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Technological Readiness in the Middle East and North Africa – Implications for Egypt

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Technological Readiness in the Middle East and North Africa – Implications for Egypt

Abstract

Innovation is widely recognized as a key driver of sustainable economic development. Governments, international organizations, donors and investors are increasingly interested in evaluating the technological capabilities and innovative capacities in developing countries, but often lack appropriate approaches for such measurement. This paper focuses on innovation and technological progress in the MENA region and discusses the challenges of understanding, expanding and fostering innovative potential in Egypt.

Keywords: Egypt, Middle East, North Africa, Technology, Developing countries

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Zusammenfassung

Technologische Anpassungsfähigkeit im Nahen Osten und Nordafrika – Auswirkungen auf Ägypten

Innovation wird weithin als eine treibende Kraft von nachhaltiger wirtschaftlicher Entwicklung angesehen. Regierungen, internationale Organisationen, Geber von Entwicklungshilfe und Investoren haben ein zunehmendes Interesse daran, die technologischen Fertigkeiten und die innovative Leistungsfähigkeit von Entwicklungsländern zu beurteilen, häufig mangelt es jedoch an geeigneten Ansätzen für eine solche Untersuchung. Dieses Paper untersucht den Fortschritt in den Bereichen Innovation und Technologie in der MENA-Region und diskutiert die Herausforderungen, die das Verstehen, Ausweiten und Fördern des innovativen Potenzials in Ägypten darstellen.

Technological Readiness in the Middle East and North Africa – Implications for Egypt*

Juliane Brach

Article Outline

1 Introduction

In an international comparison with peer economies, the economy of the Arab Republic of Egypt displays relatively low growth rates. These are coupled with high rates of population growth and a very tight labor market. One of the major challenges in the near future, for Egypt as much as for the other Arab countries in the Middle East and North Africa (MENA), is sustainable job creation (Nabli 2007).

There is ample economic literature on the existing growth deficit and weak economic performance of Arab MENA countries. However, little research has investigated the constraints on economic development in the Arab MENA countries that might explain why they perform below their potential. Understanding the most binding constraints to economic development and growth is a prerequisite for identifying effective structural adjustment measures, both nationally and internationally. National governments, as well as international organizations, have only limited financial and administrative resources to dedicate to structural adjustment and development support. Rarely, if ever, is it possible to tackle all constraints. Policymakers have to make choices and set priorities to ensure that their efforts and the available resources are directed toward alleviating the most binding constraints.

The central aim of this paper is to take a closer look at the technological progress and innovative activities in the MENA region in order to understand the challenges and limitations of sustainable economic performance and job creation as well as to best possibly support policymakers' decision-making processes in this context.

The remainder of the paper is organized as follows: Section 2 provides an overview of the related literatures. Sections 3 and 4 present the methodology and the results of the empirical analysis, respectively. Section 5 discusses the more general implications of the empirical results, while Section 6 concentrates on the implications for the case of Egypt. Section 7 concludes.

2 Related Literature: An Overview

Traditionally, growth theory focused on physical and human capital accumulation as the ultimate sources of growth. Today, economists and policymakers alike recognize innovation as a key driver of economic growth and development (OECD 2009). The body of literature on innovation is vast and covers an extensive variety of subjects. Drawing on Schumpeter's seminal contribution from 1950, theoretical advances were made in the 1990s (by Romer, Aghion and Howitt, and by Grossman and Helpman, among others) and were followed by a substantial increase in empirical studies. These studies center almost exclusively on the analysis of research and development (R&D)-intensive activities and sectors in OECD countries, where over 90 percent of recent technologies have been developed. Innovation in developing countries has only rarely been an explicit research subject.

Early exceptions are Basu and Weil (1998) and Hausman and Rodrik (2003), who have argued that developing countries face a technology bias and need to appropriate existing technologies, and that this process of technology adoption is not cost-free but rather as uncertain as the innovation process in the OECD countries. In general, the bulk of the literature on economic development in developing countries has concentrated on these countries' access to international technologies through international trade rather than on their innovative and creative capacities (e.g. Sachs and Warner 1999; Dollar and Kraay 2004). More recently, the interest in "incremental" or "inside-frontier" innovation and technological capacity as important drivers of development in developing countries has been increasing. The need for further theoretical and empirical research in this direction has been underscored and encouraged by leading researchers (e.g. Fagerberg et al. 2009; Freeman and Soete 2009) and research institutions (e.g. OECD–UNESCO 2009).

Despite the plethora of scholarly articles and international organizations' publications on economic growth in various countries and regions of the world, the contributions on economic growth performance in MENA countries remain limited. Important components of the existing literature on MENA growth use the aggregate "MENA region" (Sala-I-Martin and Artadi 2003; Aubert 2004; Dasgupta 2003). The definition of the region varies significantly from study to study but generally covers around twenty countries, including Iran, Turkey and Israel. Consequently, these studies yield only very general and generic observations. Only few papers investigate MENA economic growth at a more disaggregated level. Bisat et al. (1997) provide a detailed analysis of the economic growth rates of ten Arab MENA countries based on a growth accounting exercise (for the years 1971–96). They find that the investment process that took place over those years was not accompanied by sufficient improvement in total factor productivity (TFP). In fact, the average annual TFP growth was negative over the whole period. More recently, Abu-Qarn and Abu-Bader (2007) have revisited the sources of MENA growth and have attempted to determine the key factors that led to economic growth in MENA countries over the period 1960–98. They found that MENA growth performance was essentially determined by physical capital accumulation and, to a lesser extent, by the accumulation of human capital. The contribution of TFP to economic growth was negligible; all six Arab MENA countries exhibit negative TFP growth. Nabli and Véganzonès-Varoudakis (2007) address the empirical link between economic reform, human capital, and physical infrastructure and MENA economic growth. They find a strong positive impact from advances in physical infrastructure and human capital, and a negative impact from structural reform on growth in six MENA countries over the period from 1970 to 1999. A very recent study also points to a severe lack of technological capacities and innovative activities in the MENA region and shows that region-specific features such as rent- and continuity-oriented political economy structures are simultaneously important determinants and hampering factors to economic development in the MENA region that can partially explain an economically inefficient allocation of resources (Brach 2009).

3 Methodology and Data

Equation (1) yields the extended core specification and baseline models in subsequent OLS and panel data regression analysis.

$$\begin{aligned} ECDEV_i = \; & \beta_1 + \beta_2\, EconInst_i + \beta_3\, Techread_i + \beta_4\, Openness_i + \\ & + \beta_5\, Marketsize_i + \beta_6\, Oildependence_i + \beta_7\, Conflict_i + \\ & + \beta_8\, Geography_i + \beta_9\, Region_i + \beta_{10}\, MENA^*Technology + \varepsilon \end{aligned} \qquad (1)$$

β1 is the intercept and ε the random error term. Throughout the paper I will be interested in the sign, magnitude, and significance of the coefficients. The interaction terms allow me to explore and control for the special impact of these variables in MENA countries.

The dependent variable "economic development" (ECDEV) of country *i*, is written on the right-hand side of the equation and is measured as the logarithm of per capita GDP. The independent variables that are presented on the left-hand side of the equation can be sorted into four groups:

1) science and technology indicators (STI) (including human capital),
2) macroeconomic indicators,
3) political economy indicators,
4) context and control variables.

Table 1 provides a list of the variables and data sources. A more detailed description and motivation of variables and indicators is provided by Brach (2009).
In total, data have been collected for 189 countries for which the variables and their sources are described in the attached table.

The biggest obstacle throughout the sample remains the availability of data from the Arab Middle Eastern and North African (AMENA) countries as well as ready and applicable data including S&T indicators across all countries, which are documented in Table A.1 in the appendix.

Table 1: Variables and Sources

Variable group	*Variable*	*Model specification*	*Description*	*Source*
Economic development	GDP per capita	Economic development	Logarithm of GDP per capita in constant prices, purchasing power parity (PPP), baseline year 2005	(World Bank 2010)
Science and Technology	Technological readiness	Technology	Country's level of technological readiness, values ranging from 1 to 7	(WEF 2007)
	Patents	Science	Logarithm of patent applications by residents	(World Bank 2010)
	Technicians	Science	Technicians in R&D (per million people)	(World Bank 2010)
	Researchers	Science	Researchers in R&D (per million people)	(World Bank 2010)
	High-technology exports	Technology	Logarithm of high-technology exports (% of manufactured exports)	(World Bank 2010)
	R&D expenditure	Technology	Logarithm of research and development expenditure (% of GDP)	(World Bank 2010)
	Adult literacy	Education	Adult literacy rate (% of population aged 15 years and over)	(Human Development Indicators, UNDP 2009)
	Education index	Education	Index ranging from 0 to 1, with a higher score indicating higher education. Based on the adult literacy rate and the combined gross enrollment ratio for primary, secondary, and tertiary schools.	(Human Development Indicators, UNDP 2009)
Economy	Fuel exports	Oil dependence	Logarithm of fuel exports (% of merchandise exports)	(World Bank 2010)
	Openness	Openness	Percentage of exports and imports of goods and services to GDP in constant 2000 prices	(World Bank 2010)
	Population	Market size	Logarithm of population, in millions	(World Bank 2010)
	Economic institutions	Economic institutions	Composite index of economic freedom, including a set of six indicators of economic institutions: business regulations, fiscal burden, property rights, restrictions on investment, capital market restrictions, and labor market rigidity. Values range from 0 to 100, combining survey and hard data	(Heritage Foundation 2010)
Context	Conflict	Conflict	Number and intensity of internal and external conflicts	(CSCW 2009, Version 4)
	Distance from equator	Geography	Distance of capital city from equator, measured as the absolute value of latitude	(Kaufmann et al. 2005)
	Landlocked status	Area	Dummy variable taking value 1 for countries without access to the sea, 0 otherwise	(Kaufmann et al. 2005)
	Dummies	D_LAC	Latin America and Caribbean	
		D_EAP	East Asia and Pacific	
		D_ECA	Europe and Central Asia	
		D_SSA	Sub-Saharan Africa	
		D_SA	South Asia	
		D_AMENA D_MED	Arab MENA country Arab Mediterranean country	
		D_EUROPE	European continent	
		D_ASIA	Asian continent	
		D_OCEANIA	Oceania continent	
		D_AFRICA	African continent	
		D_SOUTH AMERICA	South American continent	
		D_NORTH AMERICA	North American continent	

Source: Author's compilation

The data used originate from a wide range of different sources of internationally recognized data and are as follows: The World Bank's World Development Indicators comprise the backbone of the performed analysis, including reliable and comprehensive data for the AMENA region. Nevertheless, data relating to S&T indicators, such as patents, R&D expenditure and employed technicians and researchers for the AMENA countries are severely lacking in the WDI database. As a result, the World Economic Forum's Global Competitiveness Index is also included as a measure of technology in the performed analysis. The data are based on an executive opinion survey (Global Opinion Survey, GOS) of over 10,000 enterprises worldwide, one of the few sources that allow for cross-country comparison.

The data for "economic institutions" are taken from the Heritage Foundation's Index of Economic Freedom and are based on a non-weighted average of the measures of business, fiscal, investment, financial, and labor freedoms, along with property rights.

The Centre for the Study of Civil War (CSCW) of the Peace Research Institute in Oslo provides data on armed conflicts. The conflict measure in the current sample is based on CSCW's Armed Conflicts Version 4-2009 and measures the cumulative amount of armed conflict since 1970. Incidents are measured by intensity with incidents resulting in between 25 and 999 battle-related deaths in a given year categorized as "minor" and given the value 1, and incidents with at least 1,000 battle-related deaths in a given year considered "war" and given the value 2.

Finally, literacy rate and education index data are provided by the United Nations Development Programs Human Development Indicators, and geographical data of each country are based on the findings of Kaufmann et al. (2005).

The sample covers 77 countries and unless reported otherwise, all data are taken from the year 2005. The base year for constant U.S. dollar prices in PPP is 2000. The quantitative data analysis is based on cross-country regressions. As a result of constraints on data availability, only 5 out of a total of 19 AMENA countries are being included in the 2005 regression analysis.

Table 2 summarizes the descriptive statistics for the key variables of interest.

Table 2: Descriptive Statistics

	Mean	*Std. Deviation*	*N*
LGGDP	3.9000	0.44946	77
ECONINST	65.6802	9.28532	77
TECHREAD	4.065	1.1905	77
OPENNESS	87.868	43.5229	77
MARKET	48.2295	153.39450	77
FUELEX	15.55	24.524	77
LGCONFL	0.5849	0.71410	77
DISTEQ	32.81	17.515	77

Source: Author's calculations

A combination of exploratory data analysis (EDA) and more rigorous testing was performed separately for each variable and bivariate relationship prior to the multivariate analysis.

4 Empirical Results

All but one explanatory variable show the expected signs consistently throughout the different models.

Technological readiness has a highly significant, positive impact and a large economic importance. The coefficients suggest that two-thirds of the variation in economic development can actually be explained by a country's technological readiness. Even after the inclusion of all dummy variables, the importance remains above 50 percent.

Table 3: OLS 77 Countries—Economic Development (lgGDPPC)

	Economic Development (lgGDPPC)							
	1	2	3	4	5	6	7	8
ECONINST	0.23***	0.21**	0.26***	0.19*	0.05	0.01	-0.03	-0.04
	(2.62)	(2.23)	(2.65)	(1.91)	(0.58)	(0.11)	(-0.30)	(-0.52)
TECHREAD	0.65***	0.65***	0.63***	0.65***	0.62***	0.63***	0.67***	0.53***
	(7.37)	(7.24)	(7.12)	(7.53)	(8.50)	(8.65)	(8.96)	(6.57)
OPENNESS		0.08	0.10	0.06	0.03	0.03	0.02	0.02
		(1.17)	(1.43)	(0.87)	(0.43)	(0.46)	(0.42)	(0.30)
MARKET		0.03	0.05	0.07	-0.01	-0.02	-0.02	-0.01
		(0.42)	(0.65)	(0.97)	(-0.12)	(-0.32)	(-0.35)	(-0.24)
OILDEP			0.12*	0.10*′	0.06	0.06	0.02	0.00
			(1.79)	(1.52)	(0.98)	(1.05)	(0.30)	(-0.03)
LGCONFL				-0.17**	-0.04	-0.03	-0.06	-0.09
				(-2.32)	(-0.59)	(-0.46)	(-0.96)	(-1.41)
DISTEQ					0.38***	0.40***	0.39***	0.24**
					(5.56)	(5.75)	(5.63)	(2.26)
MED						-0.08	0.43*′	0.39*′
						(-1.34)	(1.51)	(1.50)
MED*TECH							-0.52*	-0.46*
							(-1.81)	(-1.72)
Regional Dummies	no	no	no	no	no	no	no	yes
Adjusted R^2	0.67	0.67	0.67	0.70	0.78	0.79	0.80	0.84
N	77	77	77	77	77	77	77	77

Note: ***, **, and * denote a significance at the 1, 5, and 10 percent level, respectively.
Source: Author's calculations

When first introduced in Model 6, the dummy for Arab Mediterranean countries (MED) displays a negative sign, but is positive thereafter. The explanation is reasonably straightforward: Model 6 points out that the generally positive impact of economic institutions, technological readiness, and the control variables might not hold true when analyzing economic development in AMCs when compared to other regions of the world, without being able to explain why. Models 7 and 8 are able to specify this finding: the negative impact of the MED dummy on economic development stems from the negative impact of lacking technological readiness. While the MED dummy now has a positive sign, the interaction term of technological readiness and MED (TECH*MED) has a negative sign, and both significant economic and significant statistical relevance (-0.52** and -0.46**, in columns 7 and 8, respectively).

In contrast, the impact of economic institutions (ECONINST) changes from positive (columns 1-6) to negative (columns 7 and 8). These institutions also lose significance and magnitude with the successive inclusion of more variables. This may be puzzling at first, but it supports the hypothesis that economic institutions matter and that they are endogenously dependent on several determinants, the impact of which can be either in support of or an obstacle to economic development. This initial indicative finding needs further investigation and interpretation, which will be provided in the next section.

With respect to identifying the most binding constraints to the economic development of the AMCs, the magnitude of the coefficients yields a sense of the potential impact. Model 8, which includes both the regional dummies and the interaction term, is a specification with a solid explanatory power of 84 percent (adjusted R^2) and reveals that technological readiness and distance from the equator in general have respectively a 53 percent and 24 percent return on economic development. Both findings are in line with the importance of these two variables, as noted in the theoretical section. With respect to the AMCs, the positive impact of technological readiness almost diminishes. Adding the interaction term to the TECHREAD coefficient gives the more precise estimate of as little as 0.07, or 7 percent.

5 Discussion

The empirical results provide strong evidence that one of the major constraints to an improved economic performance and sustainable job creation is the general lack of MENA countries' technological capacities. Since innovation in these countries is closely linked to the adoption, refinement, and modification of existing technologies (also dubbed "inside-frontier" or "diffusion-based" innovation), innovation and productivity are negatively impacted by the low level of technological readiness. These results have three important implications for both policymakers and researchers, as I will discuss below.

First, developing countries such as MENA countries that are not, or only to a very low extent, capable of using and appropriating existing technologies efficiently, are not able to fully internalize the positive effects of technology transfer and technology spill-over effects that relate to international trade and trade openness. Trade liberalization is thus not very likely to have a "natural" positive effect. Rather, there has to be an explicit focus on the transfer of both technology and knowledge in order to ensure and facilitate a positive impact.

Second, although there is now strong evidence for the fact that technological readiness is a major constraint, the reason for this remains only speculated upon. What exactly makes MENA economies less productive than economies in other regions? Brach (2009) provides some fresh insights into economic institutions, yet there is still no explanation that is based on the ultimate unit of productivity and competitiveness: the firm.

Third, more research is needed in order for us to be able to understand the technological and innovative capacities at the level of the firm. This would require 1) the availability of relevant, recent, and reliable firm-level data and 2) new indicators and approaches to complement standard (OECD-inspired) innovation surveys.

Economic performance will only gain momentum if it is possible to close the productivity and technology gap between the AMENA countries and the rest of the world, which will continue to widen unless urgent measures are taken. Thus, more research and political effort need to be directed towards not only understanding and fostering technology diffusion within and into these countries but also conducting in-depth investigations of their technological capacities.

6 Implications for Egypt

Egypt is at a crossroads of economic development. Despite an overall favorable setting, such as a relatively high degree of economic diversification, good educational attainment and human capital, a large domestic market and a relatively low degree of social inequality, it faces a high burden of subsidies, and large-scale unemployment, especially among the youth and increasingly also among university graduates. The informal sector of the economy is already considerably large and is constantly growing. Innovation and improvisation are taking place on a daily basis in various industries. Egypt has a lot to offer, and there does not seem to be a general lack of entrepreneurial competence, talent, or innovative capacity. However, Egypt seems to be unable to systematically transform innovative activities into knowledge and products, and that inability is hampering its productivity and economic performance.

Egypt is an economic hub in the region, especially for intra-regional trade and factor movements, not only because of its large domestic market, but also because of its status as a political actor and benchmark. However, in terms of technological and innovative capacities, Egypt does not rank among the top performers. MENA countries face very different stages with respect to access to and mastering of recent technologies and can be broadly categorized – as the following table shows – into two groups: technology developer and technology user. Within the group of technology users, we identify three sub-groups of countries: *technology consumers*, *integrated technology users*, and *isolated technology users*. Out of the 20 countries in the MENA region, only the three non-Arab countries are classified as technology developers.

Table 4: Technological Competences by Country Groups

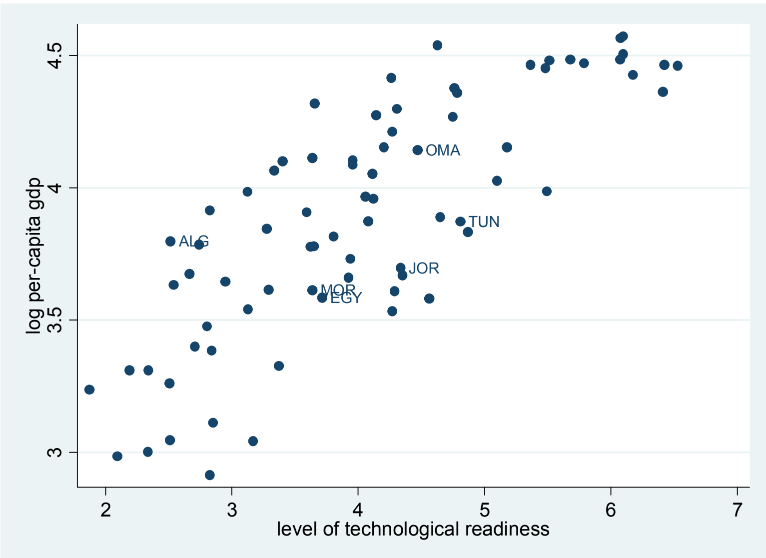
		Access (recent technologies are generally available)	Adoption (available technologies are applied efficiently)	Development (development of new-to-country technologies)
Country groups	**Standard measures and available indicators:**	**trade openness, WTO membership, number of free trade agreements, average tariff**	**total factor productivity, international competitiveness, technological readiness, business sophistication**	**R&D expenditures, patents, number of researchers**
Developer	Israel, Iran, Turkey	++	++	++
User	***Consumer:*** Bahrain, Qatar, Kuwait, Oman, Saudi Arabia, United Arab Emirates	++	++	-
	***Integrated User*:** Tunisia, Jordan, Egypt, Morocco, Lebanon	++	+/-	+/-
	***Isolated User*:** Algeria, Syria, Palestinian Territories, Yemen, Libya, Iraq	-	+/-	--

Author's own compilation

Technology developers are technologically well advanced and are characterized by excellent access to, and mastering and development of, new technologies through both research and technology adoption. Countries within this group in the MENA region are Israel, Turkey and, to some degree, Iran. All three have invested early and systematically into education and the development of national innovative, science, and research capacities. They also profit from well-educated nationals returning to their home country. All other countries in the region generally depend on foreign technologies, because they do not – or, if they do, then only to a very limited extent – develop or improve technologies according to their needs. Among the technology users, the *technology consumers* are highly integrated into the global market and thus have access to international, state-of-the-art technologies. In contrast to the users, especially the more advanced users like those in Tunisia or Jordan, Gulf countries do not possess the necessary skills, but they do have the funds to equip themselves with both the technologies and the experts to manage them. The *integrated technology users* have (through systematic trade opening) improved their access to international technologies; however, neither the more advanced users like those in Tunisia and Jordan nor users in Egypt and Morocco have in the past ten years experienced the significant productivity improvement that was anticipated. This anticipation was based on analogies to other developing regions, but, as recent studies show, many MENA countries lack the necessary capacities to exploit the new (technological) opportunities to which they have now access (Brach 2009). Finally, the *isolated technology users* face the most difficult situation. Their integration into the world market is fairly recent and rather selective (Syria, Algeria, and especially Libya), or has been delayed or harmed because of ongoing war and conflict (Iraq and the Palestinian territories). Countries in this group lack capacities, funds, and most of the basic infrastructure.

Egypt is an *integrated technology user* and displays only a limited ability to sufficiently use and apply existing technologies to spur sustainable economic development, as is depicted in Graph 1. The access to recent technologies is still the necessary condition to economic growth, but it is not sufficient if the capacities to use, refine, and apply these technologies are limited and not well established.

Graph 1: Economic Performance and Technological Capacities



Source: Own calculations based on World Bank 2008 and World Economic Forum 2008

The relatively low impact of the current economic crisis on Egypt gives its government room to maneuver and the opportunity to adjust to and develop sustainable and innovation-based sources of growth (Brach and Loewe 2009). Understanding innovative activities and the potential of firms and industries is the crucial link here to an improved economic performance. As mentioned in Section 5, the availability of suitable tools such as appropriate models and data is also of high importance.

The MENA region in general is, in comparison to the rest of the world's regions, the one whose data are most incomprehensive and most difficult to access. An overview of the availability of science, technology, and innovation (STI), as well as education indicators, is provided in Table 1 in the appendix. These data constraints lead to a lack of international economic research on the MENA region, which as a consequence yields only very little relevant scientific output.

Egypt is no exception here. For example, there is no representative innovation survey that is conducted at regular intervals. There is also a considerable time lag, sometimes several years, before data are published. In general, the access to (firm-level) data is very restricted. Rules and registration procedures are very non-transparent. Requests, if at all successful, can be subject to delays of several months. In turn, the lack of data limits the understanding and insight of national authorities and policymakers in key questions such as

— What are the determinants of technology-upgrading in Egypt? and
— How do we make use of standard economic modeling of the innovation process in order to improve the empirically observed process of technology adoption?

Policymakers should consider the comprehension of innovation at a firm level across economic industries a high priority because this is where a large number of sustainable jobs will be created in the future. Complementing standard innovation surveys, a suitable approach will, however, explicitly focus on both research-based and diffusion-based innovation and cover a variety of different aspects relevant for technological competences and upgrading possibilities at the firm level, such as

— the stock of technologies (e.g. the type, age, or cost of current production technologies and machinery),
— the development of technologies that are new to the world, e.g. the number of patents and amount of expenditure for R&D and other standard indicators that are implemented in OECD and/or UN S&T surveys,
— the channels of technology transfer that specify how technologies that are not developed in the firm have been acquired (e.g. arms' length trade, value chain integration, or labor migration),
— the adoption of technologies, i.e. activities that are related to the development of technologies that are new to the firm and/or to the country and that are based on the adoption and modification of pre-existing technologies rather than original R&D, and
— the diffusion of technologies that have been developed or modified within and across industries at the country level.

7 Conclusion

Economic research on technological progress and growth has in the past two decades very much focused on innovations in high-technology sectors. Economic modeling and empirical analyses have centered on the question of how to spur innovation in an OECD context. Therefore, policymakers and researchers are able today to draw on an established research setup, (standard) science and technology indicators that support informed decisions.

However, domestic high-technology industries and sectors are virtually nonexistent in the context of developing countries. Despite the sharp increase in demand for policymakers in developing countries to create sound innovation and productivity-enhancing policies, the available toolkit is still only partially available to them.

Necessary economic growth, accelerated economic development, and sustainable job creation crucially depend on the performance of, and the sound cooperation between, three very country-specific features: firms, government(s), and (economic) institutions. Therefore, panacea or "one-size-fits-all" approaches are not suitable. As in the case of Egypt, national and international structural adjustment programs over the past two decades have shown only limited results. What is urgently needed are innovation and diffusion-based development strategies that are tailored specifically to the country.

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Table A.1: STI & Education Data Availability

	ST indicators						Education				
	World Bank					WEF	HDI		World Bank		
Country/Region	High-tech exports (% of manufactu-red exports)	Technicians in R&D (per million people)	Researchers in R&D (per million people)	Patent appli-cations, residents	R&D expenditure (% of GDP)	Technological readiness	Adult literacy	Education index	Labor force with primary educa-tion (% of total)	Labor force with secondary educa-tion (% of total)	Labor force with tertiary educa-tion (% of total)
AMENA	**14**	**3**	**4**	**8**	**5**	**12**	**19**	**19**	**1**	**1**	**1**
Algeria	x			x		x	x	x			
Bahrain	x					x	x	x			
Djibouti							x	x			
Egypt	x			x	x	x	x	x			
Iran	x		x		x		x	x			
Iraq							x	x			
Jordan	x			x		x	x	x			
Kuwait	x	x	x		x	x	x	x			
Lebanon							x	x			
Libya						x	x	x			
Morocco	x	x	x	x	x	x	x	x	x	x	x
Oman	x					x	x	x			
Qatar	x					x	x	x			
Saudi Arabia	x			x	x		x	x			
Sudan	x			x			x	x			
Syria	x			x		x	x	x			
Tunisia	x	x	x			x	x	x			
UAE						x	x	x			
Yemen	x			x			x	x			
OECD	**30**	**19**	**26**	**29**	**27**	**30**	**30**	**30**	**27**	**26**	**27**
Non-OECD	**115**	**30**	**34**	**52**	**47**	**98**	**151**	**151**	**33**	**32**	**33**
N	**145**	**49**	**60**	**81**	**74**	**128**	**181**	**181**	**60**	**58**	**60**
Total sample	**189**	**189**	**189**	**189**	**189**	**189**	**189**	**189**	**189**	**189**	**189**

Source: Author's own compilation, World Bank (2010), World Economic Forum (2010).

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