
Security Implications of Emerging Technological Challenges in North Africa

OPEN Publications

Volume 4 I Number 1 I Spring 2020



NATO ALLIED COMMAND TRANSFORMATION

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OPEN Publications – Security Implications of Emerging Technological Challenges in North Africa

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oke.thorngren@act.nato.int

[1] Prof. Dr. Juliane Brach is a specialist for economic development, technology, entrepreneurship, and emerging countries, especially in the Middle East and North Africa. She is full Professor at the HSB Hochschule Bremen, City University of Applied Sciences and the founder and managing director of the Knowledge Company. Dr. Juliane Brach holds a Master´s degree in International Economics from the University of Tübingen and a Ph.D. in Business and Social Sciences from the University of Hamburg, Germany. She has also studied in Damascus and Copenhagen.

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Executive Summary

1. **Technology followers:** North African countries have limited technological capacities and little prospect for advancing from technology followers to technology leaders in the near future. Internalizing and harnessing the potential positive effects of emerging technologies for economic development remains a challenge.
2. **Limited macroeconomic benefits:** High hopes as to large-scale job creation in new businesses relating to (emerging) technologies did not materialize and are not likely to do so in the short to medium term. Growing demand; rapid growth of digital and information and communication and civil technology infrastructure; and fintech solutions especially in communication, banking and money transfer, create new market opportunities and attract foreign (rather than local) business actors and investors.
3. **Government-controlled cyberspace:** Comparatively low digital literacy leaves regimes and governments vulnerable to cybercrime. At the same time, North African governments increasingly use digital surveillance technologies to control communication with and amongst their local audience. Cyberspace in North Africa is therefore strongly under the control of national governments. This reduces the freedom of expression and increases the risk of repressing virtual activities or content.
4. **Decreasing technology imports from NATO-Allies:** All countries in North Africa rely heavily on technology imports in all areas, including production and communication, but also defense, deterrence, control and surveillance. Traditionally, these were sourced in Western and especially NATO countries; increasingly, these are provided by non-democratic societies, especially China.
5. **Strong security implications at the national and international level:** Threats from the use of technology in North Africa do not stem from high advances in military technology, military might, technological sophistication or industry threatening technological catch-up, but rather from the ambiguity and complexity of technology use to secure internal, national security and political stability.

Introduction

Understanding the information and technology environment in the countries of North Africa[2] and, in particular, their capacity to withstand and adopt emerging technologies, is crucial to the prospect of stability and security in this region and beyond. National and international policies and policy-making institutions are challenged.

The five North African countries Morocco, Tunisia, Algeria, Libya and Egypt share a geographical location on the African continent, north of the Sahara desert. They also share a common culture and language, a rich history as well as the relatively young age of the states and their populations. Today, over 95 million North Africans are between 15 and 29 years old (World Bank 2019b). All countries within this group also share that their economies and economic performance, present and past, are considered below potential by locals and experts alike (Nabli 2007; Sekkat 2010; Cammett et al. 2018; Cammett 2007; Brach and Loewe 2010). Overcoming structural deficits of the economies and providing jobs and economic perspectives for the large youth cohort is a major challenge.

Economic theory has long pointed to technological readiness and technological sophistication as the keys to long-term, sustainable economic growth and development (Grossman and Helpman 1991; Basu and Weil 1998; Aghion et al. 2001; Acemoglu and Zilibotti 2001). Despite the initial focus on the member countries of the Organization for Economic Cooperation and Development (OECD) and their context, this nexus is by now well established both in academia and in policy making in OECD and non-OECD[3] countries (Organization for Economic Cooperation and Development 2019a, 2019b). In an international comparison, all Arabic speaking countries in the Middle East and North Africa (MENA) region suffer from a relatively low level of technological sophistication and lacking technological capacities (Brach 2008; Drine 2012; Morgan and Lee 2017). While the rich Arab Gulf monarchies counter the existing gap with expensive large-scale imports of technology and experts, the North African countries lack the funds to do likewise (World Bank 2019b). This is true regardless of whether or not they are abundantly endowed with natural resources (Algeria or Libya), scarcely endowed with natural resources (Tunisia or Morocco) or a net energy importer (Egypt). With respect to whether these challenges are perceived as opportunities or threats and how they are met and dealt with, North African states are very heterogeneous.

Moreover, technology does not only affect economic, but also political, social and cultural environments in North Africa as much as in the rest of the world (Ndemo and Weiss 2017). First and second order effects of emerging technological challenges will continue to substantially impact societal cohesion, state – non-state actors and civil-government relations. North African countries have witnessed this confluence in recent history as the Jasmin Revolution that triggered the destabilizing events in the South and technological progress in information and communication technology (ICT) are tightly linked (Andersson and Djeflat 2013; Al-Shammari and Willoughby 2019; Campante and Chor 2012). Given the highly authoritarian nature of North African governments, benign and malign effects of technological advances are often judged differently than in democratic societies.

North Africa is the gate and border zone between Europe on one side and its neighboring countries in the Middle East and sub-Sahara Africa on the other. As such, security issues in the North African region have a high potential to directly impact national, regional and international security and stability.

[2] In the scope of this paper the term “North Africa” uses a narrow geographical definition and comprises the following countries: Morocco, Algeria, Tunisia, Libya and Egypt

[3] OECD has 36 member countries, among them no Arab countries neither from North Africa nor the Middle East or Gulf region.

Against this backdrop, the aim of this paper is twofold. First, deducting the security implications that derive from emerging technologies and technological challenges in North Africa and second, to provide recommendations for NATO to develop policies to enhance security and stability in the region.

The remainder of the paper is organized as follows: Section 2 presents stylized facts about the existing levels of technological readiness and availability of latest technologies by drawing on a variety of ICT as well as science, innovation and technology (SIT) indicators. Section 3 elaborates on the use of technology across North Africa, focusing on manipulation and control of local audiences, technological dependence, and criminal use. Section 4 discusses the security implications of emerging technologies today and military operations and challenges, political stability and economic perspectives in North Africa. Section 5 then provides tailor-made policy recommendations to NATO and finally, section 6 concludes.

Technological Readiness and availability of latest technologies in North Africa

The capacity to use and employ new technologies requires digital literacy and technological readiness. The degree to which emerging technologies are mastered successfully is mirrored in the technological sophistication of exports as patent applications. Technology diffusion can be measured by the spread of internet and mobile phones as well as the number of blogs. Finally, the availability of latest technologies and the sophistication of exports indicate whether the technologies used originate in the country or rather abroad. The percentage of imports from key suppliers hints at technological dependency or self-sufficiency. Table 1 provides an overview of 2017 (or latest year available) of these key ICT and STI indicators for the North African countries and offers a regional as well as the world average as a benchmark and reference. All data, if not stated otherwise, is taken from the World Bank databases Word Development Indicators (World Bank 2019b) and Open Trade and Competitiveness Data (TCdata360) (World Bank 2019a).

	Algeria	Morocco	Tunisia	Libya	Egypt	Arab World	Africa	World
Fixed-Phone per 100 people	8,2	6	8,6	21,5	7,1	7,7	1	13,6
Mobile-cellular per 100 people	113,9	120,7	125,8	119,8	113,7	107,1	74,6	101,5
Fixed-broadband per 100 people	6,9	3,7	5,6	2,6	5,2	4,7	0,4	12,4
Active mobile-broadband per 100 people	64,6	46	63	34,9	52,6	45,2	22,9	52,2
3G Coverage (% of pop.)	83,4	95	99	78,1	98,7	81,9	59,3	85
LTE/WiMax (% of pop.)	3,6	68	73	n.a.	0	33,8	25,7	66,5
Mobile-cellular prices (% GNI pc)	2,5	4,4	0,9	1,3	0,8	4,3	14,2	5,2
Fixed-broadband prices (%GNI pc)	3,6	4	1,4	4,4	1,8	10,1	39,4	13,9
Mobile-broadband prices 500 MB (%GNI pc)	2,6	2	1,4	1,5	0,7	4,5	9,3	3,7
Mobile-broadband prices 1 GB (%GNI pc)	5,4	4	1,1	2,2	0,9	5,5	17,7	6,8
Percentage of households with computer	38,4	54,9	39,3	23,5	53,1	43,3	9,6	46,6
Percentage of households with internet access	34,7	68,5	37,5	22	43,3	45,3	16,3	51,5
Percentage of individuals using the internet	42,9	58,3	49,6	20,3	39,2	41,8	19,9	45,9
Int. Internet bandwith per internet user (kbit/s)	40	25,7	32	5,3	17,2	39	51	74,5

Table 1: North Africa – ICT and technology indicators performance in an international comparison (World Bank 2019a), own compilation

Without going into further detail to explain and comment on each indicator individually, the key message is obvious: the overall level of these standard indicators remains low by international standards. North African countries are clearly technology followers rather than technology leaders.

However, looking at trends from all available data reveals that there has been respectable progress in different areas. Figures 1 and 2 below depict how the technological readiness and innovation capacities have improved. The same is true for trademark applications (cf. Figure 3). Egypt, Morocco and Tunisia are the promising tech hubs on the African continent, while ranks and values for Algeria and Libya remain low or even unmeasurable.

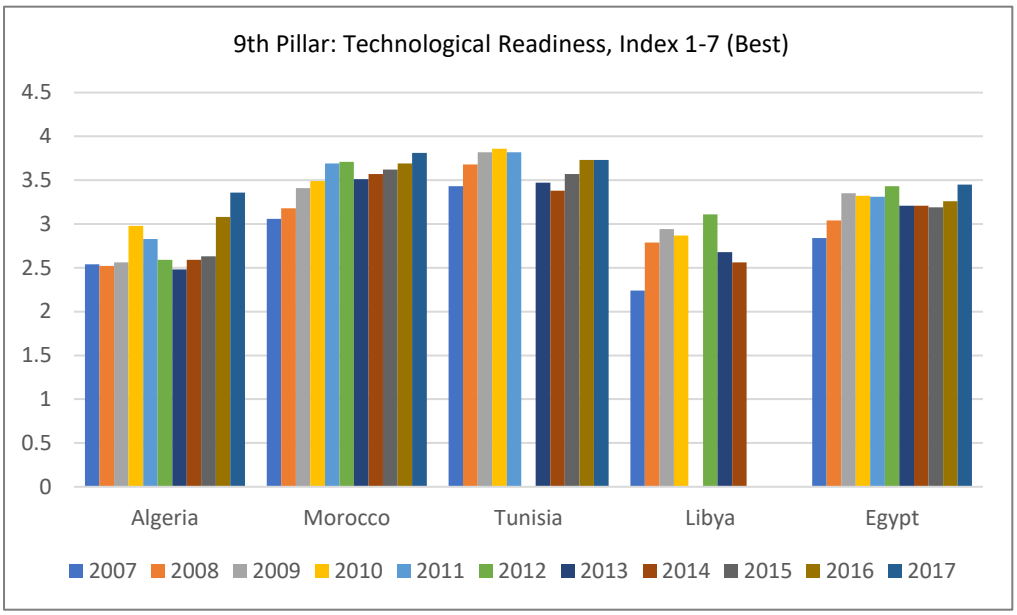

Figure 1: Technological Readiness in North Africa (World Economic Forum 2019), own compilation

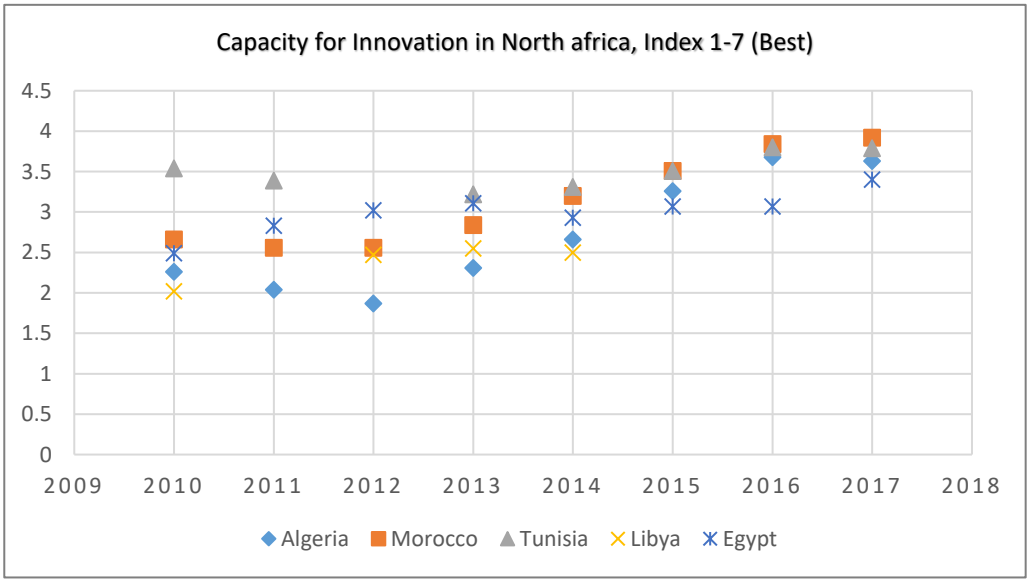

Figure 2: Capacity for Innovation in North Africa (World Economic Forum 2019), own representation

Yet, the prospect of timely technological catch-up and the capacities to close existing technology gaps remains low. Rankings for availability of latest technologies, as well as overall innovation scores, declined in all countries, leaving them worse today than rankings ten years ago (cf. Figure 3 and 4).

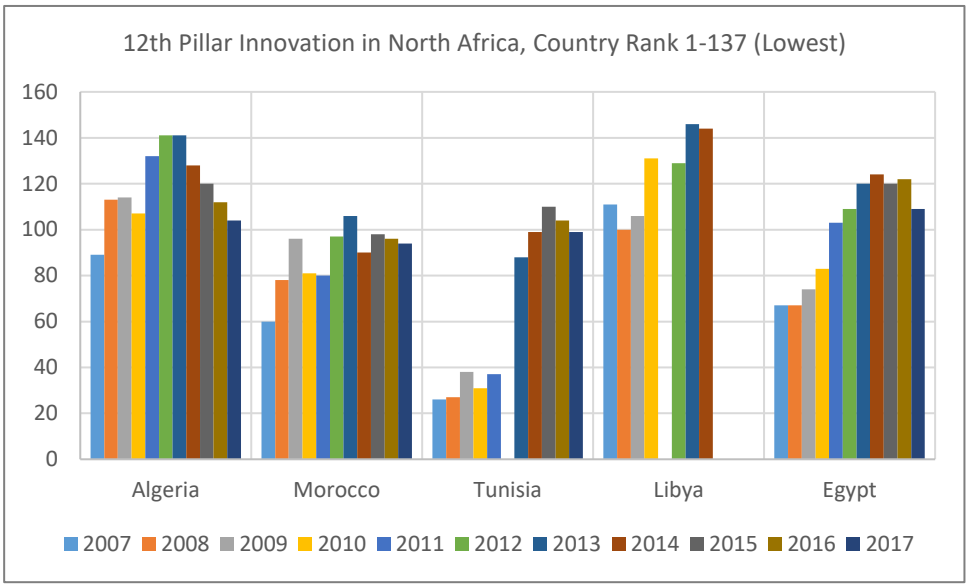

Figure 3: 12th Pillar: Innovation in North Africa (World Economic Forum 2019), own representation

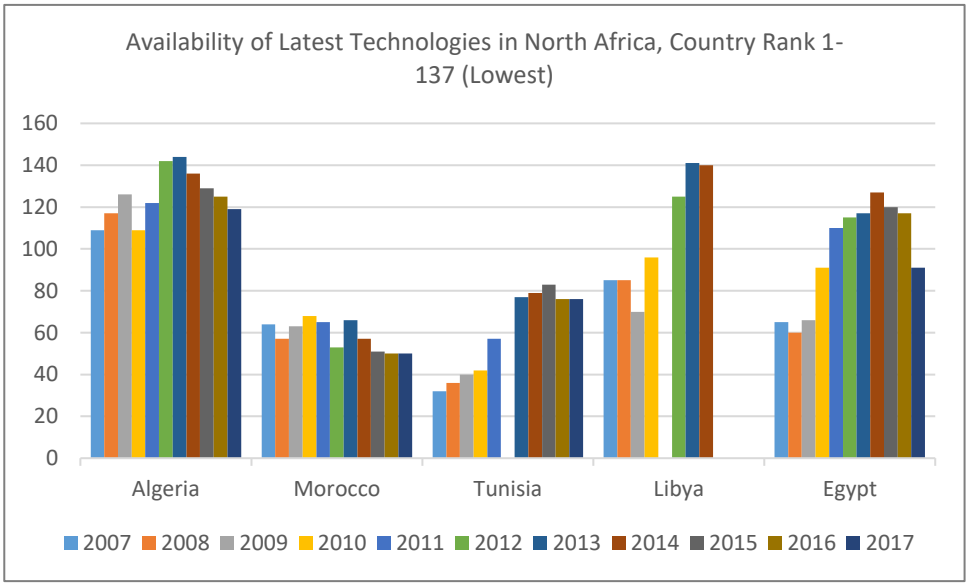

Figure 4: Availability of Latest Technologies in North Africa (World Economic Forum, 2019), own representation

Use of Technology across North Africa

Technology is a powerful tool in many respects and its impact stretches from the economy to society, including security, infrastructure and information, and politics. At the microeconomic level, technology impacts through new products, increasing productivity and efficiency at the firm-level and at the macroeconomic level through offering new approaches for overcoming key challenges and structural economic deficits. Emerging technologies also facilitate innovative solutions for the use and substitution of scarce resources, especially in energy or water supply. Technology also has a social impact. Not only through speeding up and opening new forms of communication, but through more decentralized and less controlled exchange of ideas. Technology also changes the politics and policy both at the national and international level. Emerging technologies open new ways for innovative

defense and military solutions to increase national security and facilitate control and manipulation of local audience, while at the same time exposing governments to (inter)national cyber criminality.

1.1 New Technology but little new (local) business

The use of internet started late (only in the early 2000s) and remained sluggish with less than 10 percent of the population having access to fixed broadband subscription in 2017 (cf. Figure 5).

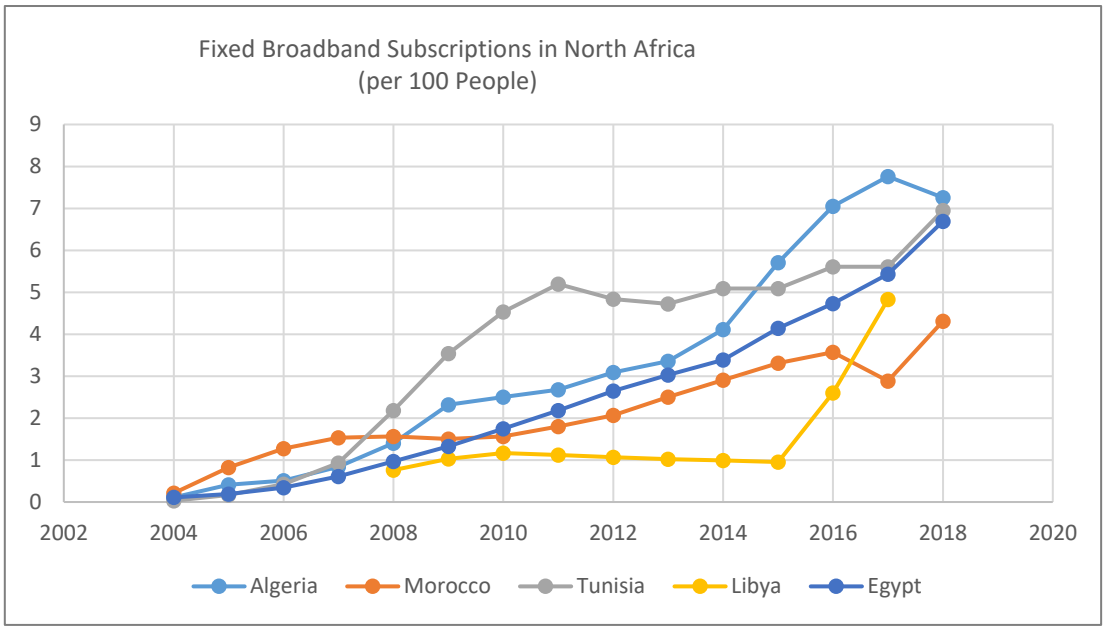

Figure 5: Fixed Broadband Subscriptions in North Africa (World Bank 2019a), own representation

However, with the spread of decentralized forms of communication through the use of mobile telephones (cf. Figure 6), internet access has recovered and innovative business (measured by the trademark applications) has gained significant momentum, especially in Egypt and Morocco (cf. Figure 7).

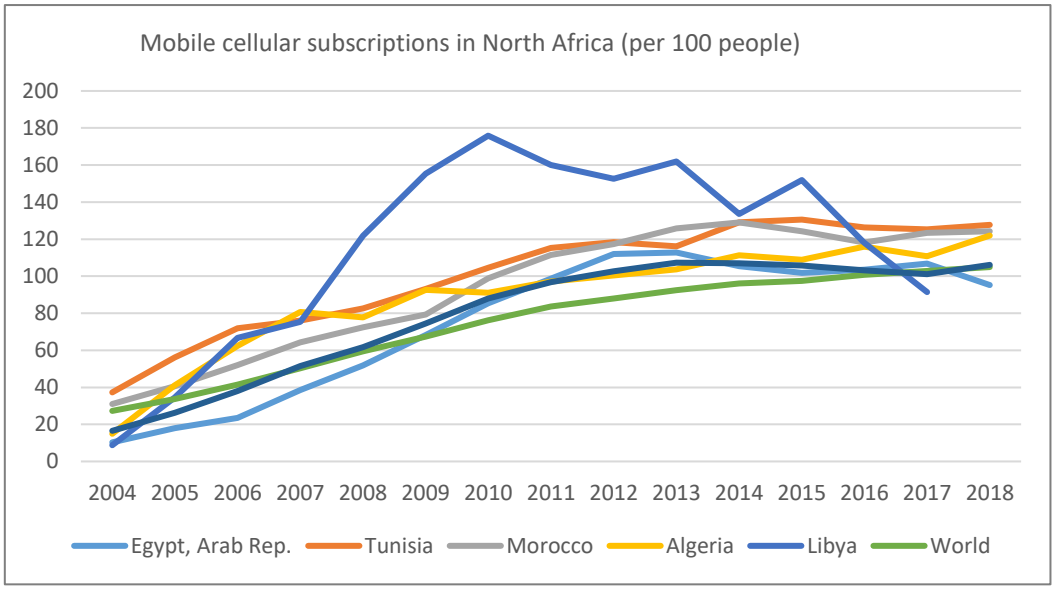

Figure 6: Mobile Cellular Subscriptions in North Africa (World Bank 2019a), own representation

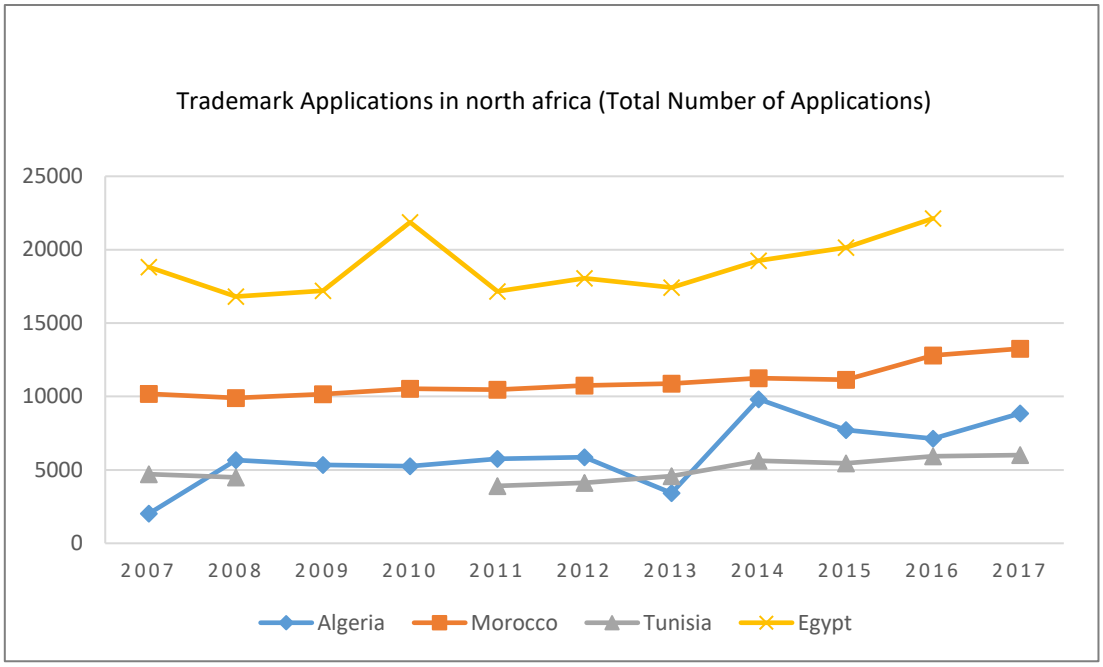

Figure 7: Trademark Applications in North Africa (World Bank 2019a), own representation

Yet local capacities in all North African countries remain limited. For example, of the more than 20.000 trademark applications in 2016 (Figure 7), less than 1.000 were filed by residents (as depicted in Figure 8). And the absorption capacity of firms is declining (Figure 9).

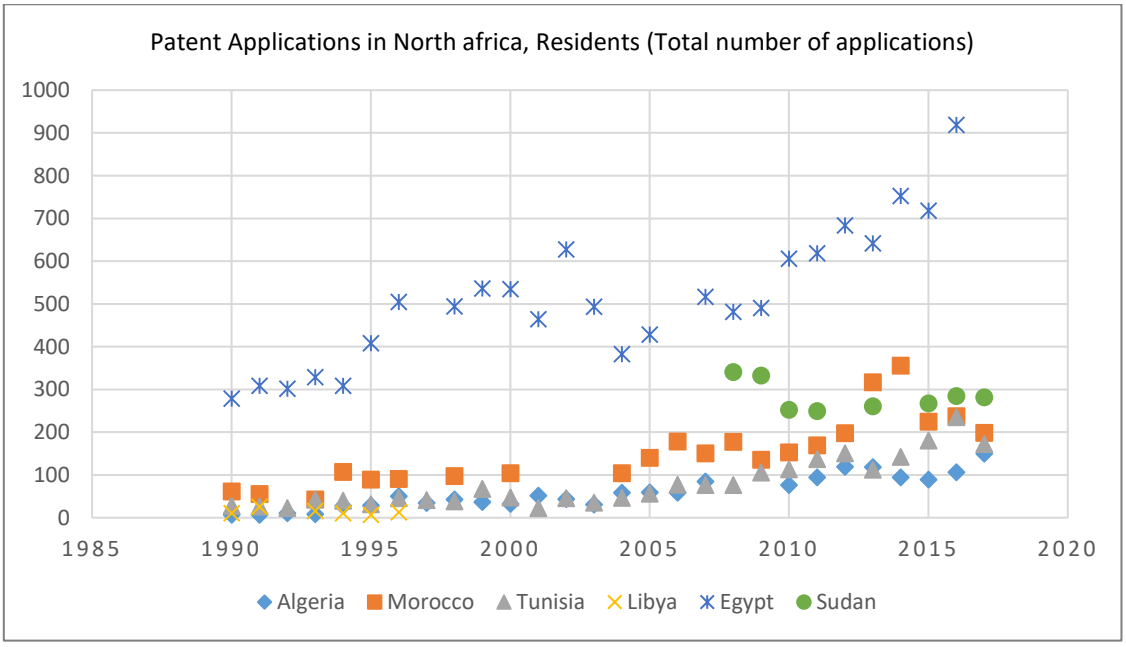

Figure 8: Patent Applications in North Africa (World Bank 2019a), own representation

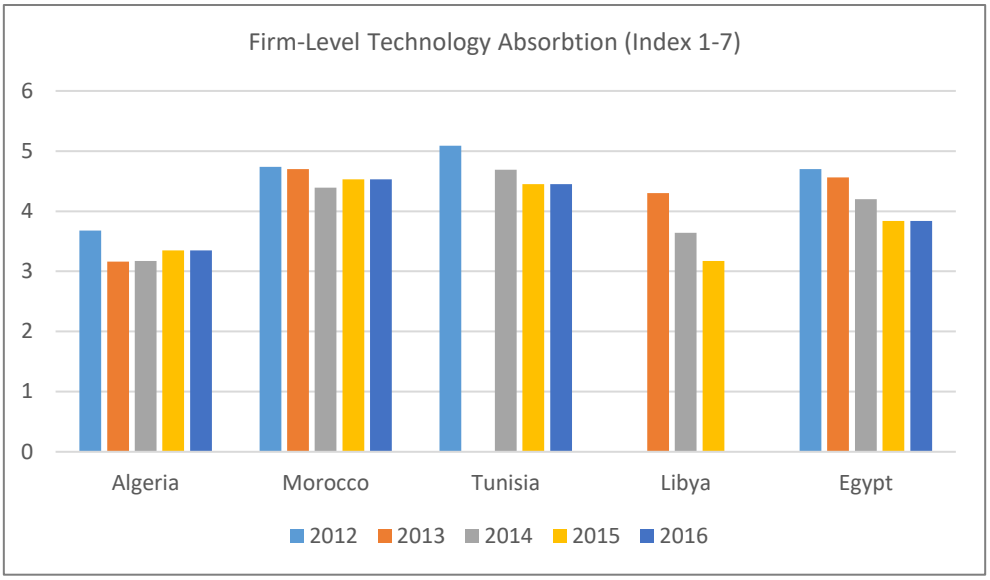

Figure 9: Firm-Level Technology Absorption in North Africa (World Economic Forum 2019), own representation

All governments recently supported strategies to improve technological upgrading and use of emerging technologies in their countries. Focusing on more or less the same themes, some are more ambitious than others.

One focus is **renewable energies**. Algeria and Tunisia target 37 and 30 percent by 2030, respectively (Griffiths 2019). While Morocco targets 42 percent by 2020 and 52 by 2030. With respect to wind power Morocco, the regional leader with 1,000MW of wind capacity plans to more than double capacity to 2,120 MW by 2020. At the same time, Morocco experiments with the use of solar, tidal stream and thermal power plants (Bouhal et al. 2018; Nachtane et al. 2018; Terrapon-Pfaff et al. 2019). Egypt ranks second with respect to renewable electricity but has formulated ambitious plans. Egypt targets 20 percent renewable energy by 2022 and 42 percent by 2035, mainly by building capacities of 1,500 MW wind power by 2020 and then multiplying these by almost 100 percent to 20,000MW by 2035 (Griffiths 2019), but also through energy efficiency improvements in the housing sector (Bampou 2017).

Similar large-scale ambitions are related to **digital transformation and ICT**. The Egyptian government formulated ICT as a high policy priority already in 1999 and placed high expectations on its economic impact (Kamel and Rizk 2017). More recently, it claims a digital leadership position and expects state-owned Telecom Egypt to become the digital and data hub on the African continent (Burkitt-Gray 2019). In contrast, Nokia sees the 5G technology widely unmanaged in North Africa with Egypt and Algeria not only falling behind, but also risking disenfranchisement, especially in rural youth populations (Thompson 2019). In certain areas, technological change and the need to adapt to and master emerging technologies is especially high, such as banking and corporate finance, as well as fintech (Labadi 2019; World Economic Forum 2018). With only a little over 40 percent of the population having bank-accounts, but 75 percent owning a mobile phone, the market for technologies related payment services such as mobile payment, money transfer and lending platforms is very promising (Domat 2019). This is especially true since private sector services supplement the mostly state-owned banks rather than posing a fundamental challenge to prevalent structures in the banking and financial sectors (Cohn 2018). While most tech players are foreign, there are national technology champions and several **success stories** of North African start-ups that are indeed able to compete regionally and even

internationally (Apa et al. 2018; Domat 2019). But these remain outliers and are not representative for the nationwide state-of the art. North African countries are not well equipped to harness the benefits of emerging technologies related to the digital infrastructure (Göll and Zwiers 2018; World Economic Forum 2018).

More **sophisticated information technologies** related, for example, to big data mining, artificial intelligence (AI), block chain or quantum computing, the gap to the frontier is too high for these countries to be able to harness the benefits in the short to medium term. The same is true for emerging technologies in fields such as nano, neuro, bio or space technologies (Badran 2/28/2019; World Economic Forum 2018; Adam and Youssef 2019).

1.2 Disinformation, Manipulation and Control of Local Audience

In the past, North African governments established more or less state-monopoly on the dissemination of information through government-controlled and state-owned newspapers and television channels. After a period of postponed digitalization through a late introduction of mobile phones and internet, governments could no longer shut their societies away from modern ICT and are nowadays heavily reliant on (low) digital technology instruments to (re)gain information power.

On the one side, through protecting state-owned telecommunication companies and internet servers against private competitors, competition and the entry of private actors is heavily restricted in this (new) market. On the other side, ICT is increasingly also used as a strategic instrument by state actors, by national governments and military alike, to provide their respective views to internet and mobile users. The Egyptian Military for example creates its own Facebook page while the military in Tunisia uses SMS text messages to update people (Khamis and Vaughn 2011).

At the same time, North African governments increasingly use digital surveillance technologies to not only manipulate but also control communication with and amongst their local audience. In light of increasing popularity of internet and online-activities, especially among the youth population, special registration procedures that require users to identify themselves in order to get internet access both in privately owned coffee shops as well as state-run IT clubs at youth centers, public libraries, schools or universities were introduced (Mehanna 2010).

Governments also use digital technology to control user generated content (UGC) on the internet, to identify and track bloggers and providers of such unwelcome content, and combine old and new school authoritarian regime survival toolkits to physically repress internet activists, bloggers and journalists. Numerous examples of websites and blogs that are shut down, especially those operated from local servers, exist. State crackdowns on UGC and the internet through blackouts, filtering and slowdowns are reported (Göll and Zwiers 2018; Howard et al. 2011) and more often than not without the declaration of legal reasons. Therefore, owners of these websites cannot object or take legal action against the authorities (Mehanna 2010). Affected civil society actors thus often depend on access to foreign servers through international hosts to continue online activities. Users as well as activists providing or sharing critical content face very real consequences such as physical violence, imprisonment or deportation (Lerner 2010; Mehanna 2010; Göll and Zwiers 2018). These documented examples find their counterparts all across North Africa, but these are mostly reported as anecdotal evidence and unreported interviews. The fear of government retaliation is too high. Internet and blogs are not platforms of free expression, but rather instruments of state surveillance to identify and track government critical UGC (Lerner 2010; Herrera 2015).

In the pre-2011 area, authoritarian regimes left no space for expression of dissent, and cyberspace created different opportunities for political protest remains unwelcome. Today, governments use technological advances in various ICT, especially internet and social media, trying to censor critical content and identify critical users. Cyberspace in North Africa is strongly under the control of national governments. This reduces the freedom of expression and increases the risk of actual repression for virtual activities or content.

1.3 Cyberterrorism vs. Cybercrime

The comparatively low digital literacy certainly has impacts on national security in North Africa. Without appropriate cyber capacities at a national level, countries lack capable cyber defenses to protect against increasing cyberattacks. Against the backdrop of a world average of more than 6100 secure internet servers per million inhabitants, Figure 10 exemplifies the very low level of cybersecurity in Egypt and Algeria (less than 200), Tunisia and Morocco (about 300) and Libya (1100).

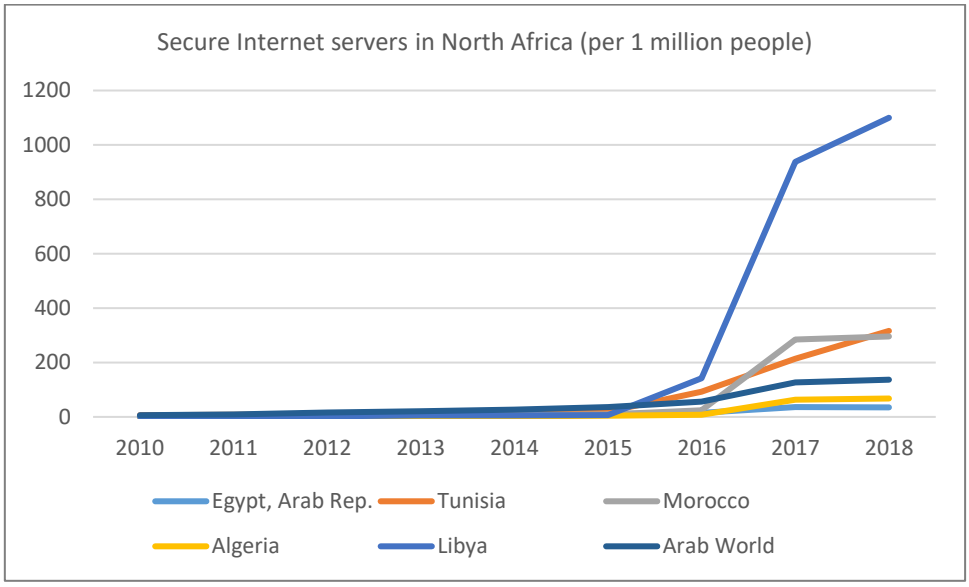

Figure 10: Secure Internet Servers in North Africa (World Bank 2019a), own representation

Acknowledging this deficit, all North African governments led by Morocco, Tunisia and Egypt continue heavily investing in the development of state and governmental cyber capacities. In addition, North African countries are also taking numerous steps to adapt the national legal and regulatory frameworks accordingly. The Egyptian government has established the High Council for Cyber Security (2014) and introduced the Anti-cyber and Information Technology Crimes Law in 2018, Tunisia passed laws supporting tech innovations, while Morocco has launched a bit of both.

However, North African regimes and governments remain vulnerable to cybercrime and cyberterrorism. What is considered a cyberterrorism (in contrast to cybercrime) and what kinds of activities fall under the terrorism definition of North African authoritarian governments, differ significantly from the perception in democratic societies. Against a Western democratic background, basic human rights such as the freedom of expression and political opposition, especially through

democratic checks and balances, are the essence of political representations. But not a single North African country classifies as a consolidated democracy (cf. Figure 11)[4].

The Jasmine Revolution and destabilizing events in the South that were closely related to recently accessible internet and mobile phones (Karagiannopoulos 2012; Badr and Demmelhuber 2014) forced three of five long-term presidents out of office and the momentum of political change spread like a spark around the MENA region, triggering political response in almost all countries. North African governments feel increasingly exposed to such (cyber)terrorist attacks since 2011 (Aboul-Enein 2017).

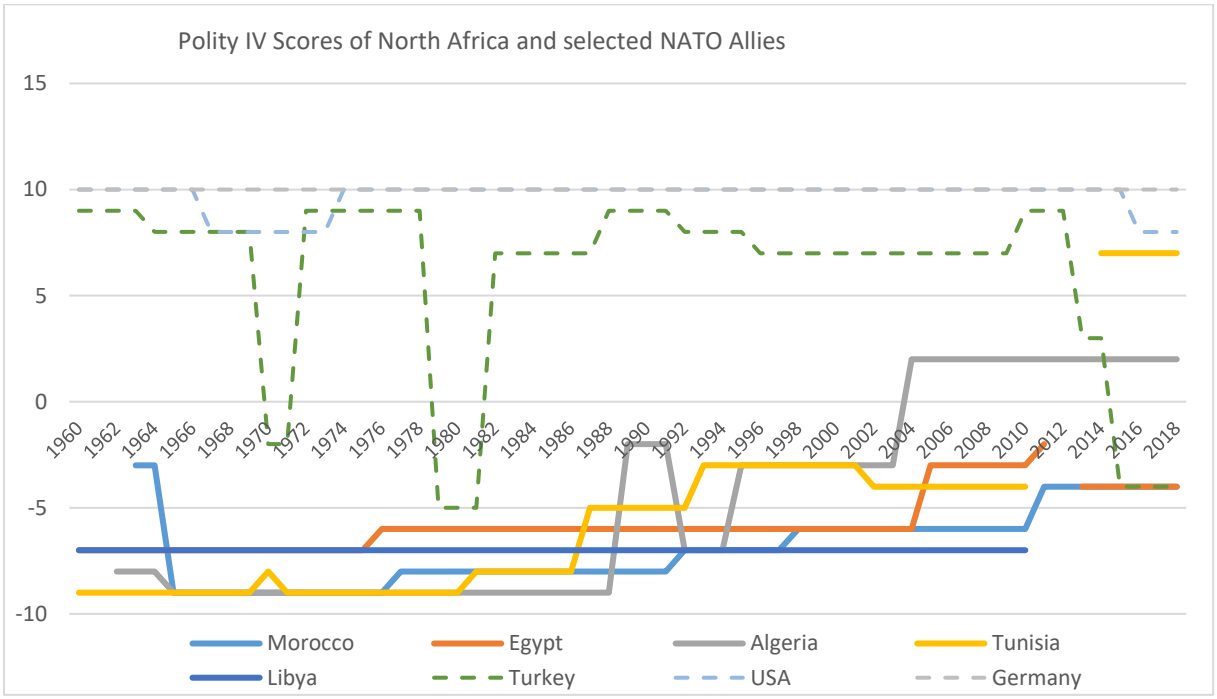

Figure 11: Polity IV Scores in North Africa and of Selected NATO Allies (Center for Systemic Peace 2019) own representation

As a consequence, North African regimes are working on building capacity to not only defend themselves against cyberattacks but also to carry out cyber offenses itself as pre-emptive means of defense, reportedly with growing success. From a regimes' perspective are non-state actors today a major source of instability in the Middle East, constituting security challenges that have previously only been seen among (foreign) state actors (Aboul-Enein 2017). Egypt is ruled by an authoritarian regime on the basis of an emergency law that labels all forms of criticism to be dubbed a terrorist attack and a threat to national security, so the idea of benign and malign aspects of technology on local society becomes at least fuzzy. Internet activists hacked government websites and paralyzed them with overload attacks, as well as deactivated government's espionage and censorship programs. New technology provides regimes with new capacities to impose new constraints on actors' political opposition (Howard 2011).

The governmental fight against terrorism interventions are substantially threatening individual freedoms and civil rights of the local civil society. Surveillance technologies and fight against terrorism

[4] The "Polity Score" captures this regime authority on scale ranging from -10 (hereditary monarchy) to +10 (consolidated democracy), where "autocracies" (-10 to -6), "anocracies" (-5 to +5) and "democracies" (+6 to +10), Center for Systemic Peace 2019).

(FAT) operations frequently turned into activities against individual rights, which are classified as legal civil society freedoms in democratic societies.

In contrast, cybercrime also occurs, but plays a much smaller role, at least in those countries like Tunisia, Egypt and Morocco, where governments have a firm grip on their societies as well as internet content. Generally speaking, cybercrime activities are relatively low technology in nature, ranging from credit card dump and stolen credentials. Yet, in the war ridden North African countries Algeria, and especially Libya the fragile, weak state-hood continues to be a substantial threat. Terrorism and criminal action remain at a relatively low technological level. Stolen identities, passport scans and copies of drivers licenses are much more of a problem in transit countries of human and drug trafficking, especially Libya. Human and drug trafficking are likely to be a much bigger challenge than cyberattacks.

1.4 Dependence on Foreign Technology & Investors, increasingly from China

Whether high or low technology used for business, surveillance, control or fighting terrorism, all **North African countries are technology importers** and rely heavily on technology imported from outside the region, buying in technologies, experts and training. Traditionally, NATO countries were the major suppliers, accounting for over 70 percent of machinery and electronics imports in the year 2000. But increasingly China is gaining market shares. While North Africa's machinery and electronics imports from China accounted for less than 5 percent in 2000, on average China today (2017 data) makes up more than 15 and 20 percent of total imports in machinery and electronics, respectively (cf. Figure 12).

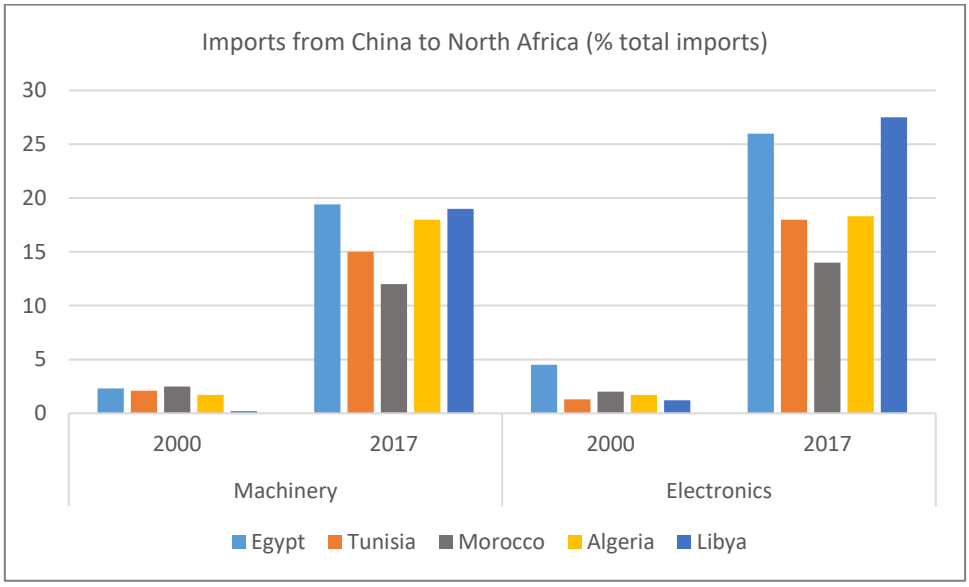

Figure 12: Imports from China to North Africa (United Nations 2019), own representation

Even though machinery and electronics are still mainly imported from European and NATO-countries with democratic and rule-based societies, North African authoritarian regimes increasingly favor China's security and digital surveillance technologies (Dahir 2019; Patrick; El Kadi 2019; Ministry of Communication Egypt 2019). China is attracted to North Africa by the size of the market and also the perspective that personal data protection is much less of an issue than in Europe or North America. North African governments are attracted by China's government-led development and growth strategy that favors civil control much more than civil freedoms.

In contrast to China, North African countries are too far away from the technology frontier in order to become a technology leader in the near future, even mastering available technologies and building digital capacities remains a challenge.

Stability and Security Implications

In well-functioning democracies, the interests of the ruling governments and the citizens are generally well aligned, harmonized and checked through regular free elections. However, not a single North African country classifies as a democracy and despite the fact that new presidents have taken over in all four North African republics, the authoritarian nature of North African regimes has not changed dramatically since 2011. This implies that the once prevailing civil-government and civil-military relations still remain in place. The regimes that stayed in power only added internet and mobile networks to their toolbox to control society.

Confronted with the same challenges as their predecessors, current regimes and governments see themselves threatened by a possible eruption of a second, digitalized and professionalized Jasmin Revolution like a wave of civil society uprisings. In this respect, the impact of emerging technology on regime vs. country stability can best be described as a dictator's dilemma (Badr and Demmelhuber 2014; Howard et al. 2011): building technological capacities will increase economic and business prospects, strengthen governmental cyber security capacities, and, correspondingly, government's digital grip on local societies. At the same time, expanding technological capacities at a national level also provides oppositional and civil society forces with more sophisticated capabilities to express discontent and coordinate, threatening regime stability and political survival.

Threats from the use of emerging technology in North Africa for regional and international security thus do not primarily stem from high advances in military technology, military might, technological sophistication or industry threatening technological leapfrogging, but rather from the ambiguity and complexity of use of technology within an authoritarian context. The perception of benign and malign effects of technology are diverging, if not opposing the Western perception. Along with it come fundamentally different and contradicting views on legal measures to secure internal, national security and political stability.

In addition, the military is an important and independent political actor with its own economic interests and agenda (Barany 2016; Roll 2016; Ali and Abdellatif 2015). In Egypt, all presidents since the foundation of the Arab republic were high ranking generals with only one exception, M. Morsi who lasted less than a year. In Algeria, the military brought President Bouteflika to power and deposed him in 2019. In Tunisia, the armed forces are also unchecked by civilians, but only interfere with politics on rare occasions (such as the withdrawal of support to President Ben Ali that lead to his ousting). In contrast, the military in Morocco is partially checked by civilians, but without constructive cooperation. Military-civil relations in Algeria are characterized by a high-degree of fragmentation on both sides, making it impossible to assert control or cooperation patterns. In general, military actors remain unchecked by civilians (Gaub 2016) – a very different set up compared to the democratic armies under civilian control of NATO Allies. Military-to-military dialogue is therefore challenging and likely to follow other rules and premises than in the past rule of law and rule-based world order.

1.5 Slow Economic Recovery & Missing Jobs

New technologies are subject to high hopes in North Africa, where labor markets are traditionally tight and yield high levels of unemployment among the younger generations – even among university graduates. But new technologies lag far behind the expected gains to create new job opportunities and market opportunities that encourage entrepreneurship.

Neither their ambitious plans nor governments' heavy investments in ICT and emerging technologies, changed the fact that North Africa's technological sophistication still lags far behind and that success stories of internationally competitive local champions or technology start-ups remain rare outliers rather than a new trend.

Against the backdrop of how low capacities originally were, that building capacities always needs time, that the resources of North African regimes are limited, and the less favorable general socio-economic and political framework conditions, the status-quo is challenging, but within what realistically was to be expected. The mere fact that the catch-up process is taking its time and could not be boosted to excellence within only ten years, is not a problem in itself.

Concerns about more positive future perspectives and development opportunities are however appropriate, as the impact of positive spillovers from emerging technologies on the national economy is very likely to also remain limited in the short to at least medium-run future. The rationale behind this argument is twofold: On the one side, lacking digital and cyber capabilities as well as deficits in digital infrastructure are related to political priorities as well as perception of risk and benefits. But without appropriate cyber capacities at a national level and the necessary economic and individual freedoms to experiment and gain competence, these countries will continue to lack business opportunities. In addition, regimes' hope to exploit the potential of ICT and other emerging technologies by attracting foreign investors specialized in selling technologies (such as surveillance technology) underestimates that multinational corporations especially from China are increasingly interested in sourcing African data and using North Africa as the hub, rather than technology transfer and job creation. And this not the least because personal data protection laws and regulations are much less restrictive than in Europe (Mann 2018). On the other side, overly positive and sugar-coated official plans and narratives about national capacities related to emerging technologies cast doubt about the political will to face the necessary policy adjustments now as much as they did in the past. Realistic governmental plans, appropriate policies and expectations are less likely to be implemented and pursued, when official assessments of national competence contradict the outside international perception: f.e. while Egypt claims a digital leadership position and expects state-owned *Telecom Egypt* to become the digital and data hub on the African continent, international private sector competitors evaluate the 5G technology widely unmanaged in North Africa with Egypt and Algeria not only falling behind, but also risking disenfranchisement, especially in rural youth populations (Thompson 2019). Governmental plans to multiply windpower capacity that does not yet exist by 100 in less than 20 years are widely regarded as unrealistic rather than ambitious (Burkitt-Gray 2019; Griffiths 2019).

This translates to lagging materialization of economic and business opportunities and prevents North African economies and societies from internalizing the opportunities and benefits of emerging technologies now and in the near future. This again weakens societal stability as urgently needed jobs and economic perspectives are not created at the necessary level. North African governments are very well aware that exactly a similar lack of future economic perspectives, especially among the youth population, was a central driver behind destabilizing 2011 events.

1.6 Improved Control & Extended Repression

The anticipated and expected loss of control over external communication mobile telephones and internet access was probably the main reason why the digital age started somewhat later in the Middle East, in general, than it did in the rest of the world. This fear was completely realized. The events of 2011 would not have taken place without new, digital possibilities to communicate (Ghareeb 2006; Whine 1999). At the same time, regimes were badly prepared to control these and overwhelmed by the fast pace, size and scope.

As the internet providers are stated-owned, there is little access to international servers and internet users and internet content are strictly controlled and monitored, making the internet a dangerous place for the expression of dissent with the ruling elites or their policies. This exposes well-known bloggers as well as less visible individuals who are actively posting (Lerner 2010). Therefore, there is high potential for negative effects on society and political freedom.

1.7 Social Unrest & Increasing Instability

The question that international practitioners and policy makers are concerned with is whether or not there is a pending mobilization comparable to the 2011 events that lead to the end of an unprecedented period of political stability in North Africa.

The answer is probably no. The current regimes are better prepared and much savvier in IT and mobile telecommunication and social media dynamics. It is much more difficult to catch them by surprise today than it was ten years ago.

Just like other authoritarian regimes across the world, North African regimes in the past mastered the control of information and spread of propaganda news mainly through traditional mass media channels such as radio and television broadcast as well as print media. To a high degree, all these communication channels were state-owned with little to no private, independent media coverage possible. In addition, the access to landline telephones was very restricted and often granted only to those related or loyal to the ruling families. And even then the use of telephones was controlled and conversations were taped. Rapid growth rates in the early 2000s largely made up for this. Today, North Africa is well connected, displaying average figures for all relevant indicators, except the cost of mobile cellular and mobile broadband prices.

North African authoritarian regimes, monarchic as well as republic, have learned their lessons from the power of technology, especially ICT, and the role they played to articulate, spread and organize civil opposition in an authoritarian environment that does not allow free discourse or freedom of expression, particularly political or religious. The probability of a second wave of destabilizing events in the South that rapidly spreads across countries is very low. Governments' grip on society and ICT is too tight. The role of expatriate and foreign actors is expected to increase, making the expansion of local control over international data flows more likely than ever.

1.8 Cyber Capacities and Fighting Against Terrorism (FAT) Interventions

Technological dependence and comparatively low cyber capabilities increase the vulnerability of states and societies alike. Successful capacity building and increased cyber literacy and defense capabilities are a result of expanded and deepened technology cooperation and engagement of international business, including well-known multinationals and many specialized firms, and international organizations and institutions such as NATO. The latter aim to enable North African partners to secure and defend themselves against terrorism (cyber or else) as the most promising path to regional security and stability. Increasingly however, North African governments consider their well-educated and

technologically savvy young population as a threat to national security rather than a potential asset. As a consequence, actors that are considered legitimate civil society partners from an international perspective are often viewed as terrorist or criminals within the national context.

Apart from cyber terrorism, malign or criminal cyber use is much less of a threat in North Africa. This is especially true in Tunisia, Egypt and Morocco, where governments and ruling elites have a firm grip on societies, their digital activities and internet content. As for the war-ridden North African countries like Algeria and Libya, the case is different. Especially with its fragile state-hood, Libya continues to be a grave concern if not a high potential threat for security. Fighting terrorism and criminal action in this country should be a priority. However, this has little to do with emerging technologies as the technological level and sophistication is the lowest in North Africa. Human and drug trafficking and cyber criminality related to these actions are likely to be a much bigger challenge than cyberattacks.

Moreover, the degree of regional coordination is very low. There are no resilient institutionalized forms of political integration. Military coordination and cooperation in North Africa is literally non-existent and there is no comparable degree of military and security cooperation unlike that among NATO member states. NATO's Mediterranean Dialog offering NATO+1 as well as NATO+7 formats may be key moderators to exchange and question current practices and priorities.

Recommendations for NATO

1. Establish a clear and common definition of terrorism and the FAT aligned with NATO core values that all NATO Allies agree upon.
2. Strictly apply the differentiation between terrorism and crime in all fields of cooperation among NATO Allies as well as non-members.
3. Evaluate the impact of NATO capacity building initiatives in the field of security including cyber security, defense and intelligence in North Africa with respect to their potential for stabilizing local civil societies (rather than authoritarian governments).
4. Verify that all FAT initiatives pursued in North Africa are not turned against local civil societies.
5. Consider political stability in North Africa as necessary (but not sufficient) for regional and international security.
6. Extend cooperation to state and non-state actors such as governments (with civilian or military leadership), military and civil society, but intensify cooperation only on the condition of adherence to core democratic principles.
7. Balance cooperation with local partners against the background that these groups have very different methods to articulate their (often non-aligned) interests and to lobby for it.
8. Strengthen credibility and leverage NATO in North Africa through concerted action and resolving internal rifts.
9. Mirror the heterogeneity of North African countries in tailored NATO partnership strategies for each country individually. Update bilateral activities.
10. Advocate sourcing arms and weaponry only with common consent outside NATO. Highlight importance of NATO members' technological leadership and debate the critical role of export of military and dual-use technology to non-NATO member countries.
11. Deepen the Mediterranean Dialogue, but avoid redundancy and coordinate within NATO, as well as with bilateral and multilateral initiatives from NATO members or international institutions, especially the European Union.
12. Explore mutual interest in closer cooperation with North African countries as a means to align common security interests in the long-run.

Conclusion

Comparatively low digital literacy in respect to sophisticated information technologies such as block chain, quantum computing, and artificial intelligence leaves regimes and governments vulnerable to cybercrime. At the same time, North African governments increasingly use digital surveillance technologies to control communication with and amongst their local audience. Cyberspace in North Africa is more tightly controlled by national governments than in Western societies. This reduces freedom of expression and increases the risk of repression for virtual activities or content. At the same time, malign or criminal cyber use of ICT has very limited potential to pose a real threat to security, especially in Tunisia, Egypt and Morocco, where governments and ruling elites have a firm grip on societies. Human and drug trafficking are likely to be a much bigger challenge than cyberattacks in Algeria and Libya

Raising awareness about how technological change can and will shape the future of North Africa is of utmost importance for the future development of these states. Arising security issues directly impact on national, regional and international security. To cope with the challenging security implications from the use of emerging technology in North Africa, the need is greater than ever for a strong NATO with a coherent strategy towards authoritarian states and military actors imposing control over civil society and politics.

Despite the fact that credibility and leverage of NATO is directly and indirectly challenged, NATO is possibly the most important institution to demonstrate and prove the benefit of democratic values and discourse to the North African countries. These countries have limited technological capacities and rely heavily on foreign technology to defend and secure their countries, they also have traditionally close links to Europe, but no regional security cooperation.

In this respect, NATO is a key player and partner with a pivotal role in safeguarding security and peace around the Mediterranean basin. This paper is a starting point for further discussing the issue.

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