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TECHNICAL
REPORT

RAND EUROPE

The impact of information
and communication
technologies in the
Middle East and
North Africa

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Prepared for the Word Bank

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Preface

This report, prepared for and funded by the World Bank, presents the results of an exploratory study to understand the impact of information and communication technologies (ICT) in the Middle East and North Africa (MENA) region. The main objective is to provide a series of analyses and inputs to the World Bank that will help to frame their thinking about ICT use in MENA.

The resources available for this study were limited (only eleven person-days in total), allowing only a broad, high-level analysis. The current work expands on a recent benchmarking paper (Van Welsum, 2010) by adding basic statistical and graphical analyses of associations between indicators of ICT diffusion and socioeconomic development in the MENA region. With the resources available, it was possible to examine a limited set of socioeconomic development indicators. In the proposal we suggested a range of topics to be examined in relation to ICTs in MENA (national income, economic openness, employment, entrepreneurship, youth and governance) and this report covers those topics. Where time series data were available, we also looked at how the relationships between ICT and national income have changed over time. Additionally, a case study was undertaken to examine the specific impacts of social media on political change.

An earlier draft of the current project memorandum has been reviewed by staff at the World Bank. We valued the comments provided, and have tried to address each of them in the current document. The document has also been through an internal review process and has benefitted from Helen Rebecca Schindler's comments.

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CHAPTER 1   **Introduction**

1.1   Overview

Rapidly developing information and communication technologies (ICTs) are creating a fast-changing information and knowledge economy, bringing new opportunities and challenges for citizens, government and business. Innovative technologies and new applications for existing ICTs are changing conventional modes of operation, and ICTs have become fundamental to economic and social infrastructure. They also drive and enable structural change and innovation throughout the economy, including in the business sector, in social interactions, and in the delivery of healthcare, education and government services. Furthermore, with continuous and rapid technological advances, such ICT-enabled changes can take place faster than ever before.

New technologies help to empower citizens in traditional and emerging democratic processes; recent events in the Middle East and North Africa (MENA) region provide a good example. They can also transform economic life, enabling consumers and firms to improve and customise products and services. An important policy challenge is to identify and harness the benefits while mitigating the risks created by the new information society.

Today it is difficult to think of any aspect of public-sector, private-sector or civil society life that is not affected in some way by ICTs. Policies need to facilitate the diffusion and use of ICTs, notably by putting in place the conditions that help to make ICT infrastructure and services available, and aid the development of the skills required to maximise the impact of the changes that ICTs enable.

With an increasing share of economic and social activity taking place over the Internet, new or adapted legislation is also needed to protect consumers, enhance cross-border scientific collaboration, foster creativity and innovation, protect intellectual property rights and privacy, and prevent accidental damage to and malicious attacks on the Internet and other ICT infrastructures.

The literature on the economic impacts of ICTs is building steadily, but still, the impacts remain difficult to identify and quantify. This is due to a range of factors, including: the multiple channels through which these effects occur; multiple levels of analysis; data problems (too many data, selection bias and other quality and completeness issues); difficulty of attributing effects or determining causation; inability to measure important aspects (including economic impacts, since many valuable services are unpriced or poorly measured by market data).

The resources available for this study were limited (only eleven person-days in total) allowing only a broad, high-level analysis. The main objective is to provide a series of analyses and inputs to the World Bank that will help it to frame their thinking about ICT use in MENA. This report builds on Van Welsum (2010), which provided a benchmarking of indicators related to the knowledge and information economy in the MENA countries, but takes the analysis a step further by adding basic statistical and graphical analyses of associations between indicators of ICT diffusion and socioeconomic development in the MENA region. Additionally, a case study was undertaken to examine the specific impacts of social media on political change.

1.2 Structure of this paper

The rest of this report is structured as follows: Chapter 2 provides some background on the economic impacts of ICTs and the growing contribution of the Internet economy; Chapter 3 discusses some of the drivers of ICT uptake; Chapter 4 looks at the associations between ICT diffusion between countries and across time; Chapter 5 presents a case study on the impacts of social media on political change in order to provide a more nuanced understanding of the impact of ICTs; finally, Chapter 6 summarises our findings and identifies areas for further research.

Background

2.1 The economic impacts of ICTs

Information and communication technologies (ICTs) were once central to the 'productivity paradox': they were everywhere, except in the data. Today, much progress has been made towards resolving this paradox, even though analysis of the full impacts of ICTs remains difficult due to numerous measurement and analytical challenges.

The productivity effects of ICTs arise throughout the value chain(s) in which they are employed. The effects of ICT *use* (as opposed to production and sale) are particularly problematic to track, since they are especially important in delivering hard-to-measure or valorise services, often enable non-technological innovations (e.g. business model and/or organisational changes, which are also difficult to measure), and work jointly with other intangible inputs such as human or organisational capital. The emergence of the Internet economy, with ubiquitous general purpose technologies (GPTs) such as wireless broadband, adds to the challenges. Like all GPTs, broadband has begun to facilitate fundamental changes in economic activity, but it will take many years before the contribution made by broadband technologies can be assessed fully.

Still, the body of empirical evidence is building up at different levels of analysis: macro-, sector- and firm-level. Indeed, to understand the links between ICTs and growth and the importance of local technological and socioeconomic characteristics, it is important to look at the effects and transmission mechanisms at each of these different levels of analysis.

The links between ICT use and macroeconomic growth can be examined using growth accounting or country-level econometric (especially endogenous growth) models. Even though there are differences in the magnitude of the effects found, the evidence clearly indicates that ICT deployment raises multifactor productivity, with the impact of increasing ICT use now outweighing that of higher ICT production.[1] However, the effect of ICT use on specific factor productivity (e.g. labour productivity) depends on whether ICTs are used as a substitute for or complement to labour. In much the same way, the impact of the Internet on local economic activity depends on the balance between providing local enterprises with access to wider input and output markets (a positive effect) and providing global or foreign businesses with access to local input and output markets (a negative impact). In addition, investing in ICTs in order to match rivals' investments may

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[1] See, for example, OECD (2004a) and the references therein. Note also that recent growth in the European Internet economy is driven more by consumption 'pull' than productivity 'push' (Cattaneo et al, 2011).

improve overall productivity and competitiveness or produce a 'prisoners' dilemma', which more than absorbs the productivity enhancements, or which replaces a locally sustainable mix of economic and societal benefits with a welfare-reducing form of 'immiserising competition'.[2] In other words, the processes underlying ICT application and the business and market models underlying them determine the overall impact.[3] There is also a growing literature on the economic impact of the 'C' in ICT, notably telecommunications infrastructure investment. These studies also tend to find evidence of a positive impact.[4]

Neoclassical growth accounting goes some way to demonstrating productivity impacts from ICT use and production. However, such estimates remain imperfect as a result of the limiting assumptions these techniques involve, as well as data difficulties such as cross-country differences in the use of 'hedonic' deflators (deflators that have been adjusted for quality changes in ICTs). Increasing amounts of firm-level data are also becoming available, and their analysis is complementing the insights gained at the macro and sectoral levels.

It must also be recognised that productivity increases do not always bring net improvements in other indicators. For instance, ICT deployment often produces both an increase in production (which leads to expanded market shares and (generally) improved competitiveness) and increases in real wages. The increased production will (in the absence of extremes of labour-saving innovation) tend to increase employment; the real wage increases will tend to decrease employment. The overall result can be a cyclic adjustment or convergence to a higher or lower long-term level of employment. Much the same can be said of job quality.[5] This possibility of rebounds or ambiguity of overall effect can also be seen in relation to national GDP: ICT developments that raise real wages in one country may reduce GDP in that country or its near neighbours if the resulting disposable income is spent on goods and services imported from elsewhere.

Many other issues remain unresolved. For example, data imperfections hamper the comparability of cross-country impact comparisons, especially regarding intangible assets and their links with ICTs. Existing studies suggest that the impact of such 'missing factors' may be large.[6] The same difficulties affect the treatment of risk and uncertainty and the task of distinguishing investment in new capacity, goods and services from replacement investment required to keep pace with technological progress.[7] Additional unresolved (econometric) issues include the interaction of ICTs with other variables, such as workforce skills or indicators of regulations that affect either competition or the ability of firms to reorganise after acquiring ICTs, or more generally, any other factor affecting the

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[2] Hoff & Stiglitz (1997)

[3] Sadun & Van Reenen (2006) put it: 'It ain't what you do, it's the way that you do IT'

[4] See, for example, Datta & Agarwal (2004), Roller & Waverman (2001) and Um *et al.* (2009)

[5] For a detailed discussion in the EU context, see Cattaneo et al (2011).

[6] See, for example, Corrado *et al.* (2006)

[7] In other words, ICT capital is imperfectly measured and its depreciation is both complex and subject to strong external shocks

overall use made of ICTs. Finally, the impact of ICTs is also likely to change over time as the technologies continue to rapidly evolve.[8]

In addition to these market-orientated studies, more specific analysis is being undertaken to evaluate the impact of ICTs on government services and governance, including, for example, the delivery of public services such as health and education, as well as the opportunities for greater inclusion and involvement of citizens in the democratic process, for example by making information available online in local languages. ICTs also have a role in the preservation of cultural heritage, ranging from digital archives and libraries to making museum collections available online. We note, however, that the measurement and valuation problems here are even more severe, and not helped by the absence of competitive market data.

ICTs also have multiple impacts at the firm and individual level and may improve welfare through many different channels (Van Welsum, 2008), for example by enabling more flexible work practices, hours and location, which in turn may contribute to easing congestion and pollution challenges in large cities. These factors may enhance the welfare of employees over and above any net effects on employment. ICTs may also generate benefits to consumers by reducing search and information costs and giving greater access to information, making price comparisons easier, raising competition, creating downward pressure on prices and increasing the speed and efficiency of labour markets. They also enable increased customisation of goods and services and improvements in product quality. More generally, ICTs change the role of individuals in production, facilitating user-driven innovation and the development of user-created content. They can also enable small- and medium-sized firms to cooperate and compete with larger firms in a wider range of markets and to re-organise and purchase services that were previously not accessible. At the firm level, ICTs enable new business models and the restructuring of existing ones, leading to efficiency improvements. In addition, there are also many new firms being created that do their business on or via the Internet. Some sectors are particularly affected by such developments, in particular content industries such as music, video, books and news, as well as software. The wide market access made possible by ubiquitous communications can also support a great diversity of niche industries and products,[9] which can produce more sustainable and diverse economic development and, as a partial consequence, greater resilience.

In addition, information products and the paths by which they are disseminated have a set of common characteristics that are crucial to any evaluation of market performance and economic impact. Key attributes include: multiple and distinct stages in the supply process, including content creation, replication, and distribution; high fixed costs of content creation; zero or low marginal costs of reproduction and distribution; economies

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[8] For example, broadband is a relatively recent, but continuously evolving technology. While it was initially difficult to measure the impact of broadband, and disentangle it from the impact of other ICTs (Van Welsum, 2008), this has begun to change as more and better data become available over more recent time intervals. For example, recent work for OECD countries has found a significant impact of broadband infrastructure on growth (Czernich *et al.,* 2009).

[9] The so-called 'long tail' economy in which specialised small-scale markets account for a greater volume of economic activity than the commoditised core.

of scope; diverse sets of consumer preferences; distinctions between static and dynamic efficiency; and externalities that cannot be privatised.

These attributes have numerous implications for the functioning of private markets, including efficiency/equity trade-offs in market structure, a conflict between scale efficiencies and promoting diversity, and crucial public benefits that are ignored by private actors.

2.2   The growing contribution of the Internet economy

The economic and social impacts of the Internet occur via multiple channels, including a macroeconomic effect, both from investment in infrastructure and the infrastructure-enabled changes that bring about increased productivity and innovation, for example. Other areas of impact include firm structure and organisation, consumer welfare, social and political inclusion, employment, job search and job matching, e-health, e-learning, e-government, to name but a few (Cattaneo *et al.*, 2011). This section considers the measurement of these impacts in an EU context; however, the dissemination of underlying technologies and the globalisation of the ICT-based economy suggest that the results are pertinent to understanding the evolution of areas such as MENA as well.

The main challenge is to trace the impacts of ICTs in general, and the Internet in particular, as they 'ripple outwards' from core ICT sectors.

The multiple effects of the Internet economy are schematically represented in Figure 2-1.

Figure 2-1: The Internet economy: its direct and indirect impacts
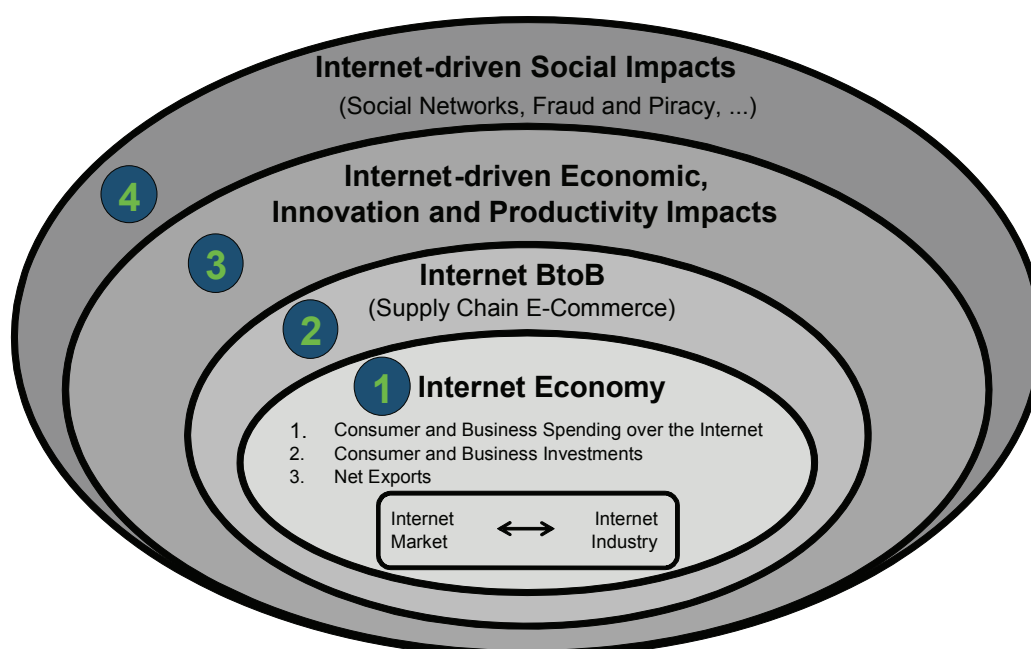
Source: Cattaneo *et al.* (2011)

Cattaneo *et al.* (2011) define the Internet economy as the sum of the value of the goods and services exchanged over the Internet by business and consumer users, plus the value of

investments made to deploy and/or access and use the Internet. To estimate the impacts of the Internet economy, both direct and indirect effects need to be taken into account, posing some difficult measurement challenges. The inner two ovals in Figure 2-1 represent the measurable direct impacts (where Oval 1 captures consumer and business expenditure over the Internet, consumer and business investments, and net exports, and Oval 2 captures business supply chains and e-Commerce: the value of products and services bought by businesses over the Internet and incorporated into their offering).

The outer ovals correspond to the indirect impacts, which are particularly difficult to quantify. Internet-driven indirect impacts of the Internet economy are illustrated in Oval 3 and include economic, innovation and productivity impacts. This category, for example, includes impacts on revenue growth, entry into new markets, market share, profitability, creation of new products or services, and transaction and business process productivity. Finally, Internet-driven social and environmental impacts are captured in Oval 4. These may include: impacts on the labour market, environmental impacts, impacts on social behaviour, impacts on governance and democracy, and so on.

In the European Union, estimates suggest that the Internet economy may have represented 4 percent of EU GDP in 2010 (IDC's estimates cited in Cattaneo et al, 2011). The UK is estimated to have the largest contribution of the Internet economy to GDP within Europe, at just over 6 percent of GDP in 2010. A report by the Boston Consulting Group[10] suggests that the contribution might be even greater, at just over 7 percent in 2009.[11] Both reports suggest that the UK benefits from its high level of 'e-readiness' and its leading position in ICT services. A further set of estimates of the size of the Internet economy is available for France, produced by McKinsey and IDC. McKinsey's study[12] estimates the French Internet economy was a little over 3 percent of GDP in 2009, a figure expected to grow to around 4.5 percent in 2010.

Table 2-1: Value of the Internet economy (% of GDP by country and source, 2009–2010)

	IDC, % of GDP, 2009	IDC, % of GDP, 2010	BCG, % of GDP, 2009	McKinsey, % of GDP, 2009
UK	5.8	6.2	7.2	
Germany	4.3	4.7		
France	4.0	4.6		3.2
EU27	3.7	4.1		

Source: IDC (2011), Boston Consulting Group (2010), McKinsey (2010)

The same analyses suggest that this segment of the economy is growing up to 7 times as fast as overall GDP. At the moment, the lion's share of the revenues is accrued by large

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[10] Boston Consulting Group (2010)

[11] The main difference comes from the treatment of government and private spending, as the ICT budget of the UK government (which is the highest in Europe) is included in the Internet economy estimate in the BCG study and not in the IDC estimate.

[12] McKinsey (2010) *Impact d'Internet sur l'économie française.*

telecom firms, and are thus highly localised. However, services are more innovative and rapidly growing, and are likely to provide the 'engine' of future growth (even if market imperfections leave the large communications providers with a dominant position). The key point is that services, and the innovative business models and forms of economic activity they enable, are inherently mobile and 'weightless', requiring only modest start-up capital and drawing on 'e-skills' that are increasingly prevalent.

CHAPTER 3   **Drivers of ICT uptake**

Internet access is a precondition for being able to use the Internet and enjoy its benefits. However, access is only part of the story. One outcome of the Internet is that it allows communication among humans (and with networked objects) and provides access to knowledge and information. It is therefore important that users can access meaningful content, including local content, in accessible languages and equally important that they can form and sustain meaningful (local and remote) social contacts.

3.1   Languages

Among the barriers to ICT uptake, and specifically the top reasons cited in Europe for not having the Internet at home, are a lack of perceived need, cost (of equipment and/or service) and lack of skills (European Commission, 2009). While the severity and balance of these reasons may vary, the reasons themselves are likely to characterise other regions as well. Of course, in many areas access to suitable infrastructures and services may be an even more important factor at the moment, but the positive feedbacks from availability to demand point to the possibility of a global convergence. In addition, as Internet supply and demand spread, the constituency for greater linguistic (and other forms of) diversity will grow as well. There is also a lack of information about the potential benefits that can be obtained from using the Internet, the possibility of managing or mitigating the associated costs and dangers, and a lack of digital literacy. At the moment, low levels of English language skills and of local content are limiting factors. Improvements in either or both could increase uptake; English is currently considered the lingua franca of the Internet and is thus necessary to engage with the Internet as a whole, while the availability of local content can encourage the growth and development of a more culturally diverse patchwork of locally based online communities of interest. However, given the essentially economic nature of much of what the Internet offers that local communities do not, English proficiency is likely to be a 'leading indicator' of near-term progress. In Figure 3-1 the percentage of households with Internet access is plotted against proficiency in English, as provided by TOEFL[13] scores.[14]

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[13] Test Of English as a Foreign Language. See http://www.ets.org. This is an imperfect proxy because TOEFL exams tend to be taken by those who plan to live, work or study abroad. Therefore, it tends to be a relatively small proportion of individuals in a country who take TOEFL exams. Furthermore, this proportion may vary widely across countries, and is likely to reflect other factors such as the resources allocated to English teaching.

Figure 3-1: Percentage of households with the Internet (x) vs. TOEFL scores (y), 2008
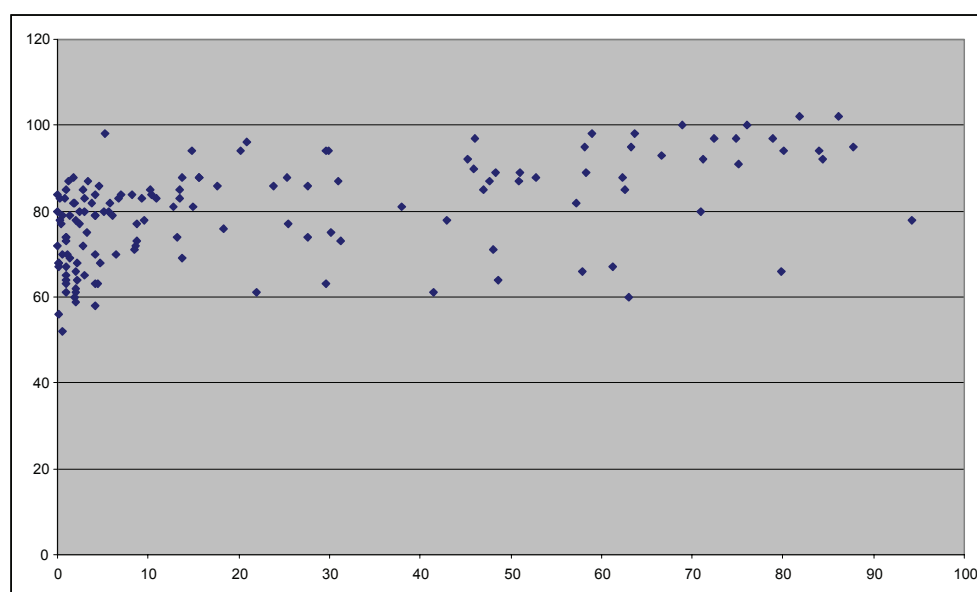
Source: ITU, based on Eurostat and national sources, and TOEFL scores from the Internet-based test from www.ets.org

Given that much of the content on the Internet, as well as 'Internet-related vocabulary', is (or is at least perceived to be) in English,[15] countries with higher levels of English language scores could be expected to have higher Internet adoption rates. The correlation between these two indicators is weakly positive (correlation coefficient = 0.50) and statistically significant. This shows that being able to understand and use English terms could be a factor related to household Internet uptake, and it might also be related to Internet usage. Indeed, repeating the same exercise for Internet users shows that the same positive statistical association holds true, and the correlation is even somewhat stronger (0.59) and is again very statistically significant. However, the modest nature of the correlation suggests that it may be possible to weaken this relationship in favour of a more diverse Internet. The presumed positive feedback between linguistic diversity amongst Internet users and the availability of content in different languages is essential for the cultural sustainability of the Information Society and may provide an important source of economic activity to smaller or developing countries. The preferred result may well be a multilingual Internet that consists of interoperable or communication language and cultural clusters, rather than an English-only hegemony or a fragmented set of isolated 'tribes'. However, language is not only important for cultural production and consumption: Internet users must be able

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Nonetheless, in spite of these limitations, TOEFL test scores currently constitute the only widely available measure of English proficiency where English is not the mother tongue

[14] OECD (2006) and Van Welsum & Xu (2007) use TOEFL scores as a proxy for English language skills, and Lee (2009) uses TOEFL scores to proxy the effect of English proficiency on economic growth.

[15] The practical, or technical, computer language also does not exist in all languages, for example words such as copy, paste, file, mouse, drive, operating system, network, burning a CD, download, broadband, Instant Messenger, etc. are often taken from the English language. This might constitute a barrier to people who do not speak English or do not feel at ease using English terminology.

to recognise and understand the choices offered and to express themselves fully.[16] For this reason, increasing the number of languages on the Internet is considered to be very important for Internet development, as well as for Internet and ICT-related development goals, as reflected in World Summit on the Information Society Target 9.[17]

3.2   Local content

The availability of local content might also be correlated with household Internet uptake. The idea is that people will not see a reason for going online if there is no content available that is relevant for them, or that they can understand (because it is not in their language). At the same time, there could also be some reverse causality: there is no incentive to provide online content if nobody is online. Country code Top-Level Domains (ccTLDs)[18] registered in each country are used as a proxy for local content.[19] Based on the ninety-eight countries for which data were available both in 2005 and 2009 (or 2008 in some cases), the twenty ccTLDs with the strongest average annual growth between 2005 and 2009 (except India: 2008) are shown in Table 3-1.

Table 3-1: The twenty ccTLDs with the strongest average annual growth, 2005–2009

	Country	ccTLD	CAGR 05-09	% ccTLD/population 2009
1	Former Soviet Union	su	102.4	n/a
2	China	cn	95.9	0.96
3	Tajikistan	tj	88.2	0.26
4	Vietnam	vn	77.5	0.13
5	Russia	ru	55.8	1.68
6	India*	in	54.4	0.04
7	Réunion	re	52.7	0.44
8	Iran (I.R.)	ir	49.4	0.17
9	Venezuela	ve	48.8	0.53
10	Poland	pl	44.5	4.10
11	Latvia	lv	41.0	3.51

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[16] This is not limited to the developing world: less than 10 percent of the 740 European price comparison websites offer more than one language, even though the efficiency of the European Single Market presumably depends on informed consumer choice and mobility.

[17] Target 9 is about "encourage the development of content and put in place technical conditions". For more information, see: http://www.uis.unesco.org/Communication/Documents/WTDR2010_e.pdf.

in order to facilitate the presence and use of all world languages on the Internet

[18] Top-Level Domains (TLDs) are divided into two classes: generic Top-Level Domains (gTLDs) include, for example, '.com' and '.org', while country code Top-Level Domains (ccTLDs) are used and reserved for countries or dependent territories and are expressed in two-letter country codes (OECD, 2009)

[19] This is an imperfect proxy as it does not take generic Top Level Domains (gTLDs) registered in each country into account, nor the fact that these registrations can be influenced by factors such as registration pricing policies. The relative shares of ccTLDs and gTLDs vary across countries. In addition, some (market-facing) ccTLDs are used primarily for global economic activity, while others primarily give expression to national specificities (see, for example, Park (2009)). Nonetheless, domain name registrations are an indicator of interest in adopting a web presence and ultimately an indicator of the development of the Internet (OECD, 2009)

	Country	ccTLD	CAGR 05-09	% ccTLD/population 2009
12	France	fr	40.0	2.45
13	Portugal	pt	39.4	2.65
14	Guadeloupe	gp	39.1	0.30
15	Lithuania	lt	39.0	3.27
16	Palestine	ps	36.1	0.12
17	Bosnia and Herzegovina	ba	35.3	0.26
18	Kenya	ke	34.1	0.03
19	Albania	al	32.8	0.05
20	Peru	pe	31.1	0.13

Source: ITU (based on Eurostat and national sources) and ZookNIC (www.zooknic.com)

* For India, we only have 2005-08 data on CAGR and 2008 data on ccTLD/population.

The twenty countries where the number of ccTLDs per population (in percentage terms) grew the most between 2005 and 2009 are given in Table 3-2.

Table 3-2: The twenty countries with the largest increase in ccTLD/population, 2005–2009

	Country	% ccTLD/pop 2005	% ccTLD/pop 2009	Difference
1	Netherlands	10.03	21.24	11.21
2	Switzerland	9.87	17.76	7.89
3	St. Vincent and the Grenadines	0.92	8.37	7.45
4	Denmark	11.56	18.57	7.01
5	Sweden	4.07	9.79	5.72
6	United Kingdom	7.32	12.84	5.52
7	Austria	5.49	10.57	5.09
8	Luxembourg	4.54	9.56	5.02
9	Germany	11.06	15.92	4.86
10	Belgium	4.45	8.92	4.47
11	Australia	2.87	7.06	4.19
12	Norway	5.28	9.21	3.93
13	New Zealand	4.88	8.77	3.89
14	Czech Republic	2.12	5.79	3.67
15	Iceland	4.53	8.15	3.62
16	Poland	0.94	4.10	3.16
17	Greenland	4.37	7.21	2.84
18	Faroe Islands	3.23	6.01	2.78
19	Estonia	2.52	5.30	2.78
20	Hungary	2.02	4.76	2.74

Source: www.zooknic.com

Accepting ccTLDs as a proxy for the availability of local content,[20] a greater number of ccTLDs per capita could be expected to be associated statistically with higher levels of household Internet usage. Plotting Internet users per 100 inhabitants against the number

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[20] Viard & Economides (2011) use a similar approach to measuring the impact of content on Internet adoption, finding a 'statistically and economically significant effect' linking content creation to Internet adoption using ccTLD registrations as an indicator

of ccTLDs/population (%) for 2005 and 2009 (Figures 3-2 and 3-3) indicates a positive correlation (Spearman's rank correlation coefficient = 0.8, and very significant). This shows that there is indeed a rather strong statistical association between these two variables, pointing to the importance of providing local content. Along the same lines as the importance of local languages, the availability of local content is considered to be key to Internet development and for achieving Internet and ICT-related development goals.

Figure 3-2: Internet users/population vs ccTLDs/population, 2005
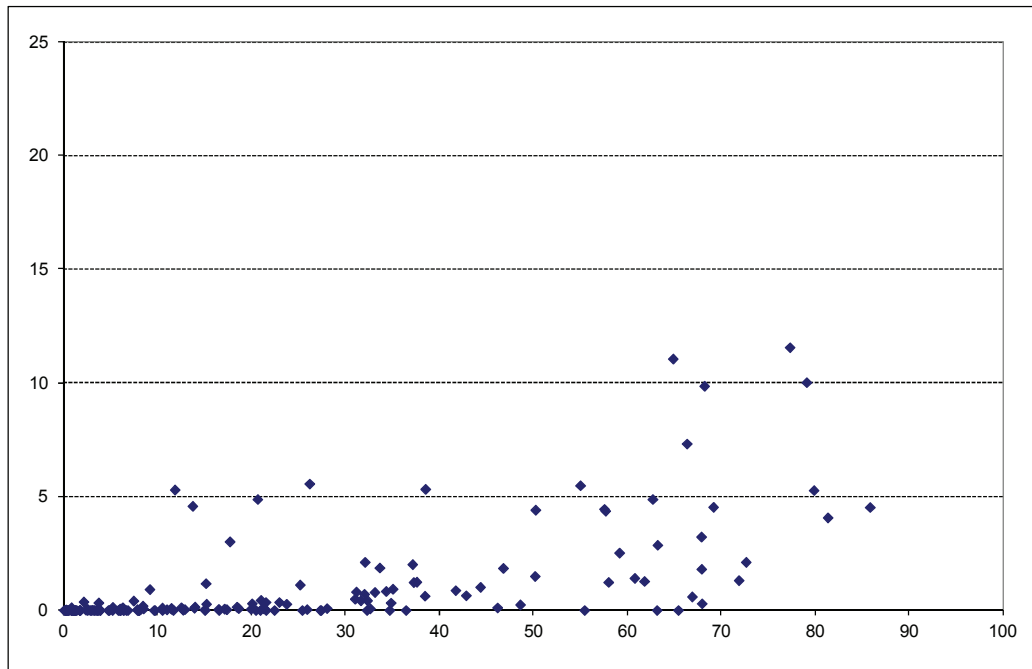
Figure 3-3: Internet users/population vs ccTLDs/population, 2009
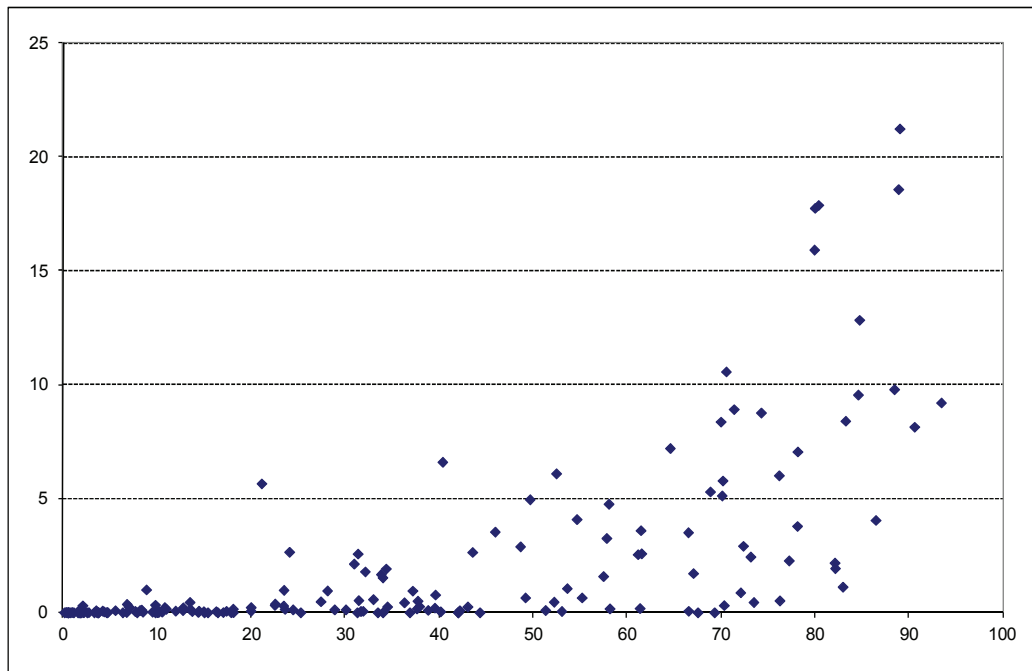
Note: In Figure 3-2 and 3-3, y-axis is ccTLDs per 100 inhabitants and x-axis is % Internet users. These charts include the ninety-eight countries for which data were available both in 2005 and 2009 (or 2008 in some cases). The 2009 penetration rates of Internet users are ITU estimates. Source: ITU (based on Eurostat and national sources) and ZookNIC (www.zooknic.com)

It is not known in which languages these ccTLDs exist. However, efforts to measure Internet web pages in certain languages[21] over several years also point to a correlation between the growth in the number of users and the growth of content. However, over time and as the Internet user penetration rate becomes higher, the correlation disappears and less content per user is produced. This suggests that promoting user-created content is a good candidate for policy consideration at least in the early stages of Internet and local content development.

Comparing the two figures, it is evident that there is little relationship between Internet penetration and ccTLDs below a critical level about 40 percent penetration, where local – offline – channels probably carry most local cultural content and where Internet needs are adequately served by globalised content and services provided via generic Top-Level Domains (gTLDs). Above this level, the relationship is strong and strengthens over time.

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[21] See http://funredes.org/lc and the observation of Latin languages, German and English

ICTs and socioeconomic development

4.1 An overview of indicators

In this section, we explore the statistical associations between indicators of ICT diffusion on the one hand, and indicators of economic and social development on the other.

4.1.1 ICT diffusion indicators

The ICT diffusion indicators to be examined are: estimated Internet users, fixed broadband subscriptions, fixed Internet subscriptions, fixed telephone lines, mobile broadband subscriptions, and mobile cellular subscriptions. These indicators are drawn from the International Telecommunication Union's (ITU's) database.

Data for these six ICT diffusion indicators in the MENA countries in 2009 are shown in

Table 4-1. It is clear that the level of ICT diffusion varies greatly among the MENA countries. For example, the number of Internet users ranges from around one per 100 inhabitants in Iraq and Somalia to seventy-five in UAE. The case of mobile cellular subscriptions is even more extreme: in Somalia there were only seven mobile cellular subscriptions per 100 inhabitants, but in seven other MENA countries (United Arab Emirates, Bahrain, Qatar, Saudi Arabia, Libya, Oman and Kuwait) mobile cellular subscriptions exceeded 100 percent.

The importance of the different indicators, and therefore their connection to economic and societal indicators, varies with the 'development trajectory' and maturity of the countries' Information Societies. For instance, in some countries mobile phones provide a rich matrix of social and economic connections and are an essential part of the economy and society (e.g. the recent anti-corruption movement in India owes far more to mobiles than to fixed-line social networks). Also, the prevalent mode of Internet connection affects the level of specific indicators; in many countries, low levels of private Internet subscriptions greatly understate access, because individuals – especially in urban areas – have ample (and affordable) access through wireless local area networks such as Wi-Fi in cafes and other points of presence. In such countries, private fixed-line telephone and Internet subscriptions are lagging indicators of 'true' adoption.

Table 4-1: ICT diffusion indicators, per 100 inhabitants, 2009

	Estimated Internet users	Fixed broadband subscriptions	Fixed Internet subscriptions	Fixed telephone lines	Mobile broadband subscriptions	Mobile cellular subscriptions
Algeria	13.5	2.3		7.4	0.0	93.8
Bahrain	53.0	9.6	10.0	30.1	57.4	177.1
Comoros	3.6	0.0	0.2	4.6	0.0	18.1
Djibouti	3.0	0.6	1.1	1.9	0.0	14.9
Egypt	24.3	1.3	2.8	12.4	8.4	66.7
Iraq	1.1	0.0		3.6	0.0	64.1
Jordan	26.0	3.2	3.9	7.9	0.0	95.2
Kuwait	36.9	1.5		18.5	31.8	129.8
Lebanon	23.7	5.3		19.0	0.0	56.6
Libya	5.5	1.0	12.0	16.6	13.3	148.5
Mauritania	2.3	0.3		2.3	3.2	66.3
Morocco	41.3	1.5	1.5	11.0	5.2	79.1
Oman	51.5	1.4	2.7	10.5	43.1	139.5
Palestinian Authority	32.2	5.4		8.1	0.0	28.6
Qatar	40.0	10.3	10.3	20.2	27.2	175.4
Saudi Arabia	38.0	5.2	7.3	16.2	117.6	174.4
Somalia	1.2	0.0		1.1	0.0	7.0
Sudan		0.4		0.9	0.8	36.3
Syria	20.4	0.2	3.6	17.7	5.0	45.6
Tunisia	34.1	3.6	4.0	12.4	0.0	95.4
United Arab Emirates	75.0	15.0	30.5	33.9	55.3	232.1
Yemen	10.0	0.2	1.9	4.2	0.0	35.3

Note: In this table, missing data are represented by blank cells. Zero values represent genuine zeros in the underlying data. Source: ITU, *World Telecommunications Indicators Database*, August 2010

4.1.2 Economic and social development and governance indicators

The economic and social development indicators to be examined cover six dimensions: income, youth, employment, entrepreneurship, openness and governance. Each of these is represented using the following measures:

- Income: Gross National Income (GNI) per capita according to the World Bank's World Development Indicators
- Youth: Total population aged 15–24 according to the World Bank's World Development Indicators
- Employment: total unemployment as percentage of total labour force according to the World Bank's World Development Indicators
- Entrepreneurship: time to start a business in days according to the World Bank and the International Finance Corporation's Doing Business database

- Openness: export of goods and services as percentage of GDP according to the World Bank's World Development Indicators.

There are six governance indicators:

- Voice and accountability
- Political stability, no violence
- Government effectiveness
- Regulatory quality
- Rule of law
- Control of corruption.

Data are sourced from the World Bank's Aggregate Governance Indicators database. Detailed descriptions of these six indicators can be found in Kaufmann *et al.* (2010).

It should be recognised that these indicators represent only a partial snapshot of a highly complex situation. Examination of a wider set of indicators will provide further insights; however, this is not possible given the resources available for this study. Some of the other key indicators are:

- On income: income inequality (e.g. the Gini index)
- On youth: share of employment by age, share of employment by education, secondary school enrolment
- On entrepreneurship: obstacles to starting business and availability of start-up and expansion capital.

4.2   Radar plots of the indicators

Using the ICT diffusion and economic/social/governance indicators, individual radar plots for each of the MENA countries have been generated (see Figure 4-2). These plots represent the six ICT variables and the eleven economic/social/governance indicators for each MENA country on a single chart.

In the radar plots each spoke represents a different variable. The ICT indicators are presented on the right of the diagram, in blue. The economic/social/governance indicators are presented on the left of the diagram, in red. The MENA country values for each indicator are scaled across the total set of MENA countries, when they do not initially represent a percentage. The scaling used ranges from 0 to 100. Thus, the highest ranked country for each indicator has a scaled value of 100. The longer the radius on each spoke, the higher the ranking of the country in question for that variable. This scaling allows a visual comparison of the MENA countries' ranking in terms of ICT and economic/social/governance indicators. A sample radar plot is illustrated in Figure 4-1.

Figure 4-1: Sample radar plot
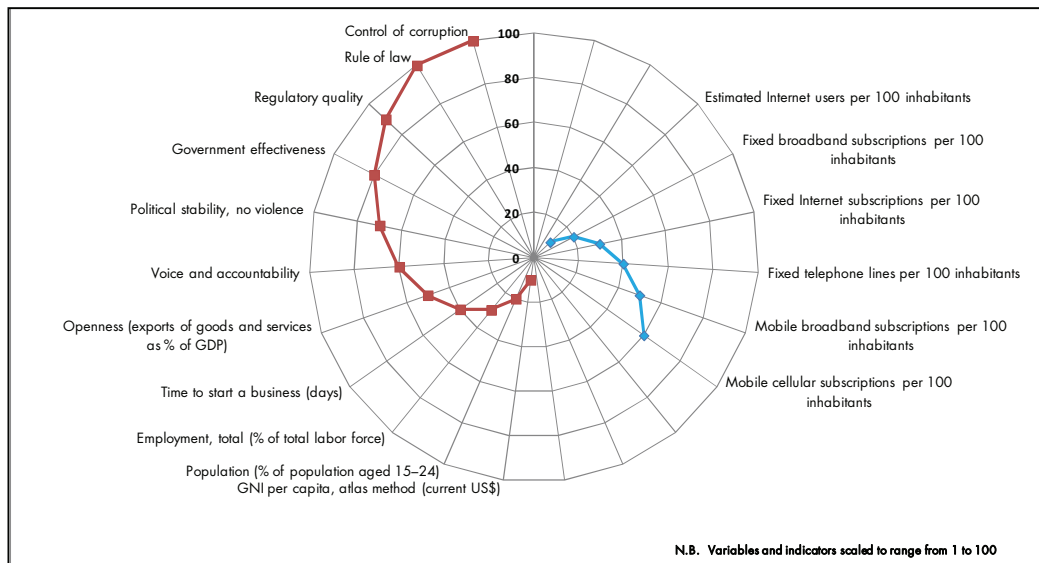
In Figure 4-1 the sample MENA country ranks poorly in terms of GNI per capita, illustrated by the short radius for this economic/social indicator. However, it is the highest ranked country in terms of 'rule of law' and 'control of corruption' governance indicators. For the ICT indicators, the sample country ranks poorly for Internet users, but ranks well for mobile cellular subscriptions.

Using a radar plot it is possible to visually identify any outliers in the multi-variable charts, and to also see how countries are grouped.

The MENA country-specific radar plots in Figure 4-2 have missing data, due to not all countries having complete data sets across all indicators in 2009. This means that the radar plots have some values of zero on some of the spokes.

Bearing this caveat in mind, the MENA countries presented in Figure 4-2 fall into three groupings. Initally, there is a group that has relatively high levels of economic/social/governance indictators. This group includes: Bahrain, Jordan, Kuwait, Morocco, Oman, the Palestinian Authority, Qatar, Syria and Tunisia. This group is identifiable by their large radii for the red economic/social/governance indicators.

The second group scores poorly on the same parameters. This group includes: Iraq, Somalia, Sudan and Yemen.

The third group scores realtively highly on the ICT indicators. This group includes: Bahrain, Qatar, Saudi Arabia and the UAE.

This groupings are indicative only, and it is not possible to determine from this analysis the reasons behind the groupings. Due to the lack of data available it is not possible to make further or more detailed groupings of the MENA countries.

Figure 4-2: Radar plots (MENA countries, 2009)

- Egypt

N.B. Variables and indicators scaled to range from 1 to 100

- Iraq

N.B. Variables and indicators scaled to range from 1 to 100

- Jordan

N.B. Variables and indicators scaled to range from 1 to 100

- Kuwait

N.B. Variables and indicators scaled to range from 1 to 100

- Lebanon

N.B. Variables and indicators scaled to range from 1 to 100

- Libya

N.B. Variables and indicators scaled to range from 1 to 100

- Mauritania

N.B. Variables and indicators scaled to range from 1 to 100

- Morocco

N.B. Variables and indicators scaled to range from 1 to 100

- Oman

N.B. Variables and indicators scaled to range from 1 to 100

- Palestinian Authority/West Bank and Gaza

N.B. Variables and indicators scaled to range from 1 to 100

- Qatar

N.B. Variables and indicators scaled to range from 1 to 100

- Saudi Arabia

N.B. Variables and indicators scaled to range from 1 to 100

- Somalia

N.B. Variables and indicators scaled to range from 1 to 100

- Sudan

N.B. Variables and indicators scaled to range from 1 to 100

- Syria

N.B. Variables and indicators scaled to range from 1 to 100

- Tunisia

N.B. Variables and indicators scaled to range from 1 to 100

- United Arab Emirates

N.B. Variables and indicators scaled to range from 1 to 100

- Yemen

N.B. Variables and indicators scaled to range from 1 to 100

4.3   Correlations between indicators

4.3.1   Approach

The resources available for this study were very limited, allowing only basic statistical and graphical analyses of associations between indicators of ICT diffusion and socioeconomic development in the MENA region. We took a two-step approach. As an exploratory step, we first calculated the statistical correlations of all possible combinations of the ICT diffusion and economic/social/governance indicators. The six-by-eleven correlation matrix resulting from this step provided an overview of which pairs of indicators are strongly correlated. Based on this correlation matrix, we selected pairs of indicators that showed a strong correlation (i.e. with a Pearson product moment correlation coefficient over 0.7). We then focussed on examining the relationship between the pairs using scatter plots.

Available data represent partial snapshots of a highly interconnected set of phenomena. As a result, a range of analytic problems are to be anticipated, especially endogeneity (roughly, a causal connection between the variable(s) and the error term). This can reflect a range of causes. These can in principle be detected and in some cases corrected by suitable econometric techniques. As noted above, resource limitations prevented the development of such models, but we here recommend some econometric methods that can be used in larger studies (see Box 4-1).

Box 4-1: Analytic problems and some econometric methods that can be used in larger studies to solve them

Problems may arise from the omission of variables correlated both with one or more independent variables, systematic errors in measuring the variables, selection bias, econometric relations linking the independent variables (simultaneity or co-determination), autoregression with autocorrelated errors, etc.

A broad class of problems reflects failures in the assumed pattern of causation (the dependent variable being caused by – but not causing – a set of independent 'regressors' that do not cause each other). The solution depends on which part of the assumption breaks down.

Relationships may be influenced by a missing variable that reflects unobserved heterogeneity across countries or over time. One commonly used technique is cross-country regression or panel regression. In particular, the relationship between ICT diffusion and other social economic development indicators may be affected both by country-specific effects and by effects that unfold over time, but which affect all countries simultaneously. In this approach, these unobserved differences are treated as country and time fixed effects.

A problem may arise from causal relations among independent variables, or through the omission of a variable whose influence on the independent variable operates solely through its (different) influence on regressors already present in the equation. In this case, the bias (and the resulting distortion of significance tests) can be addressed by instrumental variable techniques, such as 2SLS (Two-stage least squares). In essence, a secondary regression is used to model the impact of one regressor (say $Y1$) on another (say $Y2$) or more generally of a suitable instrument on both variables. The secondary regression models $Y1$ and a

function of Y2; the residuals (errors) in this equation thus represent that part of Y1 that cannot be accounted for by Y2. Then the original equation is re-estimated using Y2 and the residuals from the secondary equation to produce uncorrelated independent variables that – between them – contain the same information as Y1 and Y2 do. Where this is insufficient (i.e. where a single variable affects both Y1 and Y2 in different ways) instrumental variables should be used – but it may be difficult to find suitable instruments (variables that are correlated with the endogenous explanatory variables, conditional on the other covariates, but not correlated with the error term in the original regression). Sometimes, non-parametric methods can be used to construct instruments; this approach suffers from the drawback that it is impossible to identify the average causal effect of the regressors on the dependent variable. It can be used, for instance, to deal with the issue of endogenous growth or the way ICT diffusion may improve the extent and effectiveness of human capital creation.

Where a problem arises from measurement error, the analysis can be improved by the use of multiple indicators (with different 'errors of measurement' to triangulate the true impact of ICT diffusion on socioeconomic outcomes). Of course, the resulting measures are likely to suffer from endogeneity problems and may need further analysis as suggested above.

In many cases, observations suffer from sample selection bias – unbalanced samples of the 'true' population where the censoring effect is correlated with the relationship being investigated. In extreme cases, this can simply take the form of censorship (e.g. people below a certain level of ability will not find jobs despite engagement with ICTs); in this case, a discrete choice approach (e.g. Logit or Probit) or a nested approach may be necessary. In other cases, the bias is more subtle, and can be corrected by, for example, Heckman techniques that effectively re-weight the empirical data to reconstruct the original joint distribution.

A final issue worth mentioning is that of bidirectional causality: at an intuitive level the relationship between ICT diffusion and socioeconomic progress is one of positive feedback, if not equilibrium; increases in one drive increases in the other. If outside data can be used to identify episodes during which one or the other causal direction was dominant, separate relationships can be estimated. It is even possible to identify these periods using additional indicators in Markov switching models. For example, if periods of excess demand for ICT skills led to increases in returns, uptake and diffusion, but were followed by periods of overshoot in which ICT development served societal rather than economic objectives; another example is a 'hog cycle' alternation between periods of growth driven by capital investment (including ICT investment) and periods of human capital formation. With time series data, Granger methods can be used to determine whether the correlation between, say, past ICT and current socioeconomic development is stronger than the relationship between past socioeconomic and current socioeconomic development (in which case we say that ICT 'Granger causes' development. More generally, the relationship can be unpicked using multiple equation models.

4.3.2   The correlation matrix

As described in Section 4.3.1, we started our analysis by looking at the statistical correlations of all possible combinations of the ICT diffusion and economic/social/governance indicators.

The Pearson product moment correlation coefficient is a commonly used measure of the strength of linear dependence between two variables. The formula for the Pearson product moment correlation coefficient, r, is as follows:

$$r = \frac{\sum (x - \bar{x})(y - \bar{y})}{\sqrt{\sum (x - \bar{x})^2 \sum (y - \bar{y})^2}}$$

(where x and y are the sample means of the first and second indicator respectively)

The Pearson product moment correlation coefficient has a maximum value of 1 and a minimum value of -1. The closer it is the extreme values of 1 or -1, the stronger the association. A negative correlation means when one indicator goes up, the other goes down.

The Pearson product moment correlation coefficients for the all possible combinations of ICT and economic/social/governance indicators (as discussed in Section 4.1) are presented in Table 4-2. The available 2009 data for the MENA countries have only five observations for unemployment rates. Thus, the high value of the correlation coefficients for this indicator cannot be taken as reliable, and hence it is excluded from further analysis.

Excluding unemployment, Table 4-2 has five coefficients exceeding 0.7. These five combinations of ICT diffusion and economic/social indicators are presented in Figure 4-3 to Figure 4-7.

None of the six governance indicators are found to be strongly correlated with the ICT diffusion indicators. This finding could result from lumping together very different types of country, the operation of two-way causality, or the (current) dominance of economic and societal motivations over political motivations in shaping current (medium-to-long term) governance indicator performance. A detailed investigation into the apparent weak correlation is warranted, although it is not possible within the scope of the current study.

Table 4-2: Pearson product moment correlation coefficient for ICT diffusion and economic/social/governance indicators for the twenty-two MENA countries

(a) Economic/social indicators

	GNI per capita, Atlas method	Population (% of population aged 15–24)	Unemployment, total (% of total labour force)	Time to start a business	Openness (exports of goods and services – % of GDP)
Estimated Internet users	0.37	-0.12	-0.19	-0.40	0.31
Fixed broadband subscriptions	0.68	-0.29	0.40	-0.31	0.45
Fixed Internet subscriptions	0.82	-0.24	-0.66	-0.15	0.75
Fixed telephone lines	0.66	-0.21	-0.78	-0.44	0.26
Mobile broadband subscriptions	0.80	-0.11	-0.58	-0.28	0.45
Mobile cellular subscriptions	0.86	-0.20	-0.79	-0.37	0.75

(b) Governance indicators

	Voice and account-ability	Political stability, no violence	Govern-ment effective-ness	Regu-latory quality	Rule of law	Control of corrup-tion
Estimated Internet users	0.10	0.17	0.45	0.51	0.48	0.44
Fixed broadband subscriptions	0.00	-0.06	0.19	0.33	0.23	0.26
Fixed Internet subscriptions	-0.23	-0.27	-0.11	0.05	-0.02	-0.11
Fixed telephone lines	0.07	0.09	0.25	0.38	0.31	0.22
Mobile broadband subscriptions	-0.33	-0.28	-0.19	-0.20	-0.20	-0.15
Mobile cellular subscriptions	-0.22	-0.01	0.09	0.18	0.13	0.08

Note: Shading indicates strong correlations (i.e. Pearson product moment correlation coefficient exceeding 0.7)

4.3.3   Analysis of scatter plots

Figure 4-3 and Figure 4-4 show that there is a strong cross-country correlation between fixed Internet subscriptions and both GNI per capita and trade openness. Figure 4-5 and Figure 4-6 illustrate a similar relationship between mobile broadband subscriptions and GNI per capita and trade openness.

We note the correlations identified only mean associations. They do not imply causality.

It is not surprising to find positive correlations between GNI per capita and ICT indicators, because of the cost of ICT subscription, usage and installation. Similarly the correlation between openness and ICT indicators might be expected, not least because the use of ICT and subscription to ICT services could be curtailed by an authoritarian or reclusive government. The fact that the correlations are higher for mobile subscriptions than for general Internet usage corresponds to current ongoing research.[22]

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[22] See La Cava *et al.* (2011)

Figure 4-3: Fixed Internet subscriptions vs. GNI per capita for MENA countries

N.B. Country groups values are calculated on population weighting
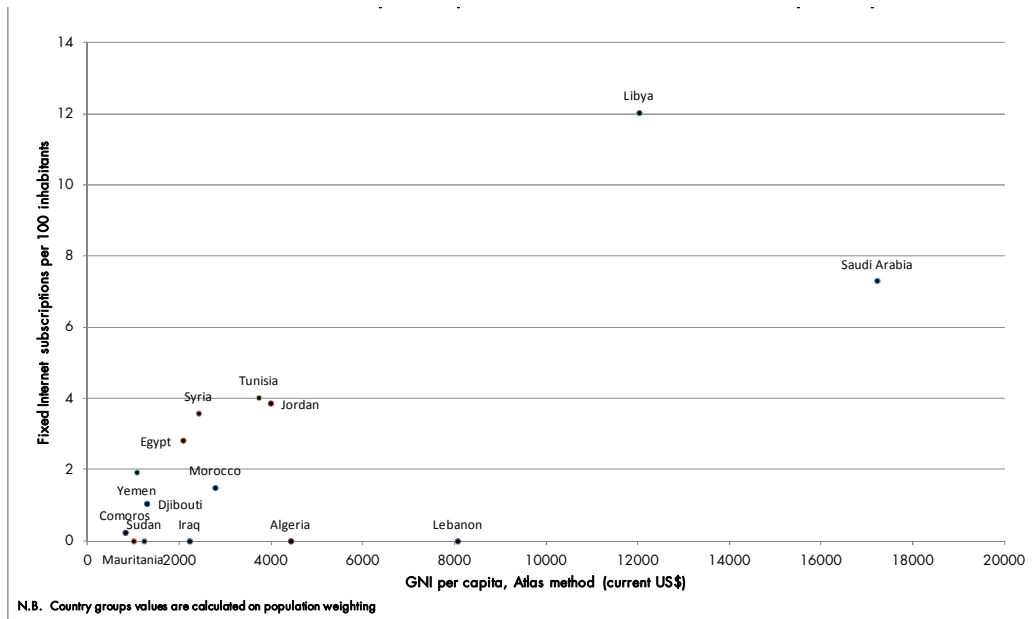
Figure 4-4: Fixed Internet subscriptions vs. openness for MENA countries

N.B. Country groups values are calculated on population weighting
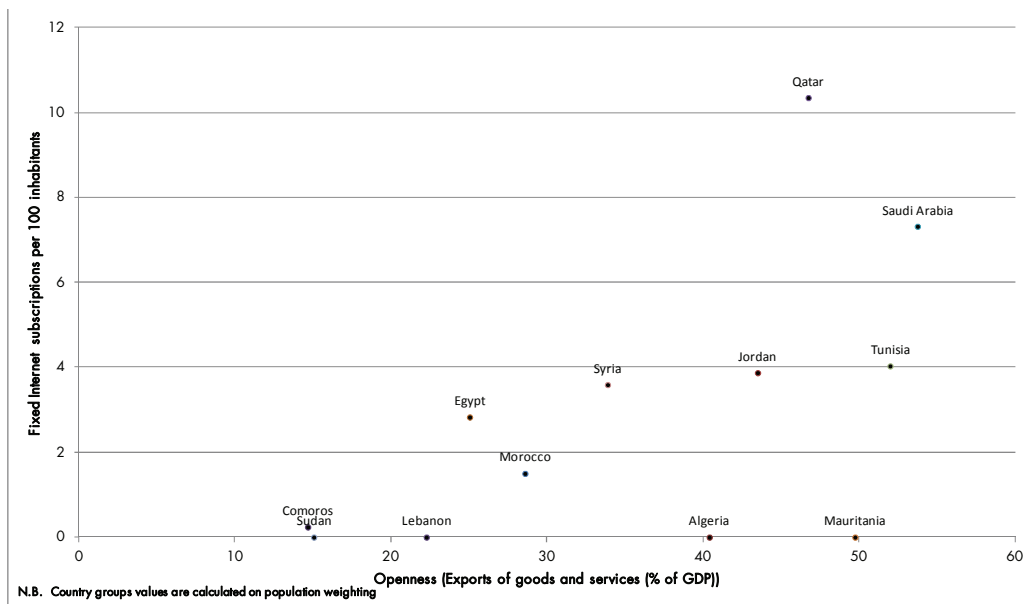
Figure 4-5: Mobile cellular subscriptions vs. GNI per capita for MENA countries

N.B. Country groups values are calculated on population weighting
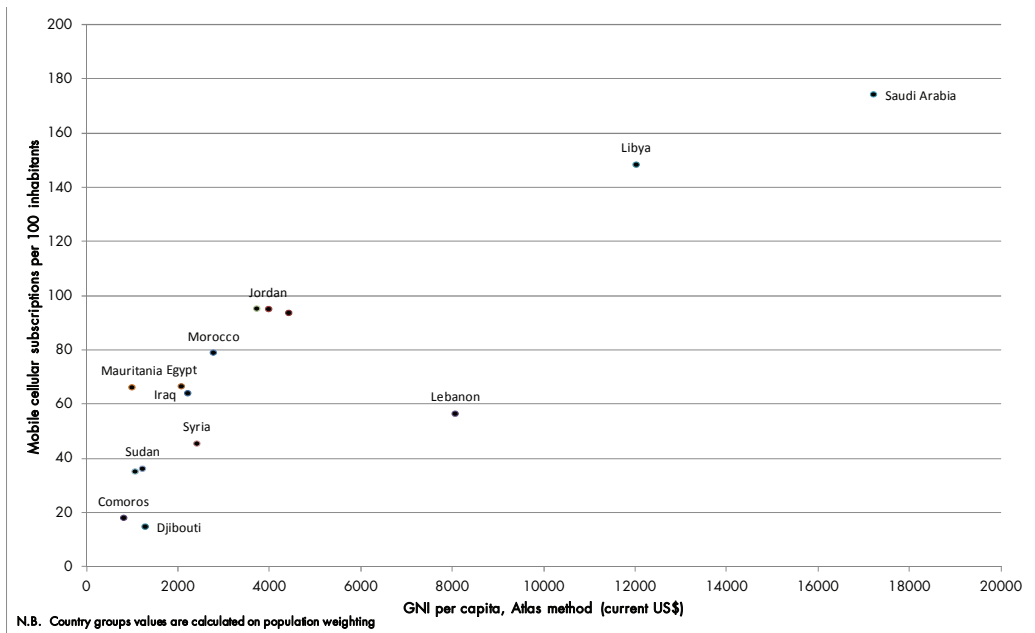
Figure 4-6: Mobile broadband subscriptions vs. GNI per capita for MENA countries

N.B. Country groups vaules are calculated on population weighting
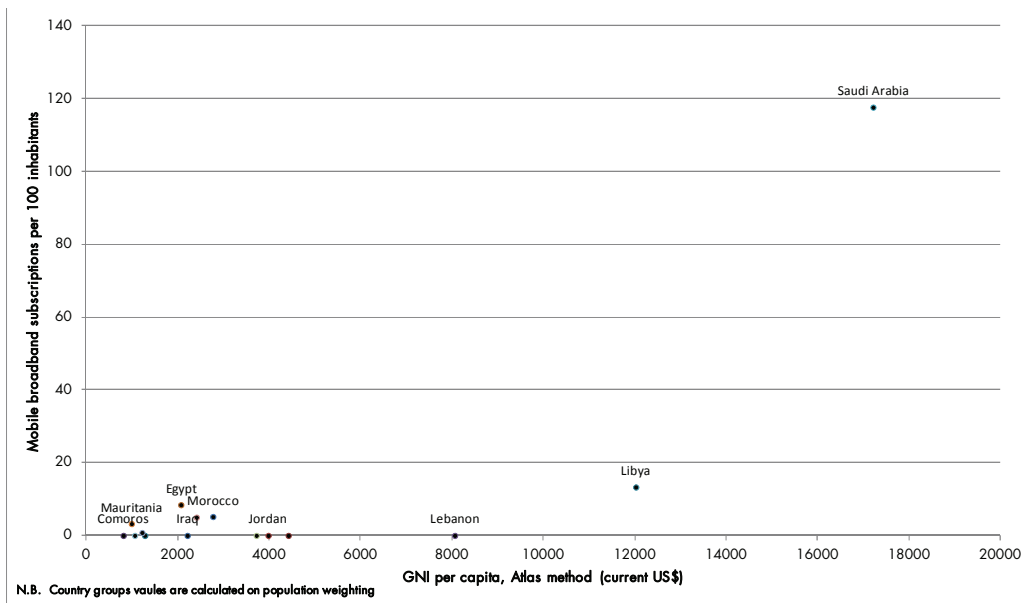
Figure 4-7: Mobile broadband subscriptions vs. openness for MENA countries

N.B. Country groups vaules are calculated on population weighting
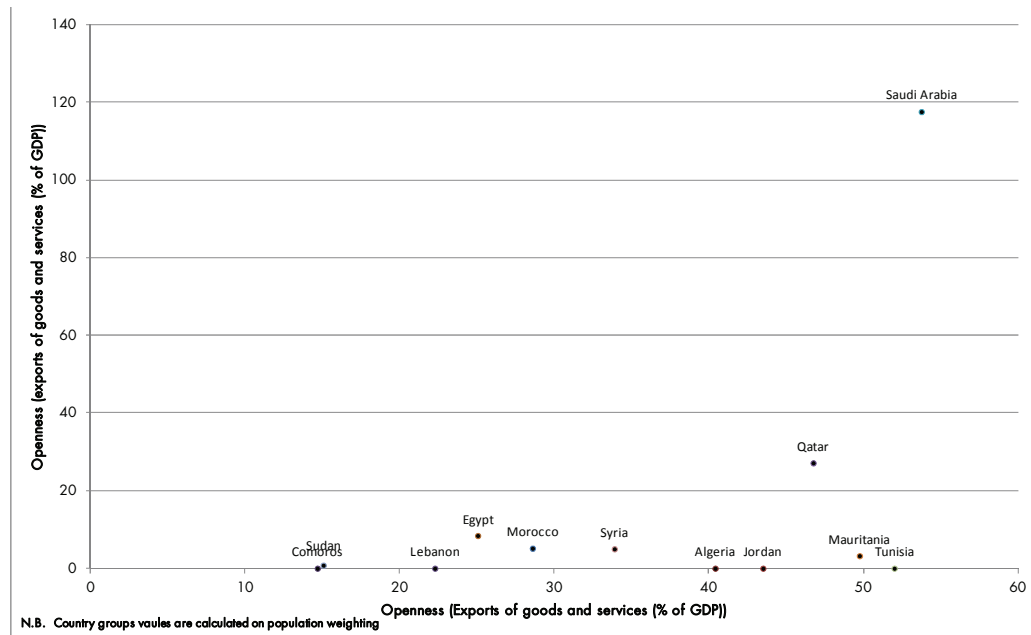
4.4   Changes over time

4.4.1   ICT diffusion between 2000 and 2009

This section looks at how the ICT diffusion indicators in MENA countries have changed over time, from 2000 to 2009. Four ICT diffusion indicators (Internet users, fixed Internet subscriptions, fixed phone lines and mobile cellular subscriptions) will be discussed in turn. Analysis of change over time in fixed and mobile broadband subscriptions cannot be presented here, as the 2000 data for these two indicators were too sparse.

Figure 4-8 shows the estimated Internet users per 100 inhabitants in 2000 and 2009 in MENA countries. The country with the highest number in 2009, the UAE, is on the far left; and the country with the lowest number, Iraq, is on the far right (there were no data for Sudan in 2009). Looking at the situation in 2000, the UAE was also the leading country; and between 2000 and 2009, the UAE was the country with the biggest absolute change in this indicator. However, in terms of rate of change, it was highest in Yemen and Syria, where the increase was over tenfold. The slowest rate of change took place in Lebanon. But even for the country with the slowest rate of change, the increase was threefold over the nine-year period. Overall, the rate of increase in the number of Internet users per 100 inhabitants was high across the region.

Figure 4-8: Estimated Internet users per 100 inhabitants, 2000 and 2009
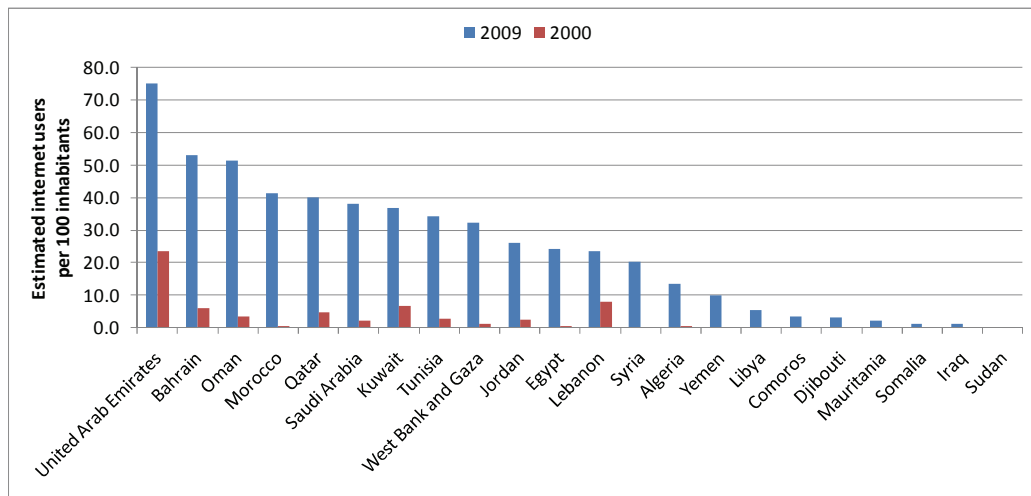
Note: For Sudan, there were no data in 2009, while data for 2000 indicated zero Internet users. For Iraq, there were no data in 2000

Figure 4-9 shows the number of fixed Internet subscriptions per 100 inhabitants in 2000 and 2009. The UAE, again, is the country with the highest penetration at both points in time. The levels were 6.5 in 2000 and 30.5 in 2009: in other words the increase over the nine-year period was close to a fivefold. Libya, at second place in 2009, has a penetration level that is less than half of the level at UAE (12.0 fixed Internet subscriptions per 100 inhabitants). It was not clear what the growth rate has been, as there were no data for Libya in 2000.[23] Qatar and Bahrain had similar levels in 2009, although back in 2000 the penetration level in Bahrain was twice as high as the level in Qatar. Many other countries have a penetration level below the 5 percent mark in 2009, including Tunisia, Jordan, Syria, Egypt, Oman, Yemen, Morocco and Djibouti. The 2000 levels for some of the countries (Tunisia, Syria, Morocco, Djibouti, Comoros, Algeria, and West Bank and Gaza) are so low that they are hardly visible in the chart. There are also many missing data in this chart: the only three genuine zeros are Yemen, Mauritania and Somalia in 2000.

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[23] The earliest data point on fixed Internet subscriptions in the ITU database was 2006. The penetration level was reported to be 1.4 per 100 inhabitants.

Figure 4-9: Fixed Internet subscriptions per 100 inhabitants, 2000 and 2009
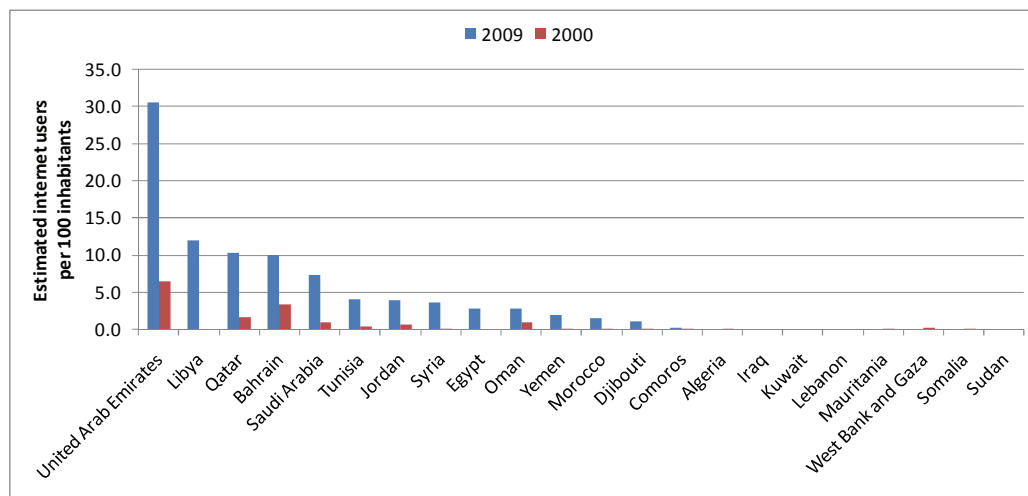
Figure 4-10 shows the number of fixed phone lines per 100 inhabitants in 2000 and 2009. By 2009, all twenty-two MENA countries have some level of fixed telephone line penetration. However, for some of the countries (Comoros, Yemen, Iraq, Mauritania, Djibouti, Somalia and Sudan) the levels of penetration remain below the 5 percent mark. Additionally, one striking feature of the chart is that it shows a reversal of fixed phone line penetration in some of the MENA countries (Qatar, Kuwait and Jordan): the level of fixed phone line penetration was actually lower in 2009 than in 2000.

Figure 4-10: Fixed telephone lines per 100 inhabitants, 2000 and 2009
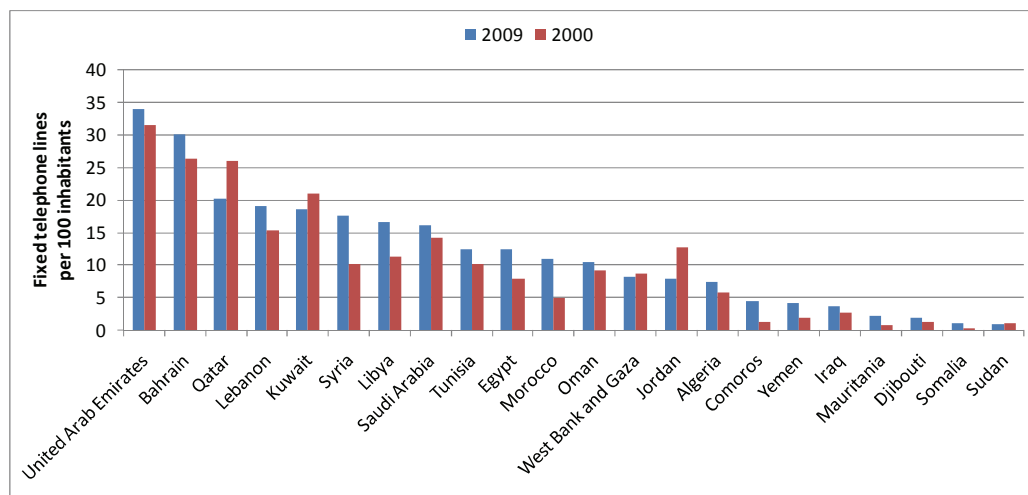
Figure 4-11 shows the number of mobile cellular subscriptions per 100 inhabitants in 2000 and 2009. Notably, the level of mobile phone subscription penetration was over 100 percent in the UAE, Bahrain, Qatar, Saudi Arabia, Libya, Oman and Kuwait; and close to 100 percent in Tunisia, Jordan and Algeria. Back in 2000, the penetration level at its highest was only 44.1 percent, suggesting that large-scale mobile phone subscription uptake took place between 2000 and 2009.

Figure 4-11: Mobile cellular subscriptions per 100 inhabitants, 2000 and 2009
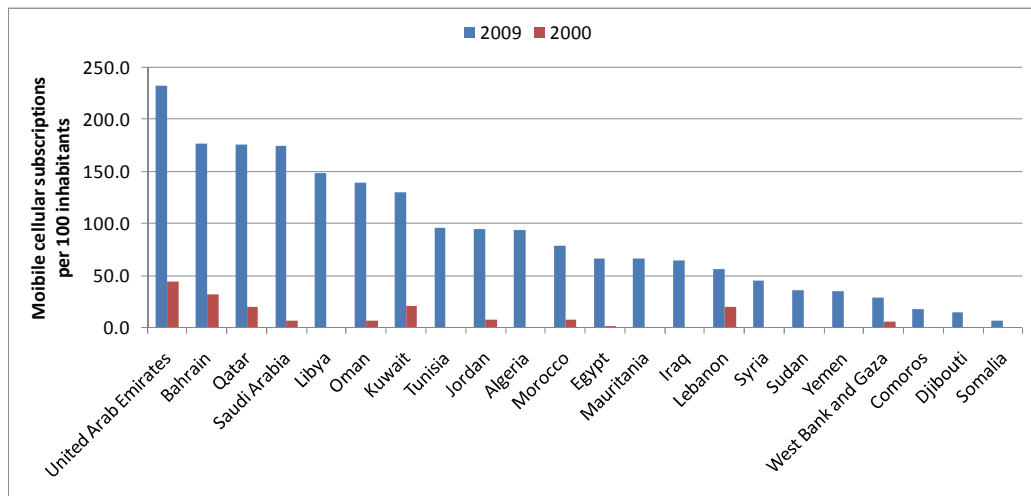
4.4.2 Relationships between ICT diffusion and economic development over time

This section examines how ICT diffusion and economic development evolve over time. Previously, in Section 4.3, we illustrated the strong relationships between five pairs of indicators (including fixed Internet subscriptions and GNI; fixed Internet subscriptions and openness; mobile broadband subscriptions and GNI; mobile cellular subscriptions and GNI; and mobile cellular subscriptions and openness). A logical next step would be to examine these five pairs of indicators further. However, because of data limitations, we are here only able to look at two:

- Fixed Internet subscriptions and GNI
- Mobile broadband subscriptions and GNI.

Fixed Internet subscriptions and GNI

In Figure 4-12, we show the relationships between fixed Internet subscriptions and GNI over time. The horizontal axis represents GNI, while the vertical axis represents fixed Internet subscriptions per 100 inhabitants. The data points on the series present time (with the earliest year on the left). The time periods covered are given in the key (it varies by country depending on data availability). Available data only support analysis of five countries (Bahrain, Kuwait, Oman, Saudi Arabia and the UAE).

Figure 4-12: Relationships between fixed Internet subscriptions and GNI
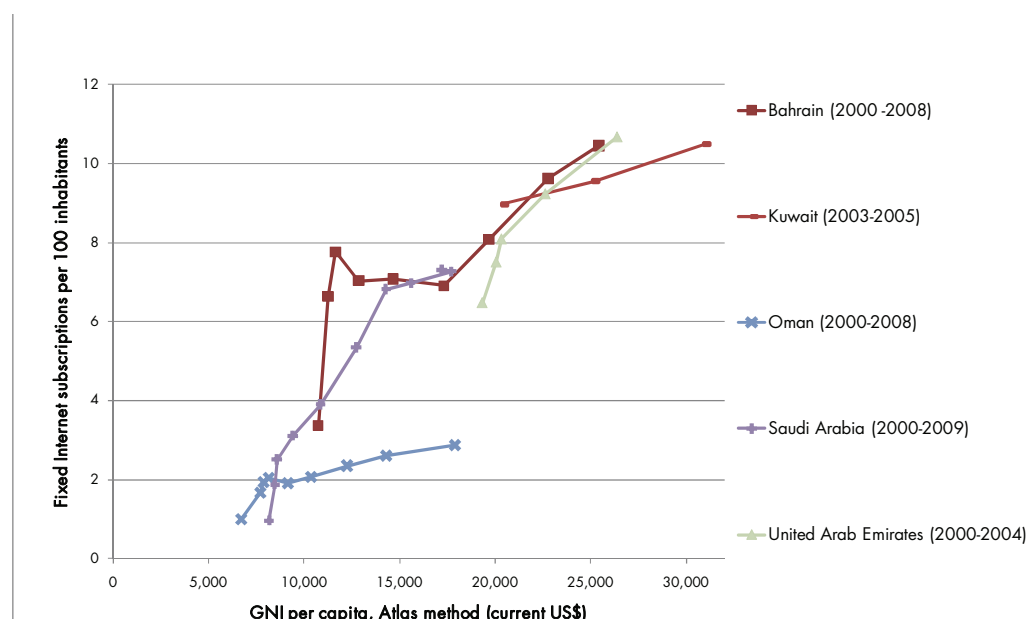
Let us first look at Bahrain, which appears to have gone through three phases. Between 2000 and 2002, fixed Internet subscriptions per 100 inhabitants increased rapidly while GNI increased only modestly. The slope of this segment of the curve indicates an increase of US$1000 GNI was associated with an increase of five fixed Internet subscriptions per 100 inhabitants. In the time period that followed (2003–2005), the penetration of fixed Internet subscriptions stagnated while GNI continued to grow. Then, in 2005–2008, fixed Internet subscriptions per 100 inhabitants increased steadily with GNI (a *c.* US$1000 increase in GNI was associated with a *c.* 0.4 increase in fixed Internet subscriptions per 100 inhabitants).

Similar to Bahrain, Saudi Arabia went through three phases. Between 2000 and 2002, there was a period of rapid increase in fixed Internet subscriptions per 100 inhabitants associated with only modest GNI increase. But, unlike Bahrain, fixed Internet penetration did not stagnate in the next period (2002–2006). The rate slowed down only slightly (so that a US$1000 increase in GNI was associated with a *c.* 0.7 increase in fixed Internet subscriptions per 100 inhabitants). Furthermore, in the third period (2006–2009), the rate of penetration became even slower, so that a US$1000 increase in GNI was associated with a *c.* 0.2 increase in fixed Internet subscriptions per 100 inhabitants.

The UAE also went through an initial period (2000–2002) during which fixed Internet subscriptions per 100 inhabitants increased rapidly while GNI increased only modestly. After that, the UAE in 2002–2004 followed a pathway that was almost identical to Bahrain in 2005–2008 (i.e. a US$1000 increase in GNI was associated with a *c.* 0.4 increase in fixed Internet subscriptions per 100 inhabitants). GNI data beyond 2004 were not available, so further analysis was not possible.

For Oman, 2000–2003 was a period of relatively fast growth in fixed Internet subscriptions, coupled with a modest growth in GNI (a US$1000 increase in GNI was associated with a *c.* 0.7 increase in fixed Internet subscriptions per 100 inhabitants).

However, from 2004, the rate greatly slowed, so that a US$1000 increase in GNI was associated with a *c*. 0.1 increase in fixed Internet subscriptions per 100 inhabitants.

For Kuwait, we only have data on fixed Internet subscriptions for the brief period between 2003 and 2005. During this time, fixed Internet subscriptions per 100 inhabitants rose slowly while GNI grew substantially. A *c*. US$1000 increase in GNI was associated with only a 0.1 increase in fixed Internet subscriptions per 100 inhabitants.

The analysis above reveals a common trait among all the countries examined (with the exception of Kuwait where data for 2000–2002 were not available): they all experienced a period of rapid diffusion of fixed Internet subscriptions initially. This period typically lasted for two years.

Mobile cellular subscriptions and GNI

In the next figure (Figure 4-13), we replace the vertical axis in Figure 4-12 with a different ICT diffusion indicator, mobile cellular subscriptions per 100 inhabitants. The countries analysed are the same as before, but the time periods covered are slightly different (see key).

Figure 4-13: Relationships between mobile cellular subscriptions and GNI
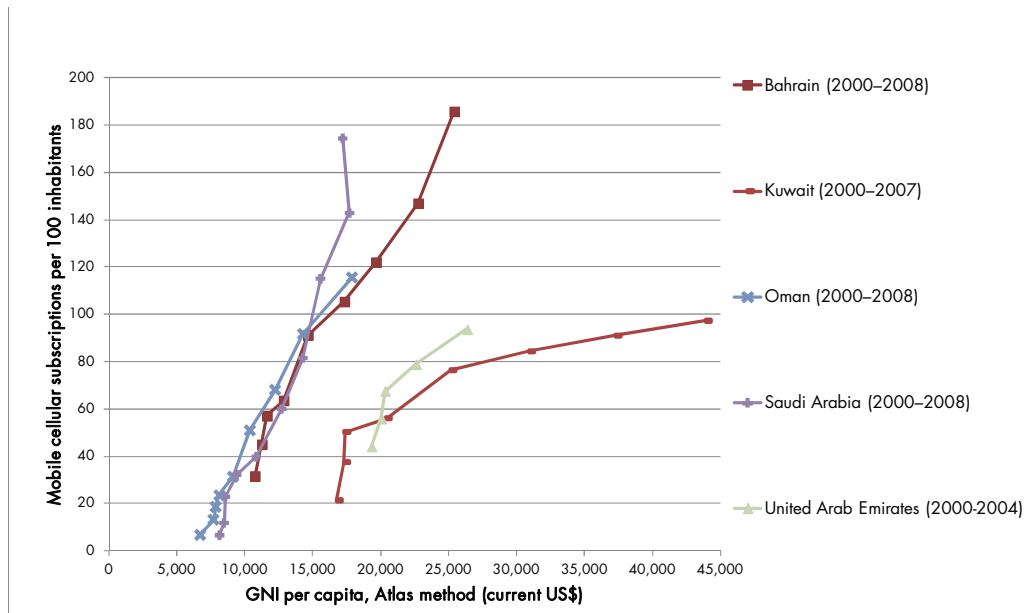
The data illustrated in Figure 4-13 suggest that the five countries can be divided into two groups. The first group comprises Saudi Arabia, Oman and Bahrain, and here the relationship between mobile cellular subscriptions and GNI is more or less constant over time. In the second group, comprising Kuwait and the UAE, the relationship goes through distinct phases.

Saudi Arabia, Oman and Bahrain share similar pathways. Over the whole period where data were available, an increase of US$1000 in GNI was associated with an increase of approximately fifteen, ten and nine in mobile cellular subscriptions per 100 inhabitants respectively.

On the other hand, the UAE appears to have gone through two phases. Between 2000 and 2002, rapid increases in mobile cellular subscriptions per 100 inhabitants were coupled

with only small increases in GNI (an increase of twenty-three mobile cellular subscriptions per 100 inhabitants was associated with a increase of US$1000 in GNI). Between 2002 and 2004, the rate of mobile cellular penetration slowed down, so that an increase of approximately four mobile cellular subscriptions per 100 inhabitants was associated with a increase of US$1000 in GNI.

In Kuwait, 2000–2002 was also a period of rapid increases in mobile cellular penetration linked with small increases in GNI (notably, an increase of fifty-two mobile cellular subscriptions per 100 inhabitants was associated with a increase of US$1000 in GNI). Then in 2002–2004, the rate dropped greatly so that an increase of three mobile cellular subscriptions per 100 inhabitants was associated with an increase of US$1000 in GNI. In the period that followed (2004-2007), the rate dropped further so that an increase of one mobile cellular subscription per 100 inhabitants was associated with an increase of US$1000 in GNI.

The analyses in the current section provide detailed descriptions of how the relationships between ICT diffusion and economic development evolve over time, the different developmental phases, and potential country groupings. Such understanding can be used to help generate or validate hypotheses in future research about the causal relationship between ICT diffusion and economic development.

4.4.3 Relationship between ICTs and employment over time

This section provides an overview of some studies in order to facilitate a specific discussion the World Bank may wish to have about how ICTs impact on employment. It is intended as an entry point into a broad literature, and does not attempt to summarise the papers cited, but instead uses them to draw out some key conceptual issues.

Skill-biased technical change

The relationship between ICTs and employment is complex, and straightforward views of ICT as a process of automation and job destruction is equally naive to seeing ICT only as a source of new employment. Nevertheless, there is a pervasive view that ICTs have a tendency to displace unskilled workers for skilled workers, and are therefore representative of '*skill-biased technical change*' (Autor *et al.*, 1998).

Skill-biased technology is thought to increase the demand for more skilled workers, exacerbating wage differentials between skilled and unskilled workers (Autor *et al.*, 1998), and triggering organisational and production process changes (Bresnahan *et al.*, 2002). It seems a reasonable explanation for the widely agreed empirical finding in the economic history literature that notes a long-term increase in the number of skilled workers (Beniger, 1986; Goldin & Katz, 1998; Von Tunzelmann & Anderson, 1998).

Rejecting skill-biased technical change

There is an alternative view that emphasises that technologies have a differentiated effect throughout the economy across sectors (Pavitt, 1984) and across firms (Nelson, 1991); so technology's impact on employment depends on a number of sector and firm characteristics. For example, firms that have a pre-existing knowledgable and skilled workforce are in a better position to extract the most and uptake the best from new technological opportunities. Whilst new hardware acquisition and new fixed investments

are a first step towards productivity gains, this school of thought makes the more normative claim that they should be *preceeded* by an intense process of training and re-organisation (Freeman & Soete, 1990).

It is possible that upskilling may be due to organisational changes that precede the introduction of new technologies. Such organisational changes may require greater decentralisation of responsibility, and greater ability to handle information, communicate and interact with other people. This is not so much skill-biased technical change as it is skill-biased organisational change (Caroli & Van Reenen, 2001; Piva *et al.*, 2005; Giuri *et al.*, 2008).

Innovation and employment

More fundamentally, the emphasis on labour-saving automation tends to overshadow the development of new products and services. The role of skilled labour in appreciating technological opportunities, developing new tailored technologies, and adapting them to local contexts, contrasts with notions of sweeping away low-skilled labour and requiring high skilled labour to operate the new technologies. It becomes clear, then, that firm strategy, as well as sectoral and technological conditions, can affect a firm's employment needs and uses (Vivarelli *et al.*, 1996).

Striving to implement labour-saving process innovations and developing new products and services are different goals but they can be blurred. This approach contrasts with the skill-biased technological approach because it means that ICTs are characterised by intangible-capital-deepening and are typified by a tangible-capital-saving bias. This means changes in labour composition may be easily noticed and may even be referred to as a skill bias, but it is the gradual increase in the knowledge base that may have the greater legacy for the economy (David, 1990, 1994) through a broader set of indirect and perverse effects.

Establishing causality in an interdependent innovation system

The skills alluded to in the term 'skilled labour' are not necessarily formed within the confines of a single institution. Training courses, employment and even day-to-day life offer opportunities to build up these skills. This is why an innovation systems perspective on ICTs and employment is particularly useful (Lundvall, 1992; Freeman, 2008).

Such a perspective allows us to consider the relative position and importance of intangible investments in technological learning activities in a variety of institutions (firms, universities, schools, governments) and make links among them. Attention to capabilities and incentives that create and exploit knowledge or human capital allow for endogenous growth (positive feedback) processes that broaden and deepen the impacts of ICTs.

But firms and individuals that are not linked up to the innovation system may be locked out of the efficiency gains associated with ICTs. More significantly, they will not be able to participate and engage in the learning activities associated with new and more efficient uses of ICTs. Large parts of the labour force can become excluded.

So there is a directionality problem that is reflected in the differing schools of thought. Do technologies cause organisational change, and create demand for skilled labour? Or do skilled labour and organisational changes allow new technologies to diffuse and take hold in the economy? There are, of course, co-dependent relationships in any system, and untangling these requires multiple forms of measurements.

Interpreting Figures 3-2 and 3-3 and developing new measures to explain ICT employment

A similar question hangs over any interpretation that might be offered for the scatter plots we present in Figures 3-2 and 3-3. Whilst plotting Internet users against ccTLDs[24] yields a strong correlation (0.8), which is even higher if we exclude countries with less than 40 percent Internet users, it remains unclear as to which is causing which. Local content may be driving more people to become Internet users; alternatively increases in Internet users may be driving the creation of new local content. Further measures and indicators are needed before an explanation can be put forward.

In this vein, the OECD has made progress in defining and developing measures of ICT diffusion throughout the economy (OECDa, 2004, 2005). It recognises that ICTs embed themselves throughout the economy and affect it in indirect and perverse ways by making three major distinctions. First it makes a distinction between personnel in the ICT sector, and ICT personnel across all sectors; second, it distinguishes between different types of ICT personnel and users; and third, it identifies particular kinds of ICT skills that are valuable. Developing ways of measuring these is a challenge it takes up.

The OECD distinguishes ICT employment into two categories: employment in industries traditionally referred to as the ICT sector, and employment in occupations that use ICTs to varying degrees but across all industries. It breaks personnel down into: ICT specialists, for whom ICTs constitute the main part of their job; advanced users, for whom ICTs are not the main job but a key tool; and basic users, who are competent users of generic ICT tools. Additionally, it identifies e-business skills as playing an increasingly important role in exploiting ICTs and aligning company strategy and competitiveness (OECD, 2004a, 2005).

Summary

This section has shown that literature relevant to the discussion of ICT impact on employment can be categorised as part of the 'skill-biased technical change' school, or the 'skills as a pre-condition for new technology' school. Other bodies of work include the 'skill-biased organisational change' school, which relates to how easily new technologies are adopted, and the school that emphasises how closely skilled adoption (uptake) and skilled adaptation (innovation) are intertwined. A perspective that emphasises how such skills are accumulated across a system of institutions has been highlighted. Finally, difficulties in interpreting some of the figures presented are suggested to reflect the ongoing debates in the literature about causality and directionality. Some measures and indicators, principally developed by the OECD, can help resolve empirical questions.

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[24] Country code Top-Level Domains are a proxy for local Internet content

CHAPTER 5   **Social media and political change in MENA countries**

This chapter is intended to be an exploratory analysis, raising questions that may be used to guide further investigations into the impacts of social media.

5.1   Learning from MENA countries' recent social and political experiences

As the extraordinary recent social and political events in several MENA countries unfolded, there were many voices attributing the changes to ICTs, and to the increasing popularity of social networking sites such as Twitter and Facebook. As reporting of the events continued, some commentators doubted that significant political change would come about,[25] whilst others were referring to 'Twitter revolutions',[26] suggesting that new technology is evidently making group action much easier to take (Shirky, 2009). However, the actual evidence base on the relationship between ICTs, social networking and these specific political movements is far from complete (see Box 5-1).

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[25] 'I don't expect these protests to bring down any regimes', in *Obama's 'Arab Spring'?*, posting by M. Lynch, 6 January 2011. As of 5 October 2011:
http://lynch.foreignpolicy.com/posts/2011/01/06/obamas_arab_spring

[26] *Social media played role in facilitating Arab Spring*. Article by A. Al Lawati, *Gulf News*, 18 May 2011. As of 5 October 2011:
http://gulfnews.com/mobile/news/gulf/uae/social-media-played-role-in-facilitating-arab-spring-1.809266

Box 5-1: The rise of social networking sites in the MENA region

This box illustrates two problems with the idea that social networking triggers political change. First, the Arab region saw lots of people signing up to social networking *during* the protests. Second, penetration rates *differed* across countries where incumbent leaders were toppled.

In April 2011, the Arab region had 27.7 million Facebook users and 6.5 million Twitter users (ASMR, 2011). That may not be a very large proportion of worldwide users (677 million Facebook users; 200 million Twitter users), but, importantly, the region saw rapid growth (30 percent increase) in the number of new users in the first quarter of 2011, doubling its user base from the same time the previous year (ASMR, 2011). The rapid growth in social media sign up during the protests also suggests that the social and political change went hand in hand rather than one occurring before the other. And whilst incumbent leaders were toppled in both Tunisia and Egypt, the two countries differed significantly in their Facebook penetration rates with the former at 18.8 percent and the latter at only 5.5 percent (ASMR, 2011). In Bahrain, 59 percent were following the protests using Facebook according to a YouGov poll,[27] but the incumbent remains in office.

Whilst it may be easy to associate changes in the MENA region with social media, it remains difficult to ascertain causality, and harder still to develop an evidence base for interventions or to evaluate the potential contribution of social media growth to societal, economic and political change.

What sort of questions should we be asking when thinking about social and political impact? One needs an understanding of the extent to which the importance of social media derives simply from the information flowing through them (as compared to human contact, economic and political transactions, and a 'public space' platform for recognising common interests, developing a collective consciousness and receiving the reassurance of critical mass that leads from thought to action). Therefore, we should consider what makes information disseminated via social media valuable and when. We know that ICTs have affected our lives as individuals, but how has improved information flow affected us as social and political groups? What constitutes improved information flow? Is more information simply better, is social network information more trustworthy (or at least trusted), or is a diversity of views preferable to common access to official information?

Recent experiences in MENA countries offer us new insights into these questions. This chapter interprets recent events reported in contemporary and grey literature in terms suggested by the scholarly literature in order to draw lessons about the sort of socio-

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[27] YouGov Siraj Survey, n=594, 24 February – 7 March 2011. This makes Facebook the third most popular source of information overall (behind international media and local media) and the second most popular among 18–29 year olds, females, wealthier citizens and native Bahrainis. As of 5 October 2011: https://surveyfiles.yougov.com/static/YGS_Bahrain_Poll_Tables.pdf

political impacts that can be expected from ICTs in general. It also draws on primary experience from an activist in the region to develop a personal vignette.

The chapter adopts the premise that quantity of information is not the same as quality of information and that there is a need to analyse the determinants of high-quality information. The chapter aims to develop a way of understanding the socio-political impacts of ICTs, moving towards a sound basis on which interventions can be made.

5.2   Information generation, dissemination and use

The next two sections draw from MENA experiences to discuss two qualities of information generation and use: *authenticity* and *relative value*. On the one hand, information can be true or false; in order to be useful, it may need verification or at least validation. On the other hand, information can have different meaning or value to different people, and such clear-cut verification is not always possible. In such cases, *editors* play important skilled roles in selecting and emphasising certain information for dissemination. These features of authenticity and relative value of information, mediated by editors, seem important for understanding how proliferating social media are related to political change in the MENA context.

5.2.1   Authenticity of information production and dissemination
The link between social media and political change is complicated by introducing the notion that information can have varying degrees of authenticity.

As events unfolded, a few newspaper outlets (such as the *New York Times*) noted how difficult it was to corroborate mobile phone video footage and other information from blogs and networking sites (such as Twitter and Facebook). Most newspapers did not bother to include caveats, perhaps subscribing to – and certainly reinforcing – the view that information coming from established channels and institutions in those countries was so riddled with political propaganda that information coming from anywhere else was likely to be more authentic.[28] International audiences found themselves receiving information from individuals offering rebellious accounts of their plight through shaky phone footage and gritty blogs.[29] All the while, the implicit suggestion from international newspapers was that these sources should be believed and reported more.

But the sources were not wholly reliable. Recently, a prominent blogger thought to be a 25-year-old Syrian 'gay girl' – whose experiences of life in Damascus were reported widely by institutions such as the BBC – turned out to be an American man writing as a fictitious

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[28] *Doctored Photo Flatters Egyptian President.* Article by R. Mackey, New York Times, 16 September 2010. As of 5 October 2011:
http://thelede.blogs.nytimes.com/2010/09/16/doctored-photo-flatters-egyptian-president/

[29] Cellphones Become the World's Eyes and Ears on Protests. Article by J. Preston & B. Stelter, New York Times, 19 February 2011. As of 5 October 2011:
http://www.nytimes.com/2011/02/19/world/middleeast/19video.html

character.[30] The hoax raises difficult questions about the reliance on blogs, tweets and Facebook postings. Journalists are becoming acutely aware of the problems of drawing on social media as information sources, with one journalist from *Foreign Policy* magazine referring to Twitter as little more than a high-tech rumour mill.[31]

One implication is that appreciation of the context of social media information is important in understanding its role. For example, if the information generator is a trusted source or if the information has gone through some sort of verification process, or if it corroborates other sources too, are all questions about the context that is likely to have had an impact on authenticity. These can be overlooked when social media are seen as platforms that anyone can join.

There is also an important interaction between newer social media and more traditional media, which can provide verification. If one sees a rumour, and asks if it can be true, one is likely to search for the rumour in traditional media to see if it has been picked up by organisations such as the BBC or Reuters. This is why the skills and expertise of journalists are significant. When normal journalistic and editorial criteria are suspended, traditional media may – thanks to their wide reach and trusted status – accelerate the propagation and 'validation' of rumour.

The contribution of professional journalism was not limited to 'fact-checking'. Personal testimony and mobile phone images and video were exposed not only through social media, but transformed and interpreted by the expertise and knowledge of trained journalists who would use this evidence to produce (often) balanced and high-quality accounts that explained the meaning, implications and limitations of the evidence in both local and wider contexts. Whilst some of such journalistic expertise is garnered through professional practice and training, much is acquired within local contexts (Darnton, 1975). It remains the role of the journalist to refine information and make it newsworthy. Editors focus attention in a world over-supplied with information, and as the tools to generate and disseminate information become more powerful, so too will editorial decisions over which information to prioritise and expose.

Given their increasingly important role in accrediting personal testimony, it was perhaps not surprising that international journalists were amongst the first groups to be targeted by Egyptian authorities. Journalists were harassed, beaten, abused and had their equipment confiscated; international journalists were barred from Egypt altogether.[32] This may have encouraged more people turn to social media to acquire reliable – or at least timely – information, which is consistent with the increasing sign-up rates.

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[30] *Syria Gay Girl in Damascus blog a hoax by US man. BBC News*, 13 June 2011. As of 5 October 2011:
http://www.bbc.co.uk/news/world-middle-east-13744980
Activists slam Syria 'Gay Girl' blog hoax. Article by S. Ambrogi, *Reuters*, 13 June 2011. As of 5 October 2011:
http://www.reuters.com/article/2011/06/13/us-britain-syria-hoax-idUSTRE75C2AZ20110613
[31] *My Year @ TwitterBay.* Posting by C. Lynch, *Foreign Policy*, 11 February 2011. As of 5 October 2011:
http://www.foreignpolicy.com/articles/2011/02/10/my_year_twitterbay

[32] *Journalists in Egypt Protests Targeted, Beaten, and Detained.* Article by K. Stoeffel, *New York Observer*, 28 January 2011. As of 5 October 2011:
http://www.observer.com/2011/media/journalists-egypt-protests-targeted-beaten-and-detained

Selected bloggers had become preferred channels for certain topics as well, but again, the following they had accumulated relied on them continuing to provide trusted and authentic information. Distinctions between journalist and blogger, and between traditional and social media may have been blurred; both became important editors of information and knowledge in different situations. Such hybridisation suggests that the contributions of social media to political change were more complex than simply everyone being able to have a say at the same time.

5.2.2 Relative value in information use

One might be tempted to see the issue only in terms of the establishment of accuracy and truth. But the 'gay girl' hoax also highlights the importance of the relative quality of information. Information from blogs, tweets and postings may not have been easily verifiable, but was deemed more newsworthy than the established sources precisely *because* these new sources of information did not have state endorsement. Once established sources are discredited, other information – however limited in authenticity and quantity – becomes valued. Information use depends on what other sources are available to the user.

International consumers of the information had little to relate to in terms of daily life in MENA countries and what it might mean to want to bring about such uprisings. What might it feel like to be a Tunisian street vendor and why might you want to self-immolate? Of course, news of such a protest may help international audiences connect on the basis of some universal human experiences. But other connections will not be made. The specific interpretation of martyrdom may differ across cultures. And initial reactions to the news may differ according to localised and accumulated experience (See Box 5-2 below). To other vendors, news of this act may have invoked memories of extortion and brutality by authorities. So, information use also depends on what background knowledge and experiences the user can relate the information to in order to make sense of it (Nightingale, 2003). This will in turn affect the user's ability to appreciate and anticipate events, and their willingness to become involved.

Box 5-2: Background knowledge matters

The usefulness of Wikipedia to expert and experienced users may not go beyond showing how others view a familiar topic; but Wikipedia may be hugely influential in providing initial insights or shaping prior beliefs on topics where the user is uninitiated.[33]

There can be little doubt that such user generated and lightly edited content can have powerful effects on social and political groups. Consider who might have contributed to the Wikipedia page for the former Egyptian President Hosni Mubarak, and who might have been reading it. Is it plausible to imagine that more people outside of Egypt have read it than inside of Egypt, where people may already be very familiar with Mubarak? The mediation of information and knowledge in the hands of the experienced, the familiar and the expert may well be economically useful, but the relationship between how the uninitiated see the information generated by the knowledgeable could be a growing factor shaping democracy and politics.

5.2.3   **Exploring events in Tunisia and Egypt: authenticity, relative value and hybrid media**
Two aspects of information quality emerge from the sections above. First, *authenticity* is not only a function of quantity and accuracy but also reflects the social and political processes by which information was generated and deemed worthy of dissemination. Second, information consumption and use depends on its *relative* quality, in the sense that its value is contingent on user's other information, knowledge and experience. These notions of authenticity of production and dissemination and relative value of use are used below to explore recent events in Tunisia and Egypt in Box 5-3 and Box 5-4.

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[33] Wikipedia faces issues of authentication (for example Sarah Palin's page was completely rewritten by an anonymous contributor the day before she was announced as US Vice Presidential Candidate), and faces issues relating to its contributors' backgrounds and experience (the average Wikipedia contributor is a North American male in his twenties, and tends to contribute to topics such as cars more readily than on topics such as jewellery). But it is the relationship between highly accessible content and expert contributions that may be more significant. The extent to which the economy values specialised knowledge, in an Adam Smith sense, suggests that the economic value of Wikipedia and perhaps information on social media more generally, has its limits with respect to transforming economies.

Box 5-3: Social media in arenas of political extremes

Information gathered in social media may suffer from problems of authenticity and relative value because its assimilation and quality is not governed by centralised coordinating institutions. But the conditions in Egypt may have been so polarised, and distrust in government and for official information so widespread, that this was less significant than the ability of social media to generate information in large quantities and disseminate it quickly.[34]

Social media may have allowed a new political voice to emerge in Egypt. Egypt was characterised by two extreme political ideologies represented by the Mubarak regime and the Muslim Brotherhood. Those who may have wanted to reject both options were allowed a platform to express an alternative. In this sense, social media may have allowed a middle ground to emerge (Haggard & Webb, 1993).[35] This 'middle' coalesced and developed despite the lack of coordinating institutions, but when the extremes are so wide, authenticity, relative value and coordination were less significant as barriers; under these conditions social media came to the fore. In political vacuums, people may be able to find agreement in their dissatisfaction with the political options being offered to them in quick, easily codifiable, short, messages (perhaps even in 140 characters or less, as Twitter requires).[36]

In short, is it possible that there was enough room (within the political landscape) for people with diverse views to find common ground on social media and unite against the political extremes being offered to them?[37]

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[34] See also Alberts et al. (2001) and Keohane & Nye Jr (1998)

[35] It would be interesting to have data on whether social media traffic tended towards a middle way, crowding out extremes. Also, it would be useful to have evidence of the extent to which 'willingness to act' depended more on common belief than on common knowledge. See Harlow & Harp (2011) and Cardoso & Lamy (2011)

[36] It is notable that the alternative did not need a high degree of specification given the state of wide disaffection and that the Muslim Brotherhood abstained from the movement

[37] See Ottaway & Hamzawy (2011)

Box 5-4: Social Media as a tool to spark or quash revolution?

The Facebook page set up by Google's Head of Marketing in MENA countries, Wael Ghonim, provided a focal point for a range of views, and was a site where anti-government protestors could find sufficient agreement with each other to act. Ghonim emphasised the lack of coordination, 'What you don't understand, and it seems what you don't want to understand, is that this protest doesn't have real organizers. It's a protest without a leader.'[38]

But the very same social media being used to try and topple incumbents can of course be used by the incumbent regimes to find, round up and suppress potential revolutionaries. They can be highly specified actions (targeting individuals for rendition, for example) or vast sweeping measures (broad censorship). In Egypt, there were both: Wael Ghonim was promptly arrested; and the authorities shut down Internet access throughout the country (Hassanpour, 2011).[39] In Tunisia there were also both: its government 'aggressively' censored the Internet by blocking political and social media websites (such as the video sharing service Dailymotion); and it hacked into activists' Gmail and Facebook accounts to identify protestors, monitor their plans and make targeted arrests.[40]

The suggestion that social media and traditional media are converging is a persuasive one when the hybridisation is seen to pay attention to notions of authenticity and relative value as discussed above. In the MENA region, Al-Jazeera offered unparalleled coverage in terms of detail and constancy but was also seen as a reputable and credible source for many.[41] How did it do this?

Al-Jazeera had 'intense social media training' that involves drawing upon a trusted network of volunteers (who go through an elaborate vetting process) to establish authenticity of its information. Al-Jazeera was also well positioned to interpret the context of the information and make relative value judgements about which information editors should select. It is possible that Al-Jazeera English could have been more sympathetic to the uprisings by giving more time to new players and providing them with a platform; and Al-Jazeera Arabic could have been more reserved in its coverage.[42] However, if Al-Jazeera veered too far from its audience, it could lose credibility as was the case with Al-Hurra, a US-funded media organisation widely seen as little more than US propaganda. Given that new hybrid

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[38] *The Facebook Freedom Fighter. Newsweek*, 13 February 2011). As of 5 October 2011:
http://www.thedailybeast.com/newsweek/2011/02/13/the-facebook-freedom-fighter.html

[39] *How Egypt shut down the internet.* Article by C. Williams, *The Daily Telegraph*, 28 January 2011. As of 5 October 2011:
http://www.telegraph.co.uk/news/worldnews/africaandindianocean/egypt/8288163/How-Egypt-shut-down-the-internet.html

[40] *The First Twitter Revolution?* Article by E. Zuckerman, *Foreign Policy*, 14 January 2011. As of 5 October 2011:
http://www.foreignpolicy.com/articles/2011/01/14/the_first_twitter_revolution

[41] *Social media: The people formerly known as the audience. The Economist*, 7 July 2011. As of 5 October 2011:
http://www.economist.com/node/18904124

[42] *Bahrain's Voiceless.* Article by A. Baker, *Time*, 24 May 2011. As of 5 October 2011:
http://globalspin.blogs.time.com/2011/05/24/bahrains-voiceless-how-al-jazeeras-coverage-of-the-arab-spring-is-uneven/

forms may be emerging that remain authentic and provide relative value, not just in the MENA region but also in other regions (see, for example, the Huffington Post[43]), is there a case for suggesting that technology, media and socio-political shifts are in constant co-evolution?

5.3 Polity and information systems in evolution

Are these notions of authenticity of production and dissemination and relative value of use particular to the Internet-enabled ICTs of today? Or have they always been around and are there more evolutionary qualities of information that can be highlighted in the recent MENA events?

It might seem odd to ask if there are lessons from history when considering such profoundly contemporary technologies as the Internet, social media and mobile phones. But not all issues relating to the impact of ICTs are new, and what appeared before might be used to guide us today.

It seems obvious – but necessary – to note that revolutions happened before modern social media emerged. Revolutionaries and oppressive regimes will use the tools of their time, be it smoke signals, wax tablets, pamphlets (Marx and Engels' manifesto is only a few pages long), videos, or social media. Uprisings occurred in Libya recently despite that country having extremely low ICT penetration rates.[44] Some of the fascination with social media in revolutions may fade, as it did before with the role of the telegraph in the 1917 Bolshevik revolt, the tape recorder in the 1979 Iranian revolt, and the fax machine and television in the 1989 Iranian revolt.[45]

It is possible that contemporary ICTs that may be intensifying existing mechanisms and accelerating established processes. They may be triggering the formation of certain communities faster, broadening the platform communication among peers; producing societal resonance that helps to clarify or harden public opinion and to trigger action (by reassuring people that they are not alone), and so forth. This is akin to Marx's view of the factory as a 'public space' where workers could recognise their common plight, develop class consciousness and foment revolutionary change. But have modern ICTs enlarged the factory floor to form a larger virtual public space?

Which elements of change are revolutionary and which are evolutionary? We address this with the help of Box 5-5, which describes an example of political influence on (rather than through) social media, and Box 5-6 and Box 5-7, which explore previous information eras to draw out more lasting features of the relationship between information technology and social change.

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[43] *The end of mass media: Coming full circle. The Economist*, 7 July 2011. As of 5 October 2011: http://www.economist.com/node/18904158

[44] INSEAD & World Economic Forum (2011)

[45] *Facebook and Twitter are just places revolutionaries go*. Article by E. Morozov, *The Guardian*, 7 March 2011. As of 5 October 2011: http://www.guardian.co.uk/commentisfree/2011/mar/07/facebook-twitter-revolutionaries-cyber-utopians

Box 5-5: Twitter and the Iranian elections

After the contested Iranian presidential election in June 2009, Iranians blogged and posted to Facebook and Twitter. Twitter users sent tweets – short text messages – marked with the '#IranElection' hashtag (i.e. labelled as being about the Iran election) at a rate of about thirty new tweets a minute in the days immediately following the election. Trends in swearing showed that in the initial weeks after the election, people used more profanity when tweeting about Ahmadinejad than about leading opposition candidate Mousavi, indicating shared anger and frustration at the result.[46]

But social networking sites are not only platforms for expressing political sentiment. They can be subject to overt political intervention.

In June 2009, while many Iranians were mobilising to protest against the disputed results of the presidential election, a US State Department official sent an email to Twitter stating the Obama administration's view that Twitter was playing a crucial role in Iran as a way for protesters to communicate. It persuaded the social networking site to delay routine maintenance work planned for the following day that would have brought down all its feeds in Iran and possibly disrupted the organisation of the protests. Twitter complied, allowing tweets to continue uninterrupted and the demonstrations to grow.

The exchange shows that social media are not immune from political influence. It may have convinced the Iranian leadership and other regimes around the world, that corporations dominating the Internet are in collaboration with the US government and are therefore an extension of international politics by new means.

In this instance, it appears Twitter did not effectively catalyse the self-organisation of groups capable of obvious political impact. In fact, swearing patterns started to cross over from Ahmadinejad to the leading opposition candidate Mousavi, suggesting that when the opposition movement flagged in February 2010, Twitter users felt angrier at Mousavi than Ahmadinejad.[46]

For understanding the role of modern ICTs in recent political upheavals, the differences in information brought about by the emergence of coffeehouses in 17th-century England (see Box 5-6 below) suggest an important set of questions. New technologies and forms can change the profile of participants. Coffeehouses changed the mix of people who engaged in information exchange. With the advent of contemporary ICTs, who had *access* to them? The information gleaned in coffeehouses may have been different to that of alehouses; but did it still constitute no more than mere *gossip*? And is this all that can be said of chat rooms and social networking sites? If gossip is important, what percentage of information in an organisation is gossip and rumour?

To what extent are the impacts of ICTs attributable to the exchange of content? Many of the messages exchanged on the Internet are repetitive and contain no new information; they may contain meta-information, facilitating the transition to common knowledge, but are often symbolic speech and human or societal contact intended to build trust or

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[46] Elson *et al.* (2011)

facilitate coordinated action (or transactions). From this perspective, gossip and rumour are at least as potent as the flow of accurate information. The challenge – particularly for outsiders attempting to facilitate development – is to participate in and ultimately engage with the groups thus formed, rather than to 'inform' them.

Potential revolutionaries in coffeehouses and Facebook alike may have found that information being *vouched for* by their friends was more effective, reliable and valuable than information spread by a no less illicit but more anonymous leaflet. Such dissemination methods may have allowed new networks to form layered on top of other existing social networks – be they online or offline; they may create new linkages and thus trigger further social change. The kind of information conveyed by text messaging or instant messaging is likely to be qualitatively different to information disseminated in person in a coffeehouse or alehouse, and is therefore likely to have systematic relationship with *geography* and distance.

Whilst it may not be necessary to elaborate on the differing nature of the drugs involved in coffeehouses and alehouses (caffeine and alcohol), it does, however, suggest that we ought to question whether ICTs affect the way we think and behave.[47] Do online chat rooms make us more *extreme*? Where a vast array of information is available do we hear and read only the information we want? There may be an effect where we are increasingly able to *select information* and seek out only opinions that are congruent with our own (Sunstein, 2002). Or in the absence of complete knowledge, there may be a *cascading or amplifying effect* where we are willing to believe what others believe (where those others also do not have complete knowledge) (Sunstein, 2001). These behaviours may differ systematically in contemporary ICTs to previous ones, and are likely to have had important influences on how recent political events have unfolded.

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[47] *Is Google Making Us Stupid?* Article by N. Carr, *The Atlantic*, July/August 2008. As of 5 October 2011: http://www.theatlantic.com/magazine/archive/2008/07/is-google-making-us-stupid/6868/

Box 5-6: Information exchange in coffeehouses and alehouses

The emergence of coffeehouses in 17th-century England provided people with an alternative to alehouses (Pincus, 1995). They were both important places for information exchange, but they garnered some important similarities and differences that are pertinent for any discussion about different ICT media. One of the differences is the clientele of the different types of establishments. Women were often seen in coffeehouses, whereas they tended to be excluded from alehouses. Journalists and politicians, and upper and political classes refrained from alehouses, but sought out information in coffeehouses once they realised they harboured socially and politically important information. As the prices of coffee dropped, concomitant with increases in the price of ale, they also recognised coffeehouses as a repository of general information and a place where they could tap public opinion. Coffee masters might greet customers with 'What news have you?' or 'What news from Tripoli?' (Pincus, 1995:819). Some gossip was gleaned through overheard conversations, in which much of what was said would and could never be written, while scholars who may have retired for the day had more learned conversations. For some, coffeehouses provided a locale for spawning political radicalism and the seeding of new ideas about religiosity and the Vatican; for others they were a venue to vent or criticise extremist ideas. It is notable also that stock exchanges started life in coffeehouses and not alehouses. And lastly, there were of course differences between the effects of caffeine and alcohol, where one might be more likely to stimulate the critical faculties and the other to relieve certain inhibitions.

In the MENA region, access to (or more accurately use of) social media was not evenly distributed across the age or gender of the population. Some 70 percent of Facebook users in the Arab region are between the ages of fifteen and twenty-nine (ASMR, 2011); the proportion of female Facebook users is about one-third. This is significantly lower than the global trend, where two-thirds of users are female (ASMR, 2011). And if social media did consist only of gossip, not everybody was gossiping to the same extent. Studies have pointed out that 20,000 'elite' Twitter users generate about 50 percent of all 'tweets', and only 30-40 million of all the Twitter users are actually active (ASMR, 2011). This suggests that Twitter users are perhaps also subject to Lotka's Law (a Matthew effect in scientific publications that shows a extremely skewed distribution) (Lotka, 1926; Price, 1963). It is also possible that whilst most information is generated by a minority, the information is consumed by the majority, perhaps as a newsfeed rather than a micro-blog. So whilst there may only be a few people gossiping, many are there to listen.

The 'gossiping youth' in the MENA region are likely to be keen that their audience extends to other regions. The Anna Lindh report/Gallup poll reveals that when Southern and Eastern Mediterraneans have talked with or met Europeans, the dominant method of interaction is through the Internet (24 percent), rather than through work, tourism or living in the same neighbourhood or street. In contrast, for Europeans, only 4 percent of their interactions with Southern and Eastern Mediterraneans was through Internet chatting. The geography of Internet chatting is thus likely to be a medium in which intercultural interregional exchange is not evenly bi-directional (Anna Lindh, 2010: 46).

The account in Box 5-7 below raises some important questions and issues for deciphering not just what happened in the political upheavals of MENA countries, but how it

happened. Just as the impact of print was contingent on a base of literate and engaged set of users, the impact of ICTs are of course most directly felt by the 'computer literate'. The *skills and capabilities of the user* are therefore extremely significant in what ICTs can achieve in terms of instigating revolutions. It is perhaps not a coincidence that Wael Ghonim (referred to earlier) happened to be Google's Head of Marketing in the MENA region, suggesting he was both a competent user and a skilled professional with a set of capabilities useful for activism. This in a country where Egyptian youth unemployment is 25 percent; in Tunisia it is even greater at 30 percent.[48]

But even assuming wide access and 'computer literacy', the guardians or censors of print are at work today with modern ICTs. The content is still subject to various forms of quality checks, guardianship or censorship. Clearly *editorship* has a more (conspicuously) minor role in some websites such as Wikipedia, but the role of Google in deciding how to index and prioritise information (for example, contemporary sources seem to be prioritised over older ones) and the value it places on some sources of information over others play critical roles. For example, according to a recent Pew research poll, 20–30 percent of visitors to the websites of big news organisations come via Google's search engine or its news site, Google News.[41] State regulation can have important qualitative effects. How does the domain name affect the respectability of information on websites? And the question of how freely available some types of information should be is at the centrepiece of current debates on net neutrality. There are propositions that some types of web content should be afforded privileged bandwidth. How different are these mechanisms from the communities of print guardianship/censorship?

Box 5-7: Information flows following the invention of the printing press

There may be yet more ways to shed light on recent events if we venture further back in history. 15th-century Europe saw the development of the printing press. Many believe this technological innovation to have heralded the information revolution of its time (Eisenstein, 1980). It allowed for mechanised bookmaking and an assembly line style of mass printing. Some have even argued that as print facilitated the dissemination of information and knowledge, it helped bring about the Reformation and Scientific Revolution.

But there is a more evolutionary analysis that can be drawn out of most revolutions. In the case of print, it can be done by tracing how communities of printers, booksellers and publishers behaved in concert to act as guardians of the conversion of knowledge and thoughts into printed dissemination (Johns, 1998). This editorship of information is a key concept for exploring how certain qualities become embedded in information. A more insidious collective term for the editorship community may be regulators or even censors depending on how you view the information that was eventually printed. For example, one of the most widely disseminated types of text was religious text, and it raises the question of whether it was even possible to be an atheist before print. The editorship rarely had complete control of information, but it did make certain texts illegal or illicit, drawing in

[48] Youth unemployment: Young, jobless and looking for trouble. The (Economist, 3 February 2011) accessed 2nd August 2011. As of 5 October 2011:
http://www.economist.com/blogs/schumpeter/2011/02/youth_unemployment

other social and legal institutions. The stamp of approval by editors or the seal of reputable institutions marked printed texts and served to distinguish them for their authenticity. Even today, sometimes the mere binding of a document can provide it with an air of respectability that it did not have when it was 'naked'.[49]

The printing press may also have served to provide a more standardised print, and more fixed text, around which shared views could form (Brown & Duguid, 2002). But equally, the impact of print was relative to the user (Darnton, 2001). To begin with many people were illiterate, and for those that weren't, books were expensive and libraries were private and the preserve of the wealthy. So the contents of books needed reading out aloud by mediators if they were to be disseminated. For the literate, print was often read, written about and read again, written about again. Use of secondary and tertiary sources can be an incremental form of Chinese whispers that leads a long way from the initial source.

Books that contained vast amounts of information required writers, editors and printers to develop strategies for coping with information overload, such as indexing, chaptering, sectioning, headings and titles, fonts and so on (Blair, 2003). How these were done affected the nature of the information and how it was absorbed and understood. Readers alike had to develop techniques such as skim-reading and note-taking. Reading may have been seen as little more than an amusement at first, but it was soon to be seen as integral to intellectual activity. Even as these features of 'print culture' evolved (Porter, 2001), reading still entailed enormous interpretive flexibility so that no two pieces of identical print were read in the same way by different people. Some of this variation does not dissipate with time. For example, the underlying basis for Islam is a single universally shared book that has been sheltered from updates and linguistic translation, yet interpretive flexibility over the Qur'an remains so wide that in some Islamic countries women are able to become Prime Minister and in others they are not able to drive cars.

Print culture remains with us in ICTs (Brown & Duguid, 1991). It is unlikely to be a coincidence that Internet use still involves book-like webpages, and bookmarks. How differently would webpages be understood and appreciated if they were presented in their native HTML form? Do the domain name and organisational logos of certain websites make a difference to how information is received? Are writers learning to adapt by including search terms in their work so that it is more likely to be 'hit' in searches? The strategies for coping with information overload remain as pertinent today as they did in the print era, if not more so. The success of search engines is a direct consequence of the need to control, order and coordinate information, not simply collect and amass it. Over the last two centuries the number of jobs that involve coordinating and managing information has increased rapidly. These are distinctly evolutionary features to what is often seen as a revolutionary technology.

Whilst print may have offered greater *fixity*, online content is constantly changing. One can be more confident that a newspaper read on the same day by two people will be the same, but a website accessed twice in the same day may have changed so much that the relevant link does not even work. There is a transience to online content that can make developing a *shared identity* difficult (Sen, 2006). Added to the extraordinary ability to

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[49] Conversely, an air of piracy and illicitness can provide a document with popular notoriety

personalise incoming information with feeds about particular topics of interest, it is a puzzle that a coherent 'revolutionary' community can form at all. The puzzle deepens further when one considers how differently people read text. Or are online rooms merely echoing chambers where thoughts get shepherded into radical propositions?

The tools of communicating social and political change are likely to form only a part of a more continual (possibly long term and painstaking) process of engaging with incumbent political institutions and social reform movements (Morozov, 2011). During the recent protests many non-virtual meetings took place between cyber-activists where bloggers, techies and activists were present in person, sharing tips on how to engage in advocacy and circumvent censorship. Most of them were never publicised for security reasons, but they run contrary to the notion that the protests were organised by random people doing random things online.[45]

These networks were not purely virtual and spontaneous, and they were influenced by myriad other organisations, corporations and institutions. For example, Google brought bloggers from the MENA region to a freedom of expression conference it convened in Budapest. And Egyptian youth leaders attended a 2008 meeting in New York where they were taught to use social networking and mobile technologies, build coalitions and develop new skills; this was sponsored by the US State Department, Facebook, Columbia University and NGOs.[50] Such organisations have published guides and provided training on how to use cameras effectively.[29] The progress of these movements relies on the development of broader infrastructure set up by a network of institutions and organisations within and across MENA countries.[51] Other social networking focal points exist besides online platforms (for example Friday prayers or the souk markets). Social media may, however, connect other groups – for example the relatively wealthy, educated and economically 'important' – whose participation can transform a movement and build credibility on a global stage.

Tracing the full extent of these networks and their evolution is clearly a significant endeavour that would be beyond the scope of this section.

5.4 Perspective from the ground: Bahrain

This section asks Ala'a Shehabi,[52] an activist in the MENA region, about her use of social media and her perspectives on its role in social and political change in the area. Questions from the interviewer are in italics and the responses are those of the informant. Responses have been lightly edited to assist the reader.

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[50] *U.S. Groups Helped Nurture Arab Uprisings.* Article by R. Nixon, *New York Times*, 14 April 2011. As of 5 October 2011:
http://www.nytimes.com/2011/04/15/world/15aid.html?pagewanted=all

[51] These include a non-governmental regional network of institutions that facilitates coordination among those active in building ICT infrastructure in the Arab region: Regional Arab Information Technology Network (RAITNET); an Algerian government organisation responsible for supporting the use of ICTs, networking and promoting the use of scientific and technical information – Le Centre d'etude et de recherche sur l'information scientifique et technique (CERIST); and in Tunisia, Agence Tunisienne de l'Internet – IAM

[52] We also tried to contact Alaa Abd El Fattah at the client's request, but he was unavailable for interview

When did you first start using social media and why?

I first started using social media before they got popular. I began with email at first just to stay in touch, but then started to use it for more activist purposes in 2003, on a site called blogger.com, where I met many other bloggers, and we expressed our views on the political situation. In 2006, I started using Facebook. I only started using Twitter in March 2011. When the crackdown began on 15 March everyone was stuck at home behind their computers because of a curfew and pseudo-martial law. Many people signed up. I had had a Twitter account since 2009, I just never used it. It's an anonymous account, which has over 10,000 followers. Nobody knows I use that account, but it's amazing how many people you can disseminate information to if you can establish yourself as a credible source. I no longer manage it, and it's now run by a group of people who work on gathering and updating news. It became just too risky.

How did you establish this credibility?

[Extracts of this answer have been heavily deleted for safety]

Social media for me are about trust and surrounding yourself with people who share your views and have a good standing in that community, not just to reinforce your own views, but to be in a safe environment to discuss and exchange ideas. But of course others use it it for different purposes and agendas. So some people will be tweeting in English, posting certain kinds of photos, and you know they're trying to talk to an international audience or to the international media. Those who tweet in Arabic are talking to their group of supporters, to encourage and mobilise them towards the cause. Then there are others, who find their purpose in just attacking the other side. These are known as 'trolls'.

How did the decision get made to go for Lulu roundabout?

A community of online activists who shared solidarity with fellow bloggers seeking freedom of expression was growing. Webforums in Bahrain are popular, because they offer anonymity and you can have better discussions in a way that Twitter and Facebook do not allow. The most popular one in Bahrain is called Bahrain Online.

Immediately after Mubarak fell in Egypt, people in Bahrain decided to have a 'day of rage' and members set a date (14 February) in order to imitate the Egyptians. Someone posted on the site a discussion that was almost like a scoping study on possible sites for a protest. They wanted a 'Tahrir Square', and suggested pros and cons of various options, and posted photos from various vantage points. Lulu roundabout was voted as the best site, and most of us following this discussion thought this all unlikely to occur. It was suggested that smaller more localised protests should be staged in villages before congregating at Lulu roundabout. But in the smaller protests, people were killed, and their funerals happened to occur near the roundabout. After the funeral procession, people marched to the roundabout. I think the website allowed people to form a vision of what could happen. I was there at the funeral that day, and I definitely got a sense of a 'collective instinct' and purpose. We arrived at Lulu and to our surprise there was no security around.

The website by this stage had become closed to new members by moderators. It had been closed to new members for about a year and a half, and this allowed greater trust in the community. After the decisions were made, an anonymous group of cyberactivists set up an anonymous Facebook page to disseminate the suggested protest site and date. Before

the 14 February protest, no one dared to 'like' the Facebook page, but afterwards lots of people did.

What did you think about the things being said on the forum?

The term 'Arab awakening' suggests that everybody was dormant before, but there was a strong sense of disillusionment and it appeared that people were fed up with politics. People in fact were like a dormant volcano that only needed a trigger for a tectonic shift in society to occur. After the protests, people became more explicit, and that's why to some it may seem like an awakening. If it hadn't happened in Tunisia, and Egypt, it probably wouldn't have happened in Bahrain I think, despite its long history of democratic struggle. It needed a trigger, and then everybody wanted to be part of it. The only reason I went out on 14 February, was because my neighbour – who wears Jimmy Choo shoes and rides a chauffeur-driven Bentley – said she was going. It showed me that the sense of injustice ran very deep; it was not just about money, it was also about not having an active say in politics. My friend has since been arrested for fifty days.

How did they find her?

She spoke against the government on Al Jazeera and was charged with criminal offences because she set up a medical tent for the protestors. My husband was also arrested on account of his Facebook page and charged with 'spreading false information inciting against the regime'.

Were there inaccuracies in the reports?

I was talking to lots of journalists and I found that at first they were accepting all sorts of information because no foreign journalists were allowed in the country and the state controlled press did not report on events, but then all these crazy false rumours started getting reported in the mainstream media, about people in freezers, and using protest footage from a couple of years ago, so I noticed they started going through a verification process and being more careful. If you sent Al Jazeera English a video link, they used to just show it, but then it changed, and they wouldn't show footage unless you said you filmed it yourself and you could verify when and where you took it. But who takes footage like that at the time? You don't start filming the date on a newspaper and then move the camera onto the protest. You have to learn to look for landmarks and things that could date it, and not everybody does that. Having stringent media processes means a lot of footage doesn't get reported. It was either that or the media wasn't interested – such as Al Jazeera Arabic who just didn't want to report on events in Bahrain.

As for the local media, people lost faith in them because they were simply just state propaganda, and played the same role that Egyptian and Libyan state television have played. Bahrain TV started doing things like humiliating the national football team for taking part in the protests and forcing them to apologise. They would get arrested the day after. So people stopped trusting them and the people with cameras on the frontline became more important, so what's happened is that people started taking journalism into their own hands. Young people could film on live Twitter feeds with the journalists viewing in real time, so it could be verified more easily. Those who are part of the opposition got their news sources 100 percent online.

Can you tell us any experience you might have had to suggest that government and private organisations were using social media?

Government organisations were using social media to suppress opposition. So there was a campaign of cyber-bullying, but instead of shutting down the Internet, it tried to manipulate it. I've seen reports that Bahrain has hired lots of IT technicians from Asia. And I was at a funeral once and I suddenly noticed all 3G connections had been switched off, so I don't know if mobile phone masts can be controlled like that, but I think it's possible. I've seen that just before government attacks, certain Twitter hashtags such as #Bahrain get spammed by pro-government messages or gibberish, from newly set up accounts known as trolls, so it makes it impossible to follow a hashtag and any useful information is buried. Twitter monitoring organisations have recorded the phenomenon of a Twitter Troll Army that appears to bombard cyberspace and then suddenly disappears before an attack. They also circulate false information (for example that the opposition is behaving violently). Presumably they have paid IT mercenaries to do this. And now when there are loads of tweets getting fired out from near government locations, I get worried that something is about to happen.

5.5   Some conclusions

Here we bring together some the themes drawn out in this chapter and identify where fruitful areas for further investigation might lie. We can think about the impact of ICTs on society in terms of the processes by which information is produced, disseminated and used. Within and across each of these domains we can identify issues that further research can focus on:

- In *information generation*, there are issues collectively referred to here as '*authentication*'

- In *information dissemination* there are issues collectively referred to here as those of '*editorship*'; there are also issues related to the impacts of social communication, independent of the content of messages being exchanged

- In *information use* there are issues collectively referred to here as '*relative value*'.

There are *cross-cutting issues* that have been identified, that is issues that affect generation, dissemination and use. The question of participation and '*access*' is critical, but it needs to be allied with an understanding of the '*skills and capabilities*' of the various interested parties involved. Of course this begins to blur the lines between production and use, but that is deliberate, as it is often the case that adoption of ICTs is closely followed by adaptation of ICTs and further adoption, often even by the same people. The editorship may shape what counts as gossip and what as bona fide fact, but their effects spill over into other institutions (legal, educational) that affect production and use of information as well as only dissemination. These features can shape the formation of extremism and radicalism, particularly if problems of '*fixity*' can be overcome to form tight knit communities with a shared sense of purpose.

Just as coffeehouses and the invention of the printing press emerged in the context of evolving *institutions*, so too do Internet-enabled mobile phones, social networking sites and

blogging sites. Modern ICTs changed the creation of information and its dissemination, but in a highly qualified way, and this section has offered some important directions in which the impact of ICTs can be investigated. It is a testament to our incomplete appreciation of how qualified the impacts of ICTs are when trends in *'geography'* appear counterintuitive to thinking about ICTs. Migration to cities accelerated to such an extent that half of the world now lives in urban dwellings, so clearly ICTs have not diminished all need for proximity, and their impacts are highly qualified and require further attention.

It seems reasonable to claim that modern ICTs and social media contributed to recent political change in the MENA region, but it remains unclear how and to what extent that contribution was made. This chapter has provided some starting points for those inclined to probe the link with more scrutiny than much of the grey and popular literature.

CHAPTER 6 **Conclusions**

The present study has examined the associations between ICT diffusion and socioeconomic development in the MENA region. It has covered a range of topics, including national income, youth, employment, entrepreneurship, economic openness and governance. A case study has been undertaken to examine the specific impacts of social media on political change.

We have undertaken analysis of statistical associations between six indictors of ICT diffusion, five indicators of socioeconomic development, and a further six indicators of governance. Our analysis suggests strong relationships between five pairs of indicators:

- Fixed Internet subscriptions and GNI
- Fixed Internet subscriptions and openness
- Mobile broadband subscriptions and GNI
- Mobile cellular subscriptions and GNI
- Mobile cellular subscriptions and openness.

None of the six governance indicators examined were found to be strongly correlated with the ICT diffusion indicators. This finding could result from lumping together very different types of country, the operation of two-way causality, or the (current) dominance of economic and societal motivations over political motivations in shaping current (medium-to-long-term) governance indicator performance. A detailed investigation into the apparent weak correlation is warranted, although it is not possible within the scope of the current study.

We also examined how ICT diffusion and economic development evolve over time. Because of data limitation, this detailed analysis is only performed for two pairs of indicators: fixed Internet subscriptions and GNI, and mobile cellular subscriptions and GNI.

Our analysis of the relationship between fixed Internet subscriptions and GNI over time revealed a common trait among all the countries examined (only Bahrain, Oman, Saudi Arabia and the UAE have data to support this analysis). Bahrain, Oman, Saudi Arabia and the UAE all experienced an initial period of rapid diffusion of fixed Internet subscriptions in which an increase of US$1000 GNI was associated with an increase of approximately

five fixed Internet subscriptions per 100 inhabitants. This period typically lasted for two years.

Our analysis of the relationship between mobile cellular subscriptions and GNI over time suggests that the countries analysed can be divided into two groups. In the first group, comprising Saudi Arabia, Oman and Bahrain, the relationship between mobile cellular subscriptions and GNI was more or less constant over time. An increase of US$1000 in GNI was associated with an increase of approximately fifteen, ten and nine in mobile cellular subscriptions per 100 inhabitants respectively. On the other hand, in the second group, comprising Kuwait and the UAE, the relationship between mobile cellular subscriptions and GNI went through distinct phases (rapid ICT diffusion initially and slower diffusion later on).

Available data represent partial snapshots of highly interconnected phenomena, but the findings on the different developmental phases and potential country groupings can be used to help generate or validate hypotheses in future research.

The associations observed do not imply causality. The issue of causality is tricky since it is likely that the relationship between ICT penetration and income is driven by an endogenous process with significant reverse effects of income on the ICT uptake. In addition, the relationship between observation (market outcomes) and expectation (including anticipation of future growth or development) complicates the analysis and may make it hard to determine where to apply stimulus in order to encourage development most effectively. In future studies, econometric techniques, such as two-stage least square models, multiple equation models (including panel models), and the other techniques indicated in Box 4-1 should be considered.

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