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Social Capabilities and Technology Capability

a comparative study of Arab countries and East-Asian economies

by

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Abstract: This thesis argues that the reason behind the lack of sustained economic growth in the Middle East compared to East Asia lies in the technology gap between the two regions, and it attempts to find an explanation for it. Through an empirically supported narrative, the paper applies the social capability framework to explain the low level of technology capability in the Arab region. The research confirms a connection between the level of technology capability and the level of social capability in both regions, and it highlights how the technology gap in the Arab region coincides not only with substantial gaps when it comes to social capability, but also with poor and slow progress in social capability-related indicators.

Key words: Technology Capability, Technology Gap, Middle East, East Asia, Social Capability

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Table of Contents

1. Introduction 1
    1.1 Research Problem 1
    1.2 Aim and Scope 3
    1.3 Outline of the Thesis 4

2.Theoretical Approach 5
    2.1 Technology and Economic Development 5
        2.1.1 Economic Growth Theories: Neoclassical vs New Growth theory 5
        2.1.2 Technology and Economic Growth 6
        2.1.3 Technology Gap Approach 7
        2.1.4 Technology Capability 8
    2.2 Social Capability 9
        2.2.1 Accountability 10
        2.2.2 Autonomy 10
        2.2.3 Transformation 11
        2.2.4 Social stability 12
    2.3 Hypothesis 13

3. Data 15
    3.1 Technology Capability 15
    3.2 Social Capability 15
        3.2.1 Autonomy 15
        3.2.2 Accountability 16
        3.2.3 Transformation 16
        3.2.4 Social stability 16
    3.3 Limitations 17

4. Methods 19

5. Empirical Analysis 20
    5.1 Technology Capability 20
        5.1.1. Scientific articles 20
        5.1.2 Patent applications 21
        5.1.3 R&D expenditure 22
    5.2 Social Capability 23
        5.2.1 Accountability 23
            5.2.1.1 Infrastructure 23
            5.2.1.2 Government Expenditure on education 24
            5.2.1.3 Enrollment in tertiary education 26

5.2.2 Autonomy 28
5.2.2.1 Corruption 29
5.2.3 Transformation 30
5.2.3.1 Economic Complexity 32
5.2.4 Social Stability 34
5.2.4.1 Before the Arab Springs 34
5.2.4.2 The Arab Springs 35
5.2.4.3 After the Arab Springs 36
5.2.4.4 Social Stability in East Asia 37
5.3 Discussion 37
6. Conclusion 41
6.1 Results 41
6.2 Practical Implications 42
References 44
Appendix A - Geographical Location of the Arab and East Asian countries selected 53

List of Tables

Table 1. Technology capability indicators……...15
Table 2. Social Capability indicators…….…… 16
Table 3. Average economic complexity index ……..……..32

List of Figures

Figure 1. GDP per capita…….....1
Figure 2. Outline of the theoretical model…….3
Figure 3. Scientific and Technical journal articles……...20
Figure 4. Patent Applications……...21
Figure 5. Research and Development Expenditure (% of GDP)……..22
Figure 6. Competence and quality of logistic services…….23
Figure 7. Government Expenditure on Education (%of GDP)……24
Figure 8. Enrollment ratio in tertiary education……...25
Figure 9. Unemployment with advanced education (East Asia & Middle East)…….26
Figure 10. Unemployment with basic education (East Asia & Middle East)……..26
Figure 11. Tax revenues (% of GDP)……...27
Figure 12. Transparency and accountability in the Public Sector……29
Figure 13. Sectoral Employment Shares in East Asia & Pacific……..30
Figure 14. Sectoral Employment Shares in Middle East & North Africa……30
Figure 15. High Technology Exports (% of manufactured exports)……33
Figure 16. Conflicts in the Middle East……...34
Figure 17. Foreign direct investment, net inflow (US$)……..35
Figure 18. North African and Middle Eastern Countries' location…….51
Figure 19. East Asian countries' location……51

1. Introduction

1.1 Research Problem

The Arab region benefits from a strategic geographical location, abundant natural resources, an increasing young work force and an entrepreneurial population. Between 1960 and 1980, the Arab countries effectively exploited their economic success and these endowments by accomplishing significant improvements in the area of human development: average years of schooling increased, and life expectancy increased by an impressive 10 years (Elbadawi, 2005). However, when the price of oil - that is the driving force of the region's growth - plummeted following the 1980s, economic growth was not sustained (Abdelbary, 2018).

When comparing the region with the most successful case of economic growth of the last decades, that is East-Asia, the difference could not be more striking: the latter is characterized by more investments, extremely high rates of economic growth and rapid reduction in poverty (Pack, 2008). Although in the 1960s Arab economies began from the same starting point of Asian countries and possessed favorable characteristics such as proximity to European markets, their Asian counterparts experienced a much more sustained economic growth, leading scholars to talk about a "miracle" (Pack, 2008). Through the growth of GDP per capita, Figure 1 testifies the similar condition of the two regions in the 1960s, and the following East Asian sustained growth on one side and the stagnation of Arab countries on the other.

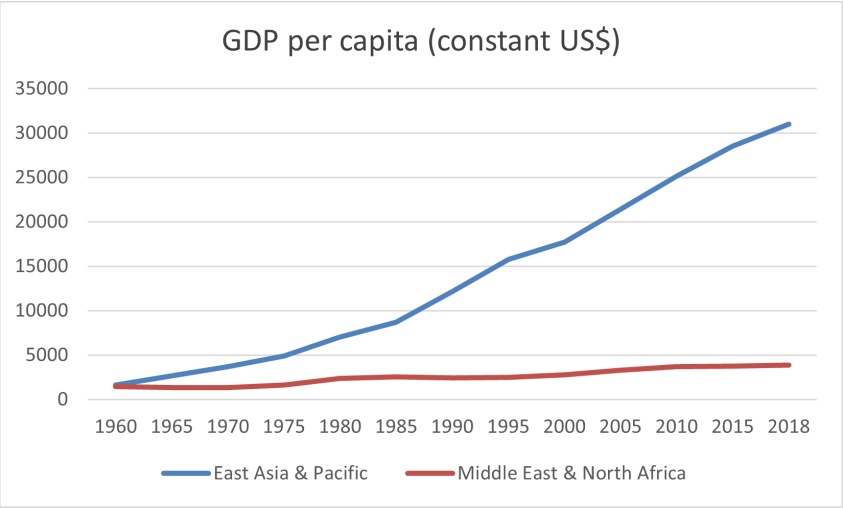

Figure 1 – GDP per capita

Source: Author's elaboration with World Bank Development Indicators data (2022)

In trying to understand why some developing countries have not been able to experience a sustained economic growth like developed countries, the New Growth Theory (Romer, 1986; Rebelo, 1991; Lucas, 1988) has claimed that the key for sustained economic growth lies in the increasing returns associated with new knowledge, and catch-up growth by less developed countries occurs as a result of technological diffusion from industrial to developing countries (Cortright, 2001). In terms of technology capability, the Arab region lags behind in technology creation and diffusion of recent innovations (Farjani, 2002); it is behind both into the "Information Age" and in terms of mature and balanced industrialization, which is particularly troubling, since the modern global economy is becoming increasingly technology driven (Kubursi & Sayegh, 2016; Sadik & Bolbol, 2001).

Despite lagging behind, Arab countries have the possibility to achieve growth by exploiting this technology gap. The main idea underlying the technology gap approach is that technological differences between countries or regions, offers the possibility to countries at a lower level of economic and technological development to catch up by imitating the more productive technologies of developed countries (Abramowitz, 1986). According to Solow (1956), technology can be considered a public good, freely accessible by anybody wishing to share it, independently of his background or location.

However, these optimistic predictions were not confirmed by historical evidence. Fagerberg (1994) and Fagerberg and Srholec (2005) showed how technology is not equally available to everybody without costs and this is confirmed by the disappointing performance of the Arab region. Pack (2008) and Sadik and Bolbol (2001) have argued that this inability to tap external knowledge to exploit the technology gap is the key element to explain the middling economic performance of the region. Therefore, this points to the need for a more realistic understanding of the factors that condition knowledge creation and influence technology capability.

The groundwork for an answer was offered by Abaramowitz (1995), who argued that to successfully generate an adequate technological capability and exploit it economically, a number of supporting social, institutional and economic factors need to be in place. This group of characteristics was described by Abramowitz (1986) as "social capability", which he defined as "countries' levels of general education and technical competence, the commercial, industrial and financial institutions that bear on the abilities to finance and operate modern,

large-scale business, and the political and social characteristics that influence the risks, the incentives and the personal rewards of economic activity" (Abramowitz 1994, p. 25).

This type of framework was further developed by following research (Fagerberg et al. 2011; Lai et al. 2006; Archibugi and Coco 2004; Crispolti and Marconi 2005), all claiming that technical progress might be offset by adverse changes in institutions and human capital over time. Figure 2 attempts to help in visualizing the connection between the theoretical elements of this study:

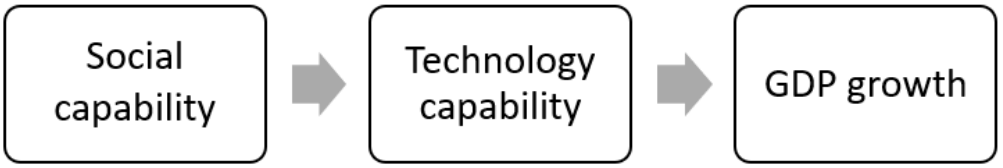

Figure 2: outline of the theoretical model

1.2 Aim and Scope

The purpose of this study is to increase the understanding of the process of technology capability development, by applying Abramowitz's framework to analyze the low level of technology capability of five non-oil rich Arab countries (that is Jordan, Egypt, Morocco, Algeria and Tunisia). The choice of these Arab countries is due to data availability and to the fact that they account for more than half the population and GDP of the region. Moreover, this type of approach makes sense mainly for them, since Libya, Lebanon, Syria and Iraq are affected by war or at least a significant social instability, and other countries such as Saudi Arabia and the United Emirates are oil-rich countries. Therefore, the different contexts of the selected countries allow us to focus on other elements.

These countries will be compared with five East Asian countries (namely Hong Kong, Singapore, Malaysia, Thailand and South Korea), to further analyze the correlation between social and technology capability. This region was chosen because no other part of the developing world has seen more dynamism and success in knowledge diffusion and creation over the last three decades than it (Brahmbhatt & Hu, 2009). The purpose of the comparison is that of further analyzing the connection between social and technology capability. To do this, a set of social capabilities indicators will be included as explaining variables for the development of technological capability.

This led to the formulation of the following research question: *to what extent can the social capability approach explain the technology gap between Arab and East Asian countries?*

This study will contribute to the research in two ways. Firstly, it will use the theory presented above for the Arab region, whereas most empirical technology-gap studies have focused on the growth of OECD countries (Dyker, 2001; Fagerberg et al., 1997). Secondly, it will change the direction of the debate by focusing on the impacts of social capability on technology capability, instead of economic growth, since there has already been extensive research on the positive impact of social capability on economic growth (Andersson, 2018; Andersson & Palacio, 2017; Temple & Johnson, 1998).

1.3 Outline of the Thesis

The thesis is organized as follows. Following this introduction, Chapter 2 presents the theoretical approach behind this study, as well as previous research on social capability and the role of technology for economic growth. Chapter 3 illustrates the data, along with its original sources, reliability and general quality, while Chapter 4 displays the methodology that will be used to conduct the empirical research. Chapter 5 shows the empirical analysis and provides a discussion of the obtained results. Finally, Chapter 6 presents the conclusion, which summarizes the main results and considers practical implications and policy recommendations.

2.Theoretical Approach

This thesis builds on the following strands of literature. First, it relates to the large body of research on the factors that influence economic growth. In particular, this literature review section explores the current state of academic research concerning the effect of technology on economic growth, and it summarizes literature on technology gap and technology capability. Second, it relates to previous work on social capability and it will connect the latter with the development of technology capability. Lastly, based on the theoretical framework, it will outline the hypothesis that the empirical analysis will test.

2.1 Technology and Economic Development

2.1.1 Economic Growth Theories: Neoclassical vs New Growth theory

The idea that constant differences in long-term growth across countries may have something to do with technology has been around for a long time. In the 1950s, Robert Solow was among the first economists who identified technology as a driver for economic growth. He built a model that emphasized capital accumulation and labor force improvement as the main sources of growth, and then added a third factor - technical knowledge - that continued to spur economic productivity and growth (Solow, 1957). However, technology was assumed to be determined by forces outside the economy, and consequently neoclassical scholars neglected it in their economic models and did not explain what caused technology to improve over time.

From the end of the 1980s, another growth theory was developed to challenge Solow's neoclassical exogenous model, because the latter did not explain the divergence in growth rates between countries, but it argued that all economies would reach a long-run equilibrium and progress at an identical rate (Bell & Pavitt, 1992). The New Growth Theory has shifted the focus to the accumulation of knowledge, rather than the accumulation of the same kind of capital, since the latter is ultimately subjected to diminishing returns and economic growth cannot rely on it (Romer, 1986). This theory claims that, although in the short run economic growth can be achieved by increasing labor and capital, the acquisition of modern technologies is required in order for this economic growth to be sustained in the long run, since knowledge and technology are characterized by increasing returns (Lucas, 2001).

Knowledge has certain features that make it particularly valuable for economic growth: it is a non-rival good, it can travel long distances and cross borders quickly, and it is also durable,

which means that it does not perish when transferred and that it can exist indefinitely without requiring additional production (Romer, 1986). The implication is that, in order to guarantee growth over a long period of time, economies should not rely solely on physical resources and should instead expand their knowledge base, and support the institutions that help develop and share knowledge (Cortright, 2001).

2.1.2 Technology and Economic Growth

Several other economist historians also suggest that the prime explanation for the success of today's advanced industrial countries lies in their technology capability (Mokyr, 2002; Rosenberg & Birdzell, 1986).

According to Kuznets (1973), advancing technology is crucial to allow "a long-term rise in capacity to supply increasingly diverse economic goods to the population". He believes that technology is necessary to meet the requirements of modern economic growth, that is a high rate of growth of per capita output, a rise in productivity, structural transformation, urbanization and modernization of the society and the ability of countries to reach out to the rest of the world. A similar definition and understanding of economic growth were provided by Tuma (1987), who argues that growth is defined by structural changes towards more processing, or value-adding industries, such that the share of manufacturing increases and the labor productivity becomes higher. This type of change in industrialization is closely tied to technical innovation.

Technology and technical change are one of the main factors affecting the structure of production, opportunities for trade, the increase in international competitiveness and the growth of national income (Koo & Perking, 1995 p. 82). Katz (2006 p. 66) also believes that, in order to enhance international competitiveness, it is essential to expand domestic R&D efforts and heighten the efficiency with which domestic knowledge-generation activities are organized and performed in the economy.

History supports the theory of a positive relationship between technological progress and economic growth. For instance, the development of technology was the main reason for the huge economic growth experienced by European countries in the 18th and 19th centuries, because it led to massive introductions of labor-saving machines in factories and huge increases in physical output (Rodrik, 2015).

The development success stories of the last decades of the 20th century can also be attributed in part to the ability of those countries to absorb modern technology and to integrate it fully into their productive and service activities. For instance, technology has been identified as one of the keys for the economic success and improvement in competitiveness of East Asian countries (World Bank, 2004). East-Asian firms were export-oriented and ready to take advantage of licensing, of global value chains or imported capital goods with advanced technologies. Growth in East Asia has been largely driven by the learning, entrepreneurship, and innovation that these economies have undertaken, which has allowed both the adoption and development of foreign and indigenous technologies (ElObeidy, 2010).

In contrast to the Asian experience, Arab countries have been performing quite poorly in terms of technology development, which is evidenced by the position of these countries on the UNDP technology achievement index (HDR, 2001). In the late 1990s, Algeria, Tunisia and Egypt were classified as "dynamic adopters" and "marginalized", in contrast with East Asian countries such as the Republic of Korea that were classified as leaders. These countries are characterized by an absence of participation in the international economy, and an emphasis in imports on final consumer goods, which are all measures of the absence of technological stimulus from abroad (Noland & Pack, 2007). In terms of scientific research and innovation, the region's recent research output has been a direct response to donor initiatives and ad hoc commissioned contracts, that focus on applied and short-term outcomes (Fergany, 1999). Consequently, research has been adjusting to unsynchronized needs and demands. Policymakers in the Middle East have always expressed interest in acquiring advanced technology, and they have had knowledge of and access to such technology (Tuma, 1987). So why have these countries remained at such a low level of technology? This is the question that has motivated this study.

2.1.3 Technology Gap Approach

The technology-gap theory identifies technological differences as the primary driver for differences in GDP per capita across countries (Cortright, 2001). In fact, it is possible for a country to suffer from a technological gap, meaning that its technological level is lower than that of other countries on the world innovation frontier (Fagerberg, 1987). According to this hypothesis, backward productivity presents a significant opportunity for rapid advancement: in fact, it is possible for a country to increase its rate of economic growth through imitation.

However, technology is not assumed to be a perfect public good in the sense that it is equally available to everybody free of charge.

A country's ability to exploit the opportunities offered by the technological gap is determined by its ability to mobilize resources for selecting, utilizing, and assimilating technology (Abramowitz, 1986). In fact, even when relevant knowledge is readily identifiable, codified and easily accessible, it cannot be guaranteed that it will be effectively transferred. Knowledge may, for example, be difficult to understand and absorb (Fagerberg et al, 2011). The path-dependency of this process is often emphasized: country-specific factors influence the process of technological change, which means that a country's level of technology capability plays a major role in the successful use of technology (Park, 2005).

2.1.4 Technology Capability

Kim (1997) has defined technological capability as the ability to make effective use of technological knowledge in order to assimilate, use, adapt and change existing technologies, as well as to create new technologies and to develop new products and processes. Technological capability has become increasingly important, because technology is constantly changing, and companies and countries need to be able to react to and take advantage of these changes if they are to remain competitive (Koo & Perking, 1995 p. 90).

Following the literature on technology-gap models (Borensztein et al., 1998; Kim, 1997; Lai et al., 2006), it can be stated that technology capability involves two main elements. Firstly, an *absorptive capability*, which is the ability to imitate foreign advanced technologies and, without it, the learning effect of importing intermediate goods or of attracting multinational enterprises is highly limited. Absorptive capability depends on the presence of adequate human capital and technological infrastructures, as well on the presence of prior related knowledge (Lai et al., 2006). Prior knowledge permits the assimilation and exploitation of new knowledge: to aid assimilation and at the same time permit effective, creative utilization of the new knowledge, some of the prior knowledge should be both related to the new knowledge and also fairly different (Cohen & Levinthal, 1990).

Secondly, technological capability should be upgraded through dynamic learning processes, that is it also involves an *innovative capability*, that is the extent to which the country is able to produce new advanced knowledge (Kim, 1997). More specifically, innovation plays a crucial role in helping firms to improve performance and implement new products, services,

and procedures, in order to acquire more value and gain competitive advantages (Mendoza-silvia, 2021).

Therefore, a country's ability to advance and take advantage of technological opportunities is dependent on the evolution of these two dimensions over time. As mentioned in the introduction, the process of imitation and adoption of new technology is by no means a free ride, while instead it requires considerable deliberate effort and the presence of endogenous capabilities to master technical change (Filippetti & Peyrache, 2011).

Bell & Pavitt (1992) claim that the ability to accumulate technology cannot be explained by different rates of market failure or defense of intellectual property rights: these differences can instead be attributed to differences in macroeconomic conditions, education levels, and resource management. Therefore, technology development requires improvements in factors such as the nature of skills, knowledge, experience, as well as established institutions and traditional behaviors. Abramowitz (1995) named these factors “social capability”.

2.2 Social Capability

There has been no attempt to define social capability in a single way. Abramowitz (1995) asserted that social capability basically consists of elements relating to (1) “people’s basic social attitudes and political institutions” and (2) “the ability to exploit modern technology”. According to him, social capability encompasses the attributes and qualities of people and organizations that impact people’s response to economic opportunity. A nation's social capabilities are determined by factors such as social attitudes, institutions and infrastructure, therefore involving the skill-level of the labor force, how well governance works (in particular with respect to economic activity), and the prevalence of norms, values and institutions that sustain economic activities and the functioning of society (Temple & Johnson, 1998). Building on that, Andersson & Palacio (2017) identified four social capabilities, that is transformation, social stability, autonomy, and accountability. This study will take into account all of them, since they encompass the main aspects identified by Abramowitz (1986) as essential to develop technology capability: the level of skills of the labor force, the effectiveness of governments, and the presence of institutions that support economic activities and the functioning of society more generally.

2.2.1 Accountability

Accountability refers to transparent governance and quality provision of public goods. A fundamental aspect of accountability is the legitimacy of the tax-collecting government among the taxed governed, that is the appropriate use of tax revenue by the State (Andersson, 2018). For the improvement of technology capability, an appropriate use of tax revenues involves expenditures in education and infrastructure. When it comes to education, a good educational system is necessary at two levels: at the university level, there is a need for qualified personnel to be able to monitor technological and other trends and assess their relevance to the future of the nation and of individual firms, as well as develop strategies to react to and exploit these trends; in addition, human resources with high levels of technical expertise are necessary to assimilate, adapt, improve and develop local technologies that may be more appropriate or otherwise superior to those that can be obtained abroad (Koo & Perking, 1995 p. 97). Toivanen & Väänänen (2016) state that education increases the inventive potential of an economy and policymakers should focus on promoting engineering education, since it positively influences the propensity of individuals to patent.

Secondly, the physical infrastructure of a region contributes significantly to its competitiveness, and a better infrastructure is thought to have a positive effect on technology diffusion, since a better infrastructure increases profitability, reduces the costs of introducing new technologies, and accelerates diffusion (Kumar, 2006). A well-functioning infrastructure is required to support productive activities and to facilitate communication between economic agents: without the ability of economic agents to communicate with each other and without the support of a well-functioning industrial infrastructure, human skills are in fact useless (Lai et al., 2006).

2.2.2 Autonomy

Andersson (2018) defines autonomy as the government's ability to keep vested interests at bay. This is not to say that the state overlooks or dismisses the interests of powerful groups; rather, it means that the state may provide chances for both powerful groups and their potential competitors, as well as bargain with them. A primary function of autonomy is a country's ability to impose direct and progressive taxation and enact policies that distribute resources in a way that promotes equality (Andersson, 2018).

Without some degree of autonomy, states would not be able to keep vested interests at bay and could be corrupted by merchant interests, instead of acting independently in favor of the

general interests of the society (Carruthers, 1994). In fact, what is mostly important about tax revenues is how this money is used. Plaw et al. (2020 p. 60) highlights how political pressure from external political actors or by the international system is an important explanation of change in development policies as well as adjustment policies. The tax revenue collection process involves several major stakeholders in society, which increases the potential for corruption. And when the latter is widespread in the public sector, it might foster a culture of corruption across a wide range of actors, which undermine the possibility of establishing a good governance in the long run (Tanzi & Davoodi, 1997).

2.2.3 Transformation

Economic growth is the result of a structural transformation in which productive resources are transferred from low-complexity to high-complexity activities, and investments are aimed at improving technologies that reduce dependency on a limited range of commodities with a volatile aggregate output (Andersson, 2018).

Kaldor (1960) was the first to theorize some stylized empirical regularities which describe how structural change towards medium and high tech manufacturing sectors helps the diffusion of knowledge and the promotion of technological change. Industry, in particular, is critical, because without it it is unlikely that an economy will develop high levels of technology capability (Elmusa, 1986). Manufacturing allows for more capital accumulation, lower average costs through expanding output levels, the acquisition of new technologies, and the promotion of embodied and disembodied technical change (Kaldor, 1960). Once new sectors of economic activity have emerged, changes occur in the industrial structure and competitive regime of the emerging activities: new businesses enter these activities, markets become more competitive, and efforts to differentiate products and improve international competitiveness increase (Katz, 2006). Firms establish new forms of collaboration with each other and with other institutions in the economy, such as colleges, engineering firms, and trade unions (Katz, 2006).

Therefore, manufacturing is the sector where most innovation takes place and where technological advancements and productivity growth are rapid (Alcorta et al., 2021). In the industrial sector, forward and backward linkages between businesses and sub-industries are higher, meaning that demand and technology shocks spread quickly through demand linkages and knowledge spillovers (Hirschman, 1958). Abernathy (1978) and Rosenberg (1982) have noted that through direct involvement in manufacturing, a firm is better able to recognize and

exploit new information relevant to a particular product market, and therefore it is able to further develop its absorptive capacity.

On the other hand, the service sector is characterized by relatively low rates of technical change and lower cases of economies of scale, and a high reliance on agriculture has been linked to low regional growth, due to poor technological development (Fagerberg & Verspagen, 1996; Nuvolari & Russo, 2021). Limited level of industrialization and the limited change in product or sector composition discourage FDI, which are directed towards countries with a stronger manufacturing base, allowing technology inflows (Sadik & Bolbol, 2001).

In addition, Rodrik (2015) reminds that it was the industrial revolution that allowed the sustained productivity growth in Europe and the United States for the first time, and it was once again industrialization that enabled a smaller number of non-Western countries to catch up and converge with the West.

2.2.4 Social stability

Political stability has come to be seen as a precondition for vibrant national systems of innovation (Allard et al., 2012). When a country's institutional profile includes a stable political and regulatory environment, systems of innovation will flourish and productivity in innovation as evidenced through patenting will be encouraged (Feng, 1997). The conventional view is that successful technological catch-up requires a stable political and social context, where legislation can be focused on supporting an institutional and organizational environment that is conducive to innovation in a modern market economy (Allard et al., 2012).

Conflicts and large-scale refugee crises affect economies through multiple channels. First, worsened confidence arising from weaker security, both in terms of objective conditions and subjective perceptions; and second, eroding social cohesion and institutional quality that together complicate economic policymaking (Rother et al., 2016). Conflicts direct resources towards less productive purposes, such as security spending. Military spending rose in the MENA region over the period 2011–14, in sharp contrast to the global downward trend in such spending over the same period. These resources cannot be used for more productive purposes such as research and development.

Conflicts tend to discourage general willingness to invest and result in continued deterioration of the business environment, which in turn hinders the growth of an economy. Business environments need to be able to promote productivity, job creation, expansion, and the introduction of new technologies, since this contributes to the productivity, efficiency, and sustainability of other factors of production in a growing economy (Bussmann, 2010). Studies observes that military conflict, political risk and terrorist incidents creates a general atmosphere of insecurity (Bussmann, 2010; Enders & Sandler, 1996).

Politically unstable countries tend to be less predictable and, therefore, less capable of attracting investment and nurturing a rich ecology of innovation (Globerman & Shapiro, 2003). FDI is able to improve the know-how, modern technology, access to international markets, and a corporate culture of efficiency and competitiveness (Kumar, 2006). FDI also improves organizational and institutional capacities, resulting in a boost in technical progress in the host economy. Incoming FDI levels are a reflection of the attractiveness of a country's investment climate, which is influenced by aggregate consumer demand, macroeconomic stability, political stability, and comparative advantages in production such as low relative wages, the absence of rigid environmental or labor regulations and a well-functioning physical infrastructure (Frankema & Lindblad, 2006).

Therefore, we expect to notice a higher presence of conflicts and unstable social contexts in those countries with lower technology capability.

2.3 Hypothesis

Following the theory and literature presented above, the thesis will consider the following four hypotheses. Hypothesis 1 (H1) regards accountability and will test whether the quality of infrastructure and the levels of expenditure on education are correlated with Arab countries' level of technology capability. Hypothesis 2 (H2) concerns the impact of corruption and transparency in the public sector on the development of technology capability. Hypothesis 3 (H3) will test whether a complete structural transformation and an adequate development of the industry sector is reflected by a higher technology capability. The final hypothesis (H4) will assess whether the stability of social contexts and the frequency of conflicts are associated with the performance in terms of technology and innovation. The hypotheses were formulated as follows:

H1: Higher quality of infrastructure and higher expenditure on education are associated with higher levels of technology capability

H2: Higher levels of corruption in the public sector are associated with lower levels of technology capability

H3: A successful structural transformation is associated with a higher level of technology capability

H4: Unstable social contexts and a high frequency of conflicts are associated with lower levels of technology capability

3. Data

The research area is the Arab and East Asian region. The panel data covers information about five non-oil rich Arab countries, namely Algeria, Egypt, Morocco, Jordan, Tunisia, as well as five east-Asian countries, South Korea, Hong Kong, Malaysia, Thailand, Singapore, whose role is that of providing a comparison. Despite considering only a subset of all Arab countries in our analysis, for convenience they will sometimes be referred to as Arab, Middle East or Middle Eastern. Appendix A contains two figures that help in visualizing these countries in the World Map.

3.1 Technology Capability

To examine technology capability, the very nature of technology makes it difficult to aggregate its heterogeneous aspects and components into a single indicator (Archibugi & Coco, 2004). This study will analyze it by making use of data on expenditure on research and development, which is typically considered to be one of the best measures to evaluate the level of technology in a country (Pakes & Sokoloff, 1996); data on patents applications, which reflect not only the innovative capability of a country but also its capacity to absorb technologies developed elsewhere (García-Muina & González-Sánchez, 2017); and data on the number of scientific and technical journals published. Data for these indicators was collected from the World Bank.

3.2 Social Capability

3.2.1 Autonomy

Following the theory in the previous chapter, the autonomy process will be analyzed by looking at data on tax revenues from the World Bank, since little consistent data was available for other useful measures, such as the efficiency of taxation, and government revenue sources. Higher tax revenues mean a country is able to spend more on improving infrastructure, health, and education, which is key for long-term prospects of development. Moreover, to analyze the autonomy process, one must take into account the role of incentives and constraints within the political system. Therefore, the thesis will examine the level of transparency of the public sector of the two regions by using data from the World Bank, which rates corruption from 1(very low) to 6 (very high).

3.2.2 Accountability

Accountability is represented by government expenditure on education, enrollment rate in tertiary education and quality of trade and transport related infrastructure. Data on the quality of trade and transport related infrastructure (that is ports, railroads, roads, information technology) was collected from the World Bank, which uses a rating ranging from 1 (very low) to 5 (very high).

3.2.3 Transformation

Transformation is characterized by the following indicators, with their respective sources. It will be measured through the sectoral share of employment in East Asia and the Middle East, adapting data from UNDP (2011). The report used data from the National Statistics Bureaus starting from the 1970s, which is not available to the public. Moreover, transformation will be examined through the level of economic complexity and the percentage of high-technology exports. This is because a country's export structure reflects its capabilities to shift and diversify into products identified as related to products it already produces (Hausmann et al., 2011).

3.2.4 Social stability

Social stability is measured through conflict frequency and information was collected from UCDP/PRIO Armed Conflict Dataset (2021, version 21.1). This is a conflict-year dataset with information on armed conflicts in the time period 1946-2020.

Table 1 and 2 summarize the indicators chosen, with the corresponding source and time availability.

Table 1 - Technology Capability indicators

Technology Capability Indicators			
Indicator	**Source**	**Availability**	
		From	**To**
Research and development expenditure	WDI	1996	2018
Patents	WDI	1980	2020
Scientific and technical journal articles	WDI	2000	2018

Table 2 – Social Capability indicators

Social capability Indicators				
Social Capability	**Indicator**	**Source**	**Availability**	
			From	**To**
Social stability	Conflict Frequency	UCDP/PRIO Armed Conflict Dataset	1992	2018
Autonomy	Tax revenue (% of GDP)		1975	2018
	Transparency and corruption in the public sector		2005	2018
Structural transformation	Sectoral employment shares	UNDP (2011)	1975	2018
	high-technology exports (% of manufactured exports)	WDI	2007	2018
Accountability	Logistics performance index: Quality of trade and transport-related infrastructure	WDI	2012	2018
	Enrollment in tertiary education	WDI	1980	2018
	Government expenditure on education (% of GDP)	WDI	1980	2018
	Unemployment	WDI	2010	2018

3.3 Limitations

This section reflects on the limitations of this study. Firstly, the data collection process was affected by data scarcity, which is an overall problem for developing countries and the

Middle East and North Africa in particular. Originally, it was planned to include more Arab countries to give a more complete view of the region, but data was not available or incomplete. Moreover, although the time period taken into account by the study goes from 1980 until 2018, time availability for certain indicators was an issue in the countries taken into account. Most of the surveys and studies performed by the Statistical Bureau of these countries start from the beginning of the 21st century. Secondly, another potential limitation that must be considered when researching developing countries is the quality of data. For instance, *Poor Numbers* by Jerven (2013) underlines how developing countries' data is shaped by both local and international politics and international aid agencies.

However, these issues are unlikely to affect the results of the study, because they do not affect the main indicators of social capability - that is government expenditure, sectoral employment shares, tax revenues and conflicts frequency -, but only secondary indicators, whose role is that of supporting the analytical narrative behind the main indicators.

When it comes to the choice of indicators, for the analysis of education it would be more useful for our analysis to examine data on the percentage of students enrolled in Science and Technology programs and compare that to the percentage of students in Humanity programs. However, this was not possible because data was extremely scattered, and it would not have allowed to give a correct overall picture of the Arab and East Asian region on this matter.

Finally, sectoral transformation will not be analyzed through primary data, but through secondary data adapted from the 2011 UNDP report on the Arab Region. This is because all public databases on sectoral shares of employment have data available from the 1990s, whereas this thesis needs data on previous decades for a complete analysis. The 2011 UNDP report was chosen because it contains data starting from the 1970s, which was gathered from national statistics bureau that did not have this data publicly available.

All things considered, it can be claimed that all of the data acquired has allowed to characterize the many dimensions of social capabilities in accordance with the framework. The validity of the data is confirmed, since the World Bank database presents the most current and accurate global development data available, and it offers the largest time availability for the countries selected for this study. The databases that it offers are formed with data coming from officially recognized international sources, such as UNESCO Institute for Statistics, World Intellectual Property Organization and International Monetary Fund.

4. Methods

This thesis will provide an empirically supported narrative guided by the social capability framework, that reflects the institutional and structural changes that account for the level of technology capability in modern-day Arab countries. This analysis echoes the analytic narrative approach of Andersson et al. (2021) and Andersson (2018) in the sense that this study, through countries' narrative, attempts to understand the puzzling aspects of the building of technology capability. This approach was designed in relation to the theoretical framework and aim of the study. A panel data regression was not considered suitable for this research, since the number of available data and countries is rather limited, and the purpose of this study is not that of establishing a direct causality but rather that of examining a correlation between social capability and the development of technology capability in Arab countries. In addition, this mixed method approach allows for a greater attention to description and detail, and it enables for a comprehensive dialogue between theory and evidence, which will facilitate better grounded conclusions as well as a theoretical discussion of the facts.

Hence, the aim is to examine the data to see whether the theory proposed by previous research is consistent with what can be observed in the Arab region. Moreover, the study will employ a comparative approach, which will offer a better understanding of the topic by the means of comparing it to other meaningful cases (Bryman, 2012 p.72). East-Asia in fact will be used as an element of comparison to examine certain features of the economy of Arab countries. An empirical relevance has motivated the choice of comparing these two regions and this has been mentioned throughout the study's earlier sections. The time period that will be taken into consideration is between 1980 and 2018, because it will allow to graphically visualize the similar conditions of the two regions in the 1980s and the beginning of the divergence in the following decades.

5. Empirical Analysis

This Chapter presents the empirical research carried out in this paper and it is divided into two main subsections. The analysis will be started with a close examination of Arab and East Asian countries performance in terms of technology capability. Secondly, the paper will examine the social capabilities indicators presented above. The last section of this chapter will turn to investigate the research question and delve into the potential relationship between social capability and technology capability.

5.1 Technology Capability

5.1.1. Scientific articles

Figure 3 shows a disappointing performance in terms of scientific and technical journals published. The number of published articles from the Arab World was low in the earliest decade of the 21st century, but showed an increase in the recent decade. Egypt in particular has demonstrated the highest research output of the region, with 13326 publications in 2018, followed by Tunisia (5564), Algeria (5231), Morocco (5056) and Jordan (2627). This is because, in comparison to other Mediterranean countries, Egypt employs more researchers and academic personnel in the public sector, as well as researchers in government, industry, business, and non-profit organizations (Nour, 2005).

However, when compared to other regions of the world, such as East Asia, it can be noticed that the total number of scientific articles is still very low in Arab countries. Noland & Pack (2007) compared their journal output with that of the rest of Africa, in spite of a much lower level of tertiary and science enrollments in the latter.

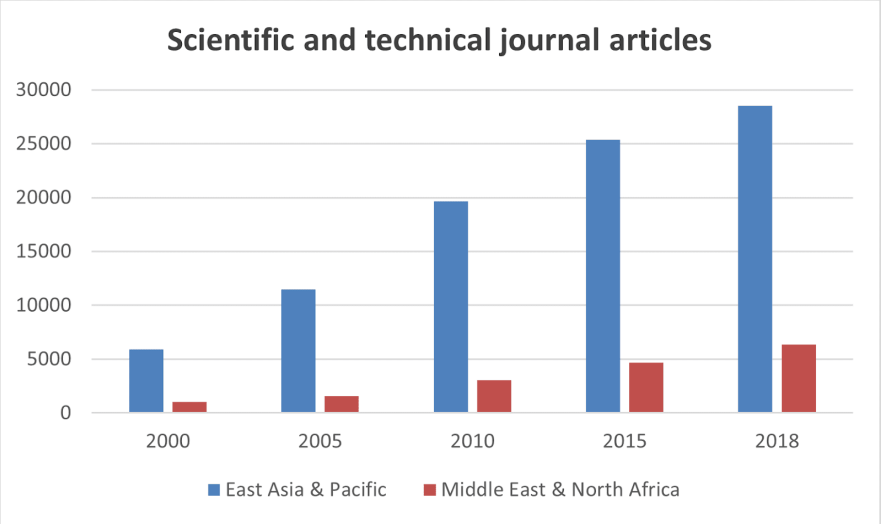

Figure 3 – Scientific and Technical journal articles

Source: Author's elaboration with World Bank Development Indicators data (2022)

5.1.2 Patent applications

When it comes to patent applications, Figure 4 shows the extremely low number of patent applications in the Arab region. This can be interpreted as an indicator of weak transfer of technology and low innovative activities, that is an inadequate application of knowledge and research outcome to innovation. Also in this case, Egypt is the best performing country with the highest number of patent applications from residents (997), followed by Morocco (187), Tunisia (180), Algeria (152) and Jordan (24). The contrast with East Asia is particularly remarkable, since in this region patent applications have been steadily increasing since the 80s. On the other hand, this positive trend has been completely absent in the Arab region.

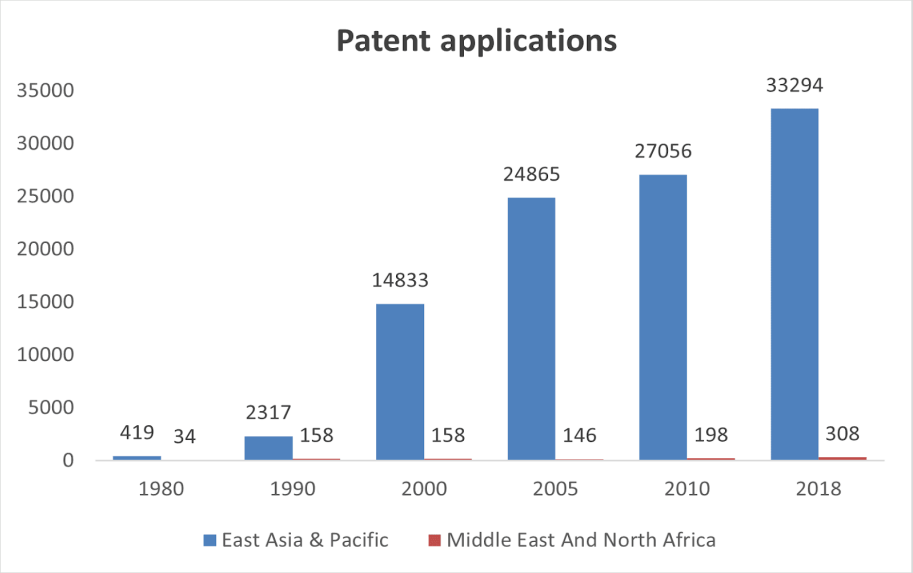

Figure 4 – Patent Applications

Source: Author's elaboration with World Bank Development Indicators data (2022)

5.1.3 R&D expenditure

When it comes to the final indicator, Figure 5 confirms as well the poor performance of Arab countries in terms of technology capability. Despite slowly improving their expenditure on research and development, Arab countries are still behind when compared to East Asian economies. The latters were already making huge progress in the late 90s, reaching almost 2% of GDP expenditure on R&D in 2016, and East Asia as a region has outspent every region on R&D over the last decade (Brahmbhatt & Hu, 2010). On the other hand, data shows that the Arab World has failed to achieve 1% of GDP spending on R&D, lagging significantly in private investment in R&D (Farjani, 2002). Arab countries have some of the lowest levels of research funding in the world and several problems affect R&D in the region, such as the fact that R&D is not part of well-defined and coherent national research strategy and research lacks a solid foundation of basic science from which to draw (Fergany, 1999).

This indicator can already offer a first explanation for the low level of both publications and patents in both Arab regions compared to advanced Asian economies: their low level is in part due to the extremely low investments in R&D over the last decades, which is rather stagnating.

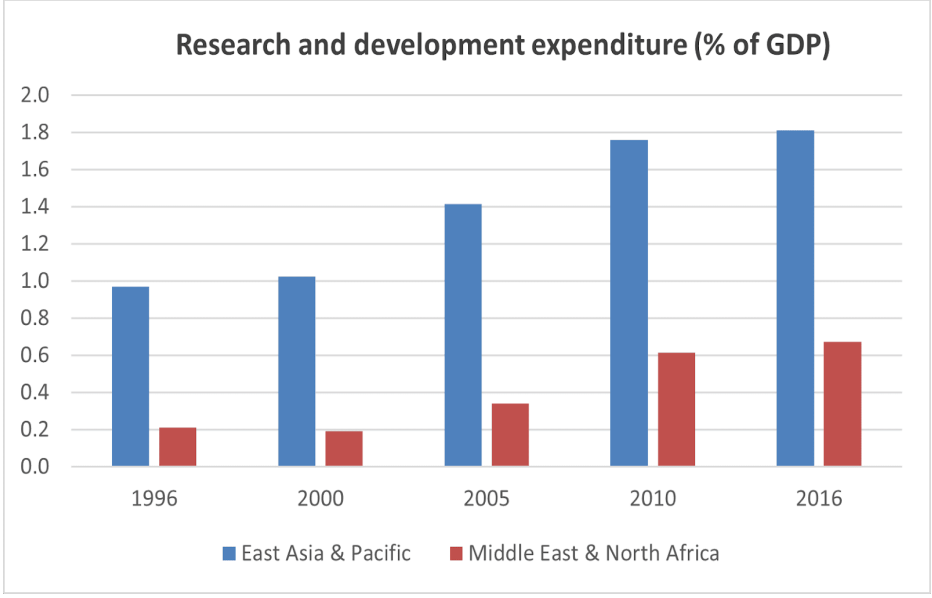

Figure 5 – Research and Development Expenditure (% of GDP)

Source: Author's elaboration with World Bank Development Indicators data (2022)

5.2 Social Capability

5.2.1 Accountability

5.2.1.1 Infrastructure

In terms of quality of infrastructure, Figure 6 shows that East Asian countries have been performing well, whereas Arab countries have not neither reached a satisfying level nor improved over the past decades. Lack of quality and cost-effective transport services, long shipping times, obstructive bureaucracy, and inadequate trade services exacerbate infrastructure problems in North Africa (Sufian & Moise, 2010).

Data on 2018 show how they have worsened in terms of quality of infrastructure compared to the previous years. A reason for this kind of pattern was offered by Chhibber et al. (1992), who argue that infrastructure investment does not always follow a steady trend. They prove their case by showing how Arab countries often rely on external aids to finance such investments, since they have low savings rates and access to international capital markets, which makes their capacity to invest limited unless it is supported by another external finance. The main issue is that the varying levels of these external aids can alter the trends on the quality of infrastructure.

When comparing with the average performance of East Asia, policy-makers in this region have seen infrastructure investment as an essential determinant of development and are centered on plans for greater integration of transport and energy markets (Straub et al., 2008). Their experience suggests that the combined effect of trade liberalization and a supportive trade-transport chain has contributed to create a virtuous cycle of lower costs, increasing trade volume, and higher efficiency in distribution and production activities (Devlin & Yee, 2005). All this has contributed to attracting foreign direct investments, which are one of the main channels to increase technology inflows and the countries' technology capability (Devlin & Yee, 2005).

Figure 6 – Competence and quality of logistic services

Source: Author's elaboration with World Bank Development Indicators data (2022)

5.2.1.2 Government Expenditure on education

Figure 7 shows that government expenditures on education are higher than in East Asia, and this could be also justified by the higher tax revenues that will be presented in the next section. Expenditures on education have followed a similar trend in both regions in the past decades and in 2018 they reached a similar level, with Arab countries spending 4.5% of GDP on education and East Asian countries spending 3.5% of GDP.

Arab countries spend more public resources on education than any other region in the world: however, the outcome in terms of human resource development is one of the poorest (Akkari,

2004). In particular, the education system is suffering from low quality. The education system has been pressured in the last years because the number of students has increased far more rapidly than the educational facilities (Shafik, 1994). Most countries responded to the pressures to raise the capacity of the social sectors by accommodating the increased quantity at the expense of quality (Shafik, 1994). Education suffers from poorly designed curricula, lack of facilities and low quality of teacher training, which is also influenced by the low salaries conferred to teachers, who are obliged to look for other jobs that consume their energy and limit the amount of time they can dedicate to students (AHDR, 2003).

Further problems have been highlighted by Noland and Pack (2007). They pointed out that in international tests in mathematics and science, - which are the main subjects that confer adequate skills to future workers for the development of technology - Morocco and Tunisia had scored the lowest in both disciplines. Moreover, they underlined how no Arab university ranked among the top 200 and the lack of peer recognition indicates that Middle Eastern academics are rather isolated from world intellectual developments, which is also confirmed by the low level of scientific journals published.

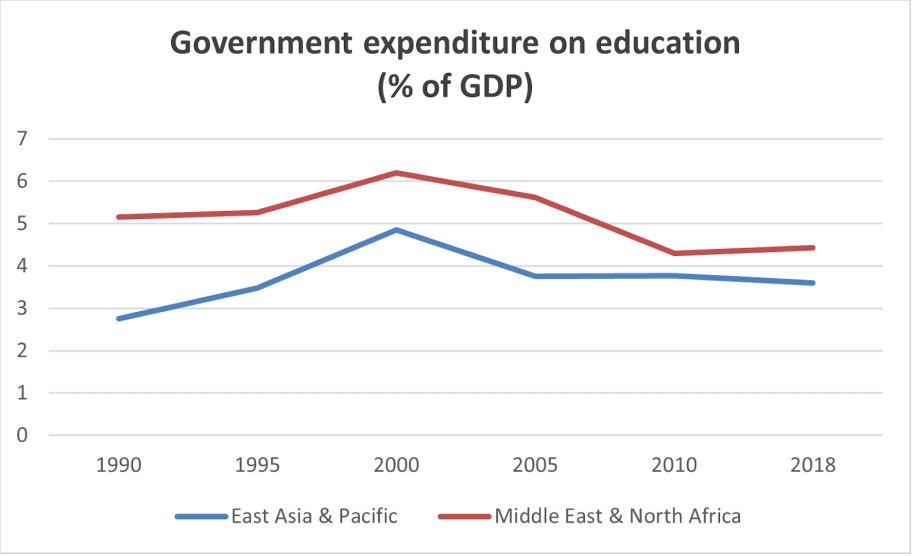

Figure 7 – Government Expenditure on Education (%of GDP)

Source: Author's elaboration with World Bank Development Indicators data (2022)

5.2.1.3 Enrollment in tertiary education

Figure 8 shows a rising enrollment ratio in tertiary education, both in the Middle East and East Asia, with the latter going over 50%. However, despite an increase of 30% in enrollments in tertiary education in Arab countries, the connection between education and market demands is still lacking and higher education investments were not matched by higher R&D fundings. Schools, specifically primary and preparatory levels, do not produce marketable skills, which has led to high unemployment rates among this group (Tuma, 1987). In fact, while education in developed countries focuses more on natural sciences and technology, education in developing countries tends to emphasize humanities and social sciences (Tuma, 1987).

A different scenario is present in East Asia, where countries have invested mainly in programmes relating to physical sciences, engineering, electronics, and computing (Marginson, 2014). This type of education has contributed to the shifting of the economy from a labor intensive to a technology based one (Shin et al., 2015).

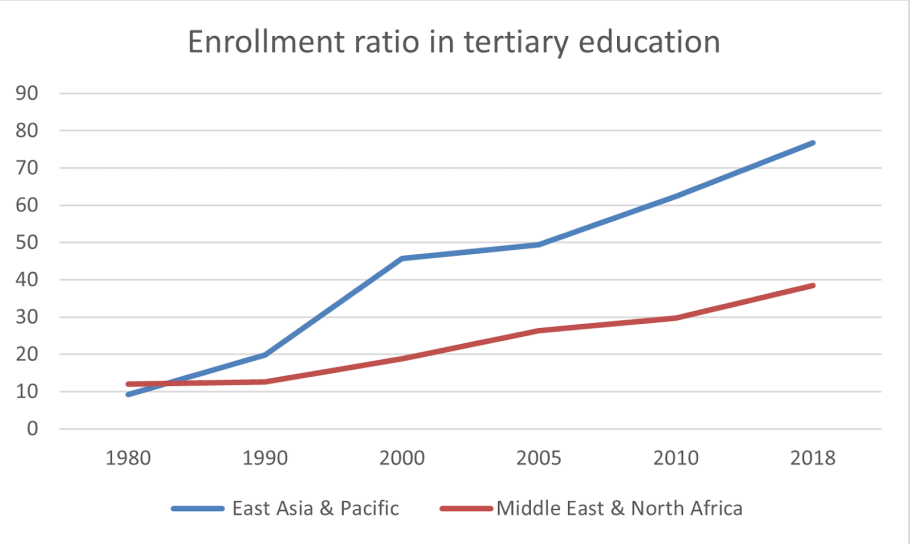

Figure 8 – Enrollment ratio in tertiary education

Source: Author's elaboration with World Bank Development Indicators data (2022)

Moreover, as mentioned above, the mismatch between educational outcomes and market demands is causing a steady increase in unemployment for higher education graduates. The contrast with East Asia is significant also in this case, with Figure 9 showing that in the past two decades unemployment for people with advanced education has ranged between 2.5 and

4% of total labor force with advanced education, whereas in the Middle East it has ranged between 10 and 27%. Figure 10 contributes in confirming that the Arab labor force without diplomas has suffered from lower unemployment rates than workers with advanced education, with values ranging between 6 and 14%. These high rates of unemployment are worth to be highlighted, because the following sections will describe how they contributed to the spread of dissatisfaction in the population, which has been a threat for social stability.

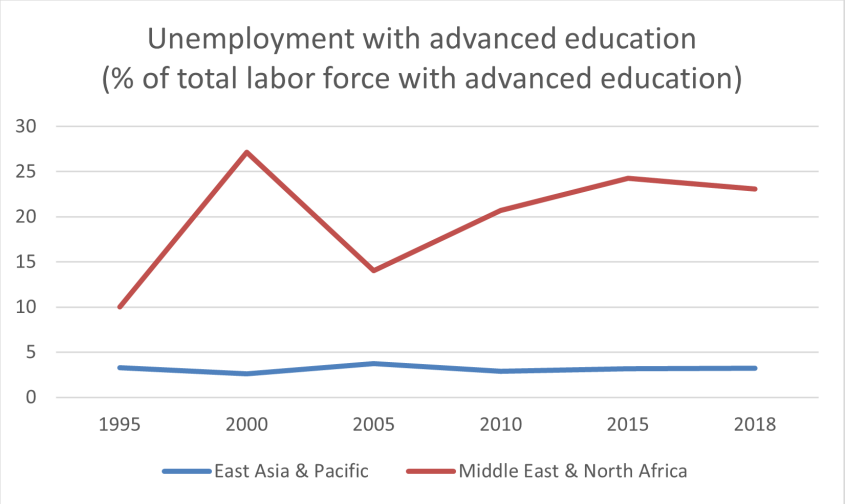

Figure 9 – Unemployment with advanced education (East Asia & Middle East)

Source: Author's elaboration with World Bank Development Indicators data (2022)

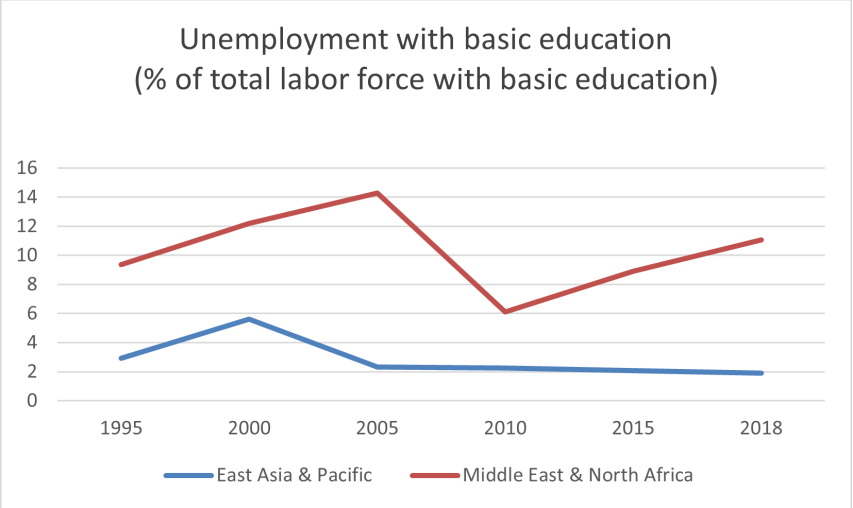

Figure 10 – Unemployment with basic education (East Asia & Middle East)

Source: Author's elaboration with World Bank Development Indicators data (2022)

5.2.2 Autonomy

As previously stated, autonomy was analyzed by looking at tax revenues. Figure 11 illustrates how tax revenues are higher in Arab countries than in East Asian countries, constituting about 19 and 14% of GDP respectively.

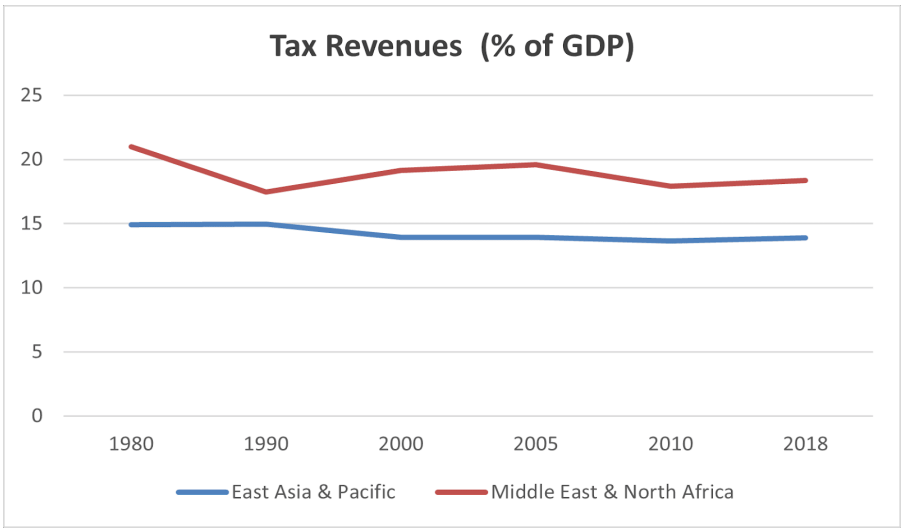

Figure 11 – Tax revenues (% of GDP)

Source: Author's elaboration with World Bank Development Indicators data (2022)

Higher tax revenues in the Middle East have been possible through reform programs of the tax system, with Egypt, Jordan, Algeria and Morocco establishing a function-based, integrated tax administrations since the early 1990s; but also through social security contributions. For instance, social security schemes in Morocco and Tunisia are modeled on the French system and cover a wide range of social security benefits, and these contributions increased tax revenues significantly (OECD, 2021). This type of taxes play a less significant role in East Asia and Pacific Island, where tax burdens at a regional scale are among the lowest in the world (Martinez-Vazquez, 2011). This is because there are very low levels of social contributions, and the personal income taxes are still at an infant stage (Bernardi et al., 2005). The advantages of a low tax–GDP ratio include a more business-friendly environment and higher foreign direct investments, while disadvantages include possible lack of resources to provide adequate public services, including those for building human capital: however, as shown in the previous section, this was not the case, meaning that resources have been allocated efficiently.

5.2.2.1 Corruption

As stated in Chapter 2, what is mostly important about tax revenues is how this money is used. Figure 12 illustrates the low level of transparency of the public sector in the Middle East, which might explain why these tax revenues have not been adequately used to invest in infrastructure and health.

According to Leenders & Sfakianakis (2002) corruption pervades several domains of the public sector, including the economic, administrative and political one and it is mentioned as one of the reasons behind the 2011 uprisings. MENA countries face corruption due to several factors, such as the lack of viable political and judicial institutions, as well as the prevalence of authoritarian rule, which favors corruption at both the public and private levels and hamper transparency in the bureaucracy, which is vital in the design and implementation of developmental activities (Leenders & Sfakianakis, 2002). For instance, Jreisat (2006) concludes that the Egyptian bureaucracy is a serious impediment to the country's economic and social progress, and he presents a similar scenario for Jordan, claiming that "no achievement in planning and socioeconomic reforms is possible, if the administrative structure required to implement them is undeveloped and without incentives".

Several measures were adopted in the past years to reduce corruption. Algeria, Egypt, Morocco and Tunisia have implemented self-assessment procedures, which reduce contacts

between taxpayers and tax officers and opportunities for negotiation. Both Jordan and Morocco have significantly modernized their customs procedures to reduce corruption opportunities, for instance by simplifying clearance processes and conducting selective post-clearance audits (Imam & Jacobs, 2007). However, these measures might have not been enough, since the data shows a worsening of the transparency in the public sector rather than an improvement.

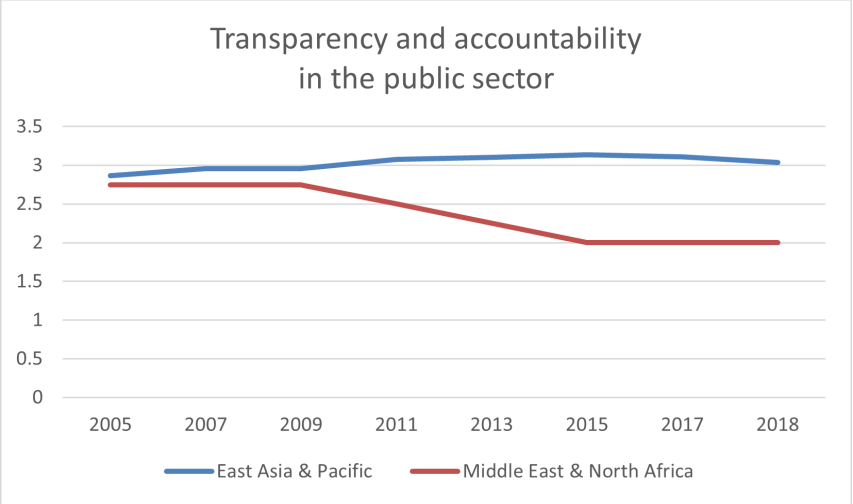

Figure 12 – Transparency and accountability in the Public Sector

Source: Author's elaboration with World Bank Development Indicators data (2022)

5.2.3 Transformation

Structural transformation was a major contributor to the Asian growth miracle (Andersson & Axelsson, 2016). Resources were reallocated from agriculture towards manufacturing, and within the latter, a significant movement occurred away from labor-intensive lines of production that used little modern technology toward capital-intensive branches that required a higher level of technological sophistication (Alcorta et al., 2021 p. 2). However, starting already from the 90s, there has been a considerable labor transition from the agriculture and industrial sector to the service sector, which is currently accounting for the majority of the share of employment and output (see Figure 13).

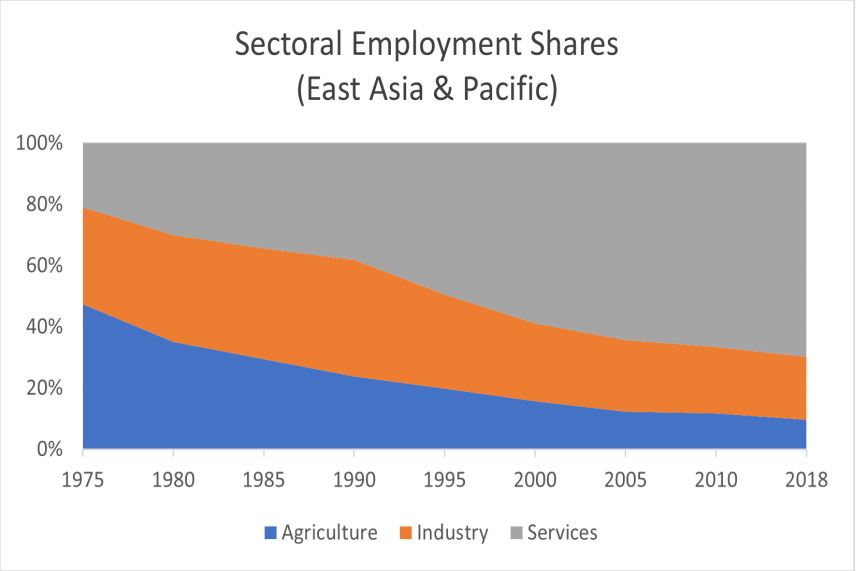

Figure 13 – Sectoral Employment Shares in East Asia & Pacific

Source: Author's elaboration with World Bank Development Indicators data (2022)

A similar scenario has been occurring in the Middle East, where countries have transformed into economies that depend strongly on imports and the services sector. There has been a 20% decline in the employment in agriculture, a labor transition into the service and industrial sector, although the labor force in the latter never reached Asian levels (see Figure 14).

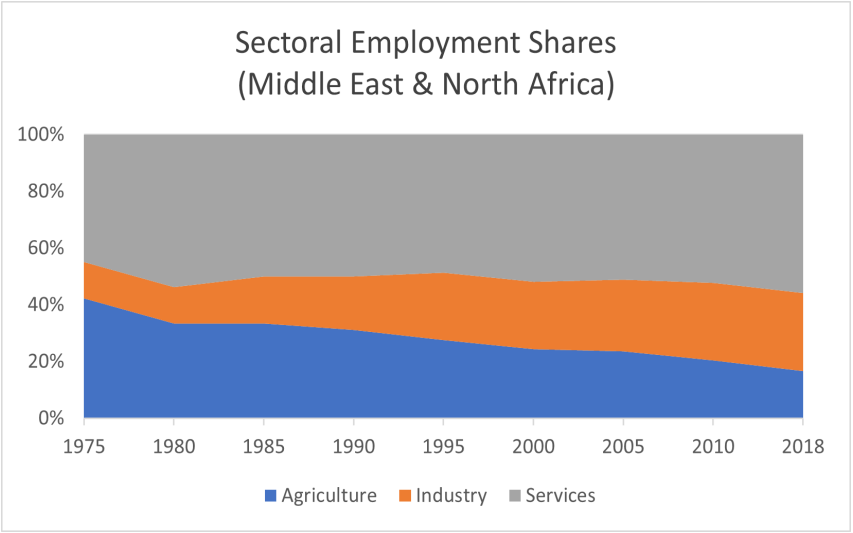

Figure 14 – Sectoral Employment Shares in Middle East & North Africa

Source: Author's elaboration with World Bank Development Indicators data (2022)

Van Ark & Timmer (2003) argue that the decline in the share of manufacturing employment is common when per capita income rises beyond a certain level and deindustrialization is a natural result of varying productivity growth rates across industries.
The same reasoning, however, cannot be applied for the Arab region. The trend shown by Arab countries is that of a *premature deindustrialization*. This term was coined by Rodrik (2015), who underlines how developing countries are turning into service economies without having gone through a proper experience of industrialization. The decline in the relative price of manufacturing in the advanced countries, together with the transformation of the manufacturing into a skill-intensive sector, put pressure on manufacturing everywhere, including those countries that have not experienced much technological progress (Rodrik, 2015).

The Middle East, in fact, is the least industrialized region of the world (UNDP, 2011). The region lacks a labor force who has the adequate education and training required of industrial workers, and industry has not yet been sufficiently established and diversified to enjoy the full benefits of cumulative growth, for example linkages and external economies. The secondary sector suffers from the backwardness of other sectors of the economy, such as transportation, power and agriculture, which often supply industries with insufficient or deficient goods or services, increasing costs and lowering the quality of their products (Issawi, 1980). This issue is particularly pressing, since, as stated in Chapter 2, manufacturing is important because it is where most of the innovation takes place.

A final note should be given on the agriculture sector. Although the latter gives a limited contribution to GDP (about 15% in 2018), the sector continues to employ around 20% of the population: this reflects the technological stagnation of the sector, which leads to a relative decline of the productivity per person of the sector (UNDP, 2011).

5.2.3.1 Economic Complexity

Further issues affect the configuration of Arab industries, such as the structure of their specialization, which focuses on the production of lower value-added petroleum related products and food, chemicals, rubber and plastic products (UNDP, 2011). This can be confirmed by taking a closer look at the technology content embodied in manufactured production for foreign markets and the economic complexity, as they reveal the degree to which advanced technologies are actually mastered.

The Observatory of Economic Complexity uses an Economic Complexity Index, whose values range usually between -2 and 2. Table 3 shows the extremely low level of knowledge intensity of Arab economies and products (see Table 3).

Region	1998	2000	2005	2010	2015	2018
East Asia & Pacific	-0.054	0.264	0.796	0.996	1.214	1.316
North Africa & Middle East	-0.708	-0.508	- 0.568	-0.38	-0.372	-0.366

Table 3 – Average economic complexity index & Country Rankings

Source: Author's elaboration with OEC data (2022)

When it comes to exports, Figure 15 reveals the sharp contrast between the Middle East and East Asia in terms of high-technology exports, with the latter representing between 35 and 45% of total manufactured exports in East Asia, and between 1 and 4% in the Arab region. In East Asia, new production was developed in manufacturing industries employing skills and capabilities easy to transfer from existing industries. This high connectivity between sectors allowed undertaking a gradual yet systematic transition towards higher value-added activities, especially those requiring similar technology and production techniques (Fortunato & Razo, 2014). By contrast, economic specialization in industries that are relatively far from high value-added products has been a feature of Arab countries, resulting in a lack of connection in their export profiles. Traditional industries continue to dominate the creation of industrial value added in the Arab world, and the types of services available in the region - travel and transport, as opposed to the more vibrant communications and financial services - occupy the lowest links in the value chain and contribute little to the development of local knowledge (Al-rubaie, 2020).

Figure 15 – High Technology Exports (% of manufactured exports)

Source: Author's elaboration with World Bank Development Indicators data (2022)

5.2.4 Social Stability

Figure 16 shows how political upheavals and military conflicts have been a constant in Middle Eastern countries, contributing to the continued deterioration of the business environment that is necessary for an economy to prosper (Allard et al, 2012).

5.2.4.1 Before the Arab Springs

The graph shows that the highest number of conflicts occurred between the 1990s and the beginning of the 21st century, and they have taken place mainly in Algeria and Egypt. Starting from Algeria, when an Islamist political party (FIS) won the majority of the votes in the parliamentary elections held in 1991, the Algerian army staged a coup and cancelled the second round of elections, which led the country into a large-scale intrastate conflict that continued into the 21st century (UCDP, 2022). When it comes to Egypt, between 1993 and 1998 the Government of Egypt has been challenged both by Islamist rebel groups, such as the Al-Gama'a al-Islamiyya, within its territory, and by conflicts occurring in other states, such as Kuwait's interstate conflict with Iraq (UCDP, 2022).

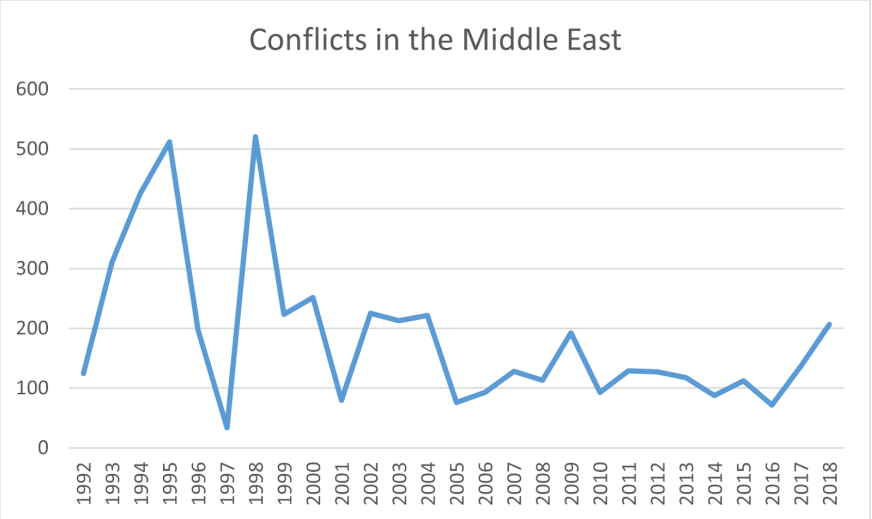

Figure 16 – Conflicts in the Middle East

Source: Author's elaboration with UCDP *data (2022)*

5.2.4.2 The Arab Springs

The economic environment was furtherly worsened by the Arab springs of 2011. Caused by the discontent towards persistent inequality and the rising unemployment highlighted above, these protests have created a fragile economic environment and have negatively affected the macroeconomic stability of the region, causing a decrease of foreign direct investment and exports and an increase of the public debt (Arayssi et al., 2019). Figure 17 clearly illustrates how the instability of the region, together with the other factors presented in the previous sections, have not made the Middle East a suitable region for FDI, whose levels have been considerably far from the ones of East Asia since the 1990s. FDI are important for the development of technology capability because they constitute a channel for technology diffusion. East Asian countries have been able to exploit this channel for the absorption of technology from abroad, which is the starting point for a country that seeks to improve its technological innovation levels (Brahmbhatt & Hu, 2009).

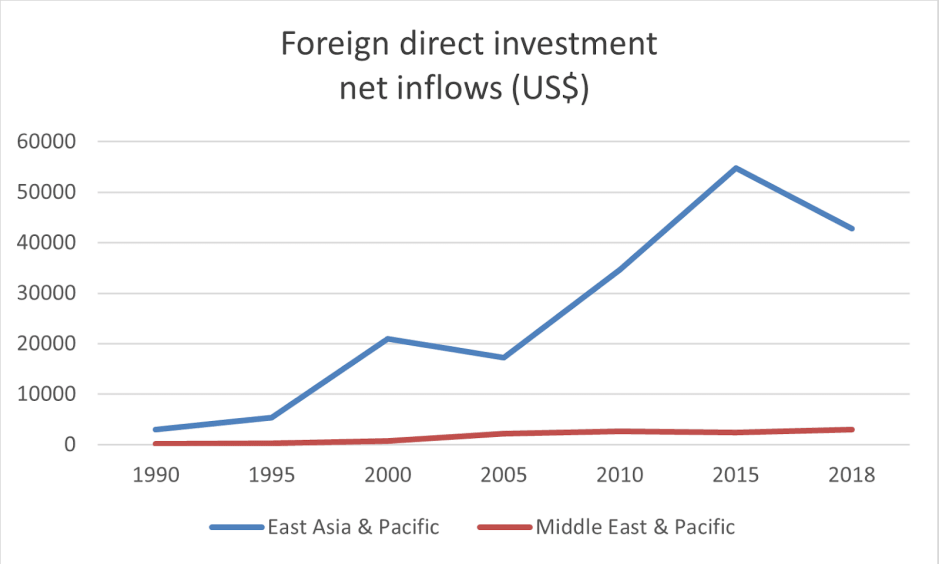

Figure 17 – Foreign direct investment, net inflow (US$)

Source: Author's elaboration with World Bank Development Indicators data (2022)

5.2.4.3 After the Arab Springs

Despite a significant reduction of the number of conflicts compared to the 1990s, the region is still experiencing more frequent and severe conflicts than any other part of the world, with more than 200 conflicts widespread in the selected Arab countries in 2018. The spread of conflicts has led to an increase in military spending in the MENA region over the period 2011-14, which has driven resources away from more productive purposes such as R&D (Rother et al, 2016).

Ali (2020) highlights how in the post-Arab Spring period, violent non-state groups, such as the Islamic State of Iraq and the Levant, have emerged as significant political and military actors, representing a threat to the Arab states at the levels of structure, sovereignty and control over territory. In addition, the MENA region is suffering from a refugee crisis that is straining the economy and the social systems. Large numbers of refugees, weak confidence and security, and declining social cohesion are all factors undermining the quality of institutions and their ability to undertake much-needed economic reforms (Rother et al., 2016).

Deep uncertainty about the future of many of the region's political regimes also contributes to the instability in the region. Morocco and Jordan are monarchies of a long historical duration and liberalism; others such as Algeria, Tunisia are authoritarian states with security services

representing their core; and Egypt combines both authoritarian and dynastic tendencies, and the current leader, Abdel Fattah al-Sisi, sized power with a military coup (Noland & Pack, 2007). Alesina and Perotti (1996) argue how, unlike democracies, these regimes are not associated with stability, but rather with socio-political instability and uncertain economic environment, which in turn raises the risks for investment. These traditional governing systems have also proven incapable of adapting to meet increasing domestic demands and rising economic and technological challenges (Jreisat, 2006).

All of the conflicts and political and economic uncertainty highlighted above are causing the escape of a large part of the population from their countries, and a report from the International Monetary Fund (2016) highlighted how a large proportion of refugees are skilled workers, representing a significant brain drain for these countries. This has a significant negative impact on origin countries since it removes the very people who can contribute in boosting economic growth by developing local productive capacities.

5.2.4.4 Social Stability in East Asia

An entirely different scenario is present in East Asian countries, where social stability and order have been at the foundation of the growth model pursued by these countries (Lin & Wong, 2013). This higher social stability can be explained by the spread of Eastern values, based upon the teachings of Confucius and which are considered superior to Western values for the realization of an orderly society (Kim, 1997). Confucian values advocate for the abidance to the tradition, for the respect of the authority, and for the priority of the society over its individual members, which are considered indispensable factors for achieving an orderly and moral society (Kim, 1997).

The only exception is constituted by Thailand, which since 1989 has experienced episodes of violence. However, the conflicts in the country are not a strong factor for loss of investments or significant slowdown in economic growth, since they occur in subnational conflict areas, which are usually relatively isolated peripheries and too distant to arouse widespread indignation (Aziz & Sundarasen, 2015).

5.3 Discussion

In this section the results and their implications will be discussed. Through the use of a descriptive and comparative approach, the thesis assesses that the Arab region performs poorly in all the indicators of technology capability, and this is confirmed by the low progress

trend in terms of scientific and technical journal articles over the period 2000–2018, R&D expenditure over the period 1996-2016, and patents between 1980 and 2018.

Moreover, this study also finds that not only is there a technology gap between the Arab world and East Asian countries, but also that this gap is growing. This is because, while East Asian countries have been improving in all indicators of social capability, the same did not happen in the Arab region, contributing to the increase of the gap. Stagnation has been particularly noticed for the levels of corruption, the share of employment in industry, high-technology exports and quality of infrastructure.

By comparing the developing economies of the Middle East with the more technologically advanced countries in East Asia, it is possible to derive lessons from the economic history of the latter and apply them to the analysis and policy making in the former. It was illustrated that the success of East Asian countries in terms of technological advancement was favored by their level of education, industrial production capacity, and an environment favorable to innovation. On the other hand, Arab countries performed badly in all these indicators.

Concerning accountability, the analysis focused on the allocation of public spending, which has shown that in all Arab countries not only is there a lack of financial and human resources for the development of technology capability, but also a serious problem with regard to the quality of higher education and of infrastructure. The lack of adequate human capital and the low quality of education can explain the absence of a significant number of scientific published papers in Arab countries, and, together with the poor infrastructure, also their low absorptive capability. Moreover, the education system promotes disciplines, such as social sciences, which fail to prepare Arab students to adapt to a world of rapid technical change. Considering this, Hypothesis 1 is confirmed, that is the quality of infrastructure and the promotion of relevant education are associated with a better performance in terms of technology capability.

Despite having made considerable progress in human development in the recent decades and despite the abundant resources given to education, the performance and the quality of education in Arab countries is still poor when compared to other parts of the world (Akkari, 2004). The East Asia educational systems can serve as a model because they successfully shifted their focus along with structural changes in the economy, that is they enabled workers to acquire the skills to adopt technology and to develop new processes and products. The

statistics on education enrollment testified the lead of East Asia in terms of an upgrading of the labor force to facilitate a more effective absorption of new technologies.

The analysis of the indicators for the State's autonomy showed that, despite benefiting from higher tax revenues, the persisting corruption in Arab countries has led to a mismanagement of resources. Corruption is rooted in the actions and behaviors of public servants, with self-enrichment interests replacing development policies as the main focus of their attention. This has deprived Arab markets of much needed funds and impeded initiatives for technology development throughout the Arab world. Consequently, this has allowed to confirm hypothesis 2, that corruption in the public sector negatively influences the formation of technology capability.

When it comes to transformation, data on Arab countries has shown that the latter did not imply a transfer of labor-force from agriculture to the emerging manufacturing industry, but to the service sector. Moreover, although the economic complexity of Arab countries did not decrease, it also did not improve significantly, which means that countries might be undergoing a premature deindustrialization. Therefore, the region has suffered from an incomplete structural transformation, and this limited industrialization and the restricted change in product or sectoral composition represent a constraint for technology inflows and the development of the region's technology capability. According to the theoretical framework, this lack of activity in the manufacturing sector can explain the lack of innovative capability and technological advance.

Unlike Middle Eastern countries, successful East Asian countries have progressively changed their production structure, substituting low value-added goods with more sophisticated activities and a wider range of products. Accordingly, Hypothesis 3 is confirmed as well, that is to say a successful structural transformation leads to a higher development of technology capability.

Finally, based on a description of events and supported by quantitative data, the thesis determines that Hypothesis 4 is confirmed. The presence of a socially and politically unstable context, together with corruption, is deteriorating the business environment of Arab countries, discouraging the general willingness to invest and disrupting trade, which are all channels that could introduce and diffuse new technology. Moreover, the increase in military spending is driving resources away from more productive purposes such as R&D. Uncertainty about the political environment, combined with the inability of the government to provide jobs for

the increasingly large youth population, is fueling the migration of the educated labor force towards Europe and America. The escape of graduates results in obstacles in sectors critical to the structural transformation of origin economies - that is lack of skills in industry, medicine, IT and other strategic fields - and it also worsens even more the differences between origin and destination countries, widening the already existing technology gap. The escape of educated students contributes to explain the low level of patent applications.

Overall, the indicators studied here suggest that different levels of social capability might offer an explanation for the different level of development of technology capability in the two examined regions. Therefore, returning to the research question, it can be claimed that the social capability framework is able to explain the low level of technology capability of Arab countries and, consequently, the technology gap with East Asia. Consequently, the results reached in this paper give strong support for the theoretical perspective outlined in chapter 2.

6. Conclusion

This closing chapter will summarize the main findings of this thesis and discuss implications for future policy choices.

6.1 Results

The research question focused on to what extent the conceptual framework of social capability developed by Abramowitz (1995) is able to explain the technology gap between East Asia and the Middle East, and specifically the low development of technology capability in the latter. The framework was built on the premise that a country's economy requires a strong and diverse set of social, political, and economic organizations in order to develop technology capability, and subsequently achieve sustained economic growth. To sharpen the comparative perspective, the experience of the Arab region was contrasted with empirical findings on East Asia.

First and foremost, the thesis concludes that the social capability approach has proved to be a useful framework to explain the weak technology capability of Arab countries. A connection between the level of technology capability and the level of social capability was confirmed in both Arab and East Asian countries. Education expenditure, quality of infrastructure, social stability, tax revenues and the advancement of the industrial sector are all key elements for the development of technology capability and for the achievement of a sustained economic growth. East Asian countries showed a good performance in all these indicators, which allowed them to develop an efficient organizational context to disseminate and produce knowledge, favoring their technological progress.

Moreover, the results establish that the technology gap in the Arab region compared to East Asia coincides not only with substantial gaps when it comes to social capability, but also with poor and slow progress in social capability-related indicators. The empirical research has helped in visualizing what was already discussed in the introduction, that is the similar conditions for some indicators in the 80s, especially corruption, enrollment in tertiary education and patent applications. However, while East Asia was able to steadily improve in all indicators, Arab countries showed poor and slow progress, which means that they failed to use their income to build the human capital through investments in high-quality and relevant education and in R&D

The opposite scenario was observed in Although the thesis finds theoretical support for the positive influence of each social capability on the development of technology capability, it must also be remembered that the presence of missing data and difficulties in the data collection process in the selected countries were sources of limitations, which might decrease the validity of the results.

6.2 Practical Implications

Overall, lessons and policy recommendations can be extracted from the Arab experience. Firstly, efforts should be put into strengthening States' autonomy to direct resources towards sectors that are crucial for technology development, that is education, industrial sector and infrastructure. To narrow the technology gap, Arab countries need monitoring, coordination and guidance of the processes of developing and applying technology in the region. They need access to new and emerging technologies, which requires technology transfer, technical cooperation and building a scientific and technological capacity to participate in the development and adaptation of these technologies to local conditions.

Moreover, they need to increase political support to invest heavily in education and R&D, create both financial and human resources, encourage private sector involvement, and improve social and cultural awareness concerning the importance of science and technology. In addition, at the regional level it is essential for Arab countries to work on an effective national and regional scientific and technological cooperation to motivate science and technology development and hence promote harmonious development in the region. Scientific cooperation should be encouraged also with the international community, in order to benefit from the experiences of the advanced Asian countries active in technology development. Finally, higher R&D efforts must be pursued, by favoring and facilitating the collaboration between research institutes and organizations in the region and by promoting research activities in the region.

The development of social capability will be crucial to develop technology capability and achieve sustained economic growth. *Social stability* and a reduction of intra and inter-states conflicts is important to attract FDI and reduce the escape of the educated labor force, which worsen the already low levels of human capital; policy-makers should also focus on the improvement of corruption and states' *autonomy*, which is fundamental to direct resources in the right channels for building technology capability; in terms of *accountability* Arab countries will need to increase investments in infrastructure to facilitate the diffusion of

technology, as well as investments in education, to build the human capital needed for assimilate and develop technology. In particular there is a need to match the supply of educated personnel with the specific demands and needs of the economy; finally, expanding investments that promote *structural transformation* and shift employment from low-value-added sectors to high-value-added sectors could be particularly beneficial for technology advancement.

This field remains an interesting and important area for further research as technology and innovation represent critical instruments for the achievement of competitiveness and economic development. Thus, finding what creates a strong technology capability has the potential of helping countries to close the technology gap with developed economies and to start a process of catch-up growth that will eventually transform them into high-income countries.

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Appendix A - Geographical Location of the Arab and East Asian countries selected

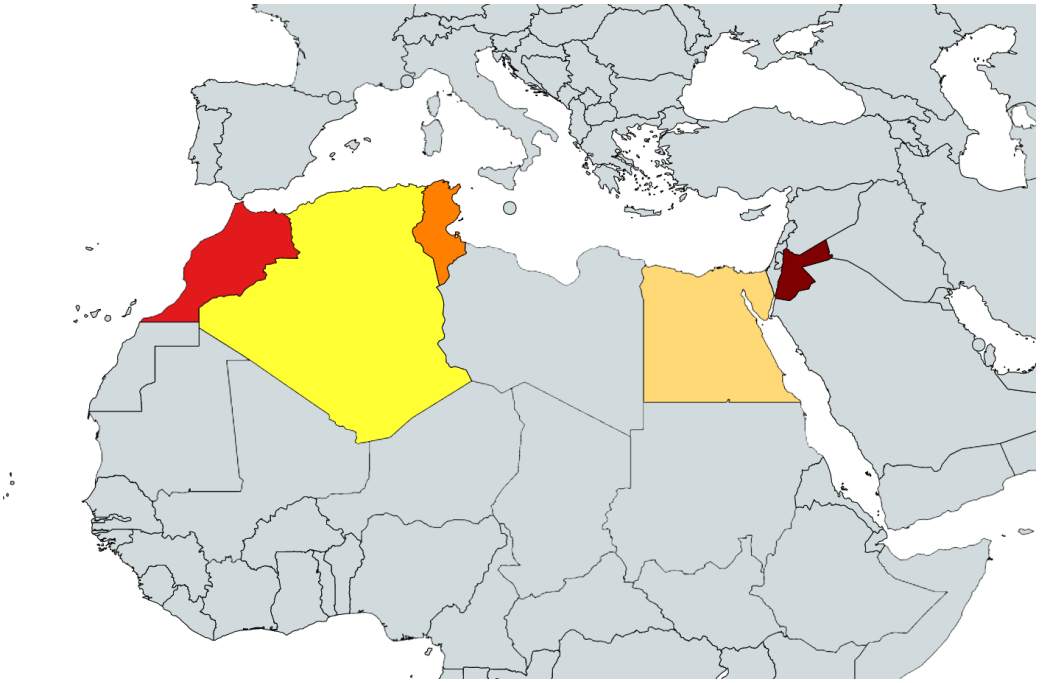

Figure 18 - North African and Middle Eastern Countries' location

Source: Author´s elaboration

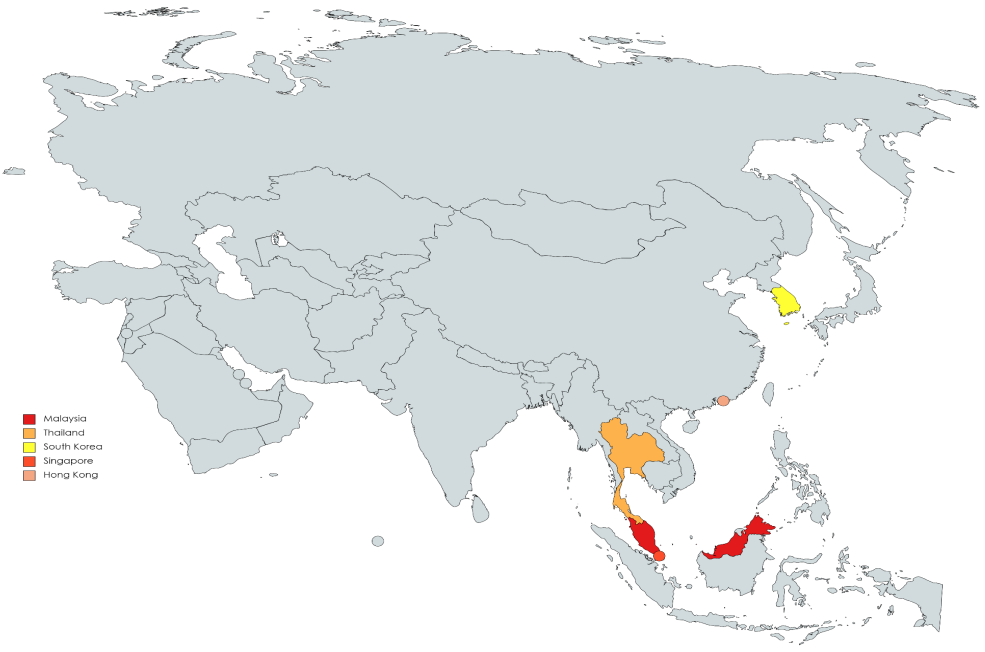

Figure 19 - East Asian countries' location

Source: Author´s elaboration