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A Study on Lebanon's Competitive Knowledge-Based Economy, Relative Strengths, and Shortcomings

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Abstract

Lebanon faces several social, political, and economic challenges delaying the efforts to develop a sustainable economy and inclusive society. The advancement of the knowledge economy is critical to the future economic prosperity of Lebanon. This paper aims to scrutinize the state of the knowledge-based economy in Lebanon, focusing on five pillars, such as education and human capital, entrepreneurship, innovation system, economic and institutional regime, and information and communications technology (ICT), and to present recommendations for future action. The methodology is based on semi-structured face-to-face and phone interviews with stakeholders using two questionnaires. The paper finds that the process of transitioning towards a knowledge-based economy in Lebanon is influenced by two contrasting factors: the education system and the entrepreneurship culture, on the one hand, and the country's political turmoil, on the other. Indeed, moving toward a knowledge-based economy in Lebanon is supported by its highly qualified and multilingual human resources, which is an outcome of the reliable educational system and reinforced by a robust entrepreneurial spirit. However, several issues, such as weak ICT infrastructure, incompetent public institutions, and the brain drain, hinder the transition to a knowledge-based economy. These results help clarify and critically analyze the present state of the knowledge-based economy in Lebanon, which has various policy implications.

Keywords Knowledge-based economy · Education · Innovation · Entrepreneurship · Economic and institutional regime · Lebanon

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Introduction

The concept of knowledge-based economy refers to the growing reliance of industrialized economies on knowledge, skilled labor, and innovation (OECD, 1996). Knowledge generation and use, inventing, and developing new products and services are becoming more critical for economic development, owing primarily to technological advancement and the relevance of human capital (Begg, 2003; Chen & Kee, 2005). One of the most often used definitions of the knowledge-based economy is that of Powell and Snellman (2004: 199), who defined it as: "… production and services based on knowledge-intensive activities that contribute to an accelerated race of technological and scientific advance as well as equally rapid obsolescence. The key components of a knowledge-based economy include a greater reliance on intellectual capabilities than on physical input of natural resources, combined with efforts to integrate improvements in every stage of the production process." Consequently, numerous governments, particularly in emerging and developing nations such as Arab countries, have made structural changes to diversify their economies and transform them into knowledge-based ones (Alnafrah & Mouselli, 2019; Ben Hassen, 2022a, b). Accordingly, numerous countries in the area have undertaken significant state-led investments in human capital for job creation, economic diversification, environmental sustainability, and social development (Schwalje, 2014).

Lebanon had a GDP of 21.8 billion USD in 2021 and a population of 6.8 million as of 2018 (World Bank, 2019, 2021a). Lebanon is a confessional democracy with political representation distributed among sectarian factions (Bayeh, 2017). Real estate, finance, and tourism have historically driven the Lebanese economy, which is free and open with limited government interference (Centre for Administrative Innovation in the Euro-Mediterranean Region, 2004; Leenders, 2012). Nevertheless, the economy has experienced a decline since the onset of the Syrian civil war in 2011. Consequently, Lebanon entered an economic recession in the last quarter of 2019 with a 10% GDP contraction (World Bank, 2019; World Food Programme, 2020b). According to the World Bank (2021a), the GDP decreased by 20% in 2020 and 9.5% in 2021, primarily due to currency depreciation and severe inflation. As a result, in 2019, the government was forced to default on its foreign debt for the first time.

Furthermore, in mid-March 2020, in response to the COVID-19 pandemic, Lebanon declared a state of emergency, with lockdown measures hampering economic activities and leading to increased unemployment and poverty, initiating a profound social and economic crisis (ILO, 2020). Besides, on August 4, 2020, a double explosion at Beirut's port caused widespread human and material damage and a nationwide economic impact. Multiple protests were staged to protest the government's delay and incompetence, which many believe caused the explosion. Consequently, on August 11, 2020, Lebanon's government resigned (Al Jazeera, 2020). During 2022, Lebanon's economic decline eased, although the general pattern and direction mainly remained identical. Real GDP declined by 2.6% in 2022, bringing the whole economic contraction since 2018 to 39.9% of GDP. By February 2023, the currency had lost over 98% of its pre-crisis value. In 2022,

inflation averaged 171.2%, one of the highest rates in the world, mainly owing to increases in food and non-alcoholic beverage costs (World Bank, 2023).

Therefore, Lebanon is under significant stress to bring a profound economic change to ensure sustainable economic prosperity and create jobs (World Bank, 2021a). In this context, the knowledge-based economy may help Lebanon's future development and job creation by leveraging human resources. It also promotes economic diversification and provides high-skilled employment, unlike the country's low-skill industries, such as tourism, construction, and agriculture (International Monetary Fund., 2017). In the years prior to the crisis, Lebanon's knowledge economy had proliferated, making it a rare success story for the country. In 2016, the knowledge economy was estimated to contribute around $403 million (UK Lebanon Tech Hub, 2016). Furthermore, several organizations and associations engaged in various activities, from education to entrepreneurs' support and funding, such as U.K. Lebanon Tech Hub, Kafalat, and SEED, were created to develop the knowledge economy (Ben Hassen, 2018).

However, the dynamics of the knowledge-based economy in Lebanon have not been extensively studied, leaving a substantial gap in the knowledge base needed to create effective policies. As a result, very little is known about the drivers, strengths, and weaknesses of Lebanon's knowledge-based economy. This lack of existing research is alarming as it hinders the ability of policy-makers to develop strategies that can facilitate the transition to a knowledge-based economy. Therefore, our paper fills an important gap in the literature by providing a comprehensive evaluation of the state of Lebanon's knowledge-based economy and identifying potential areas for improvement.

Several socio-economic factors may accelerate or slow the knowledge-based economy transition. For instance, despite several reforms in the Arab region, the knowledge-based economy's progress lags behind other areas, and significant challenges lie ahead (ESCWA, 2015a). Furthermore, due to issues such as high illiteracy rates, outdated educational systems, weak innovation systems, insufficient research and development (R&D) funding, and in certain instances, local cultural and legal impediments, many Arab governments' route to KBEs is a wishful headline (Hanafi & Arvanitis, 2015; Nour, 2014a, b). This shift is also hampered by weak governance and apathy towards social and cultural support factors (Nour, 2014a, b), inadequate public investment in education (Nour, 2014a, b), and weak investment in innovation and R&D (Hanafi & Arvanitis, 2015).

Indeed, the shift to a knowledge-based economy is fraught with several issues due to a lack of technical infrastructure and socio-economic conditions (Alnafrah & Mouselli, 2019), especially in developing and small countries such as Lebanon, given the difficulties linked to the economy's size. Several structural and positional issues might either help or impede the transition toward a knowledge-based economy. In Lebanon, the intricate interplay between education, culture, government policies, political instability, and entrepreneurship significantly influences the development of its knowledge-based economy. Our paper aims to explore these dynamics and shed light on the particular drivers, strengths, and weaknesses of Lebanon's knowledge-based economy. By doing so, we hope to contribute to developing effective policies that stimulate the growth and competitiveness of Lebanon's knowledge-based economy.

Accordingly, the purpose of this paper is to conduct an in-depth evaluation of the knowledge-based economy in Lebanon, with a specific focus on its competitive advantages and local constraints. To achieve this, the paper has three main objectives:

i) To examine the current state of the knowledge-based economy in Lebanon. This analysis will provide a comprehensive overview of the current state of Lebanon's knowledge-based economy.
ii) To identify the relative strengths and weaknesses of Lebanon's knowledge-based economy. The study will examine the five pillars of the knowledge-based economy: education and human capital, entrepreneurship, innovation system, economic and institutional regime, and ICT. By focusing on these pillars, the paper aims to provide a detailed understanding of the key factors contributing to the success or failure of Lebanon's knowledge-based economy.
iii) To provide recommendations for policy-makers and stakeholders to improve Lebanon's knowledge-based economy and enhance its competitiveness. The paper will draw on the findings from the previous two objectives to provide practical and actionable recommendations that policy-makers and stakeholders in Lebanon can implement to develop the knowledge-based economy.

By achieving the three main objectives outlined above, this study will contribute to the literature on knowledge-based economies and provide practical recommendations for policy-makers and stakeholders in Lebanon.

The Knowledge-Based Economy: Insights from Key Theories

Understanding the knowledge-based economy establishes the groundwork for investigating the diverse theories illuminating its dynamics and implications. A content analysis approach revealed that several significant theories had been proposed to better comprehend the mechanics and dynamics of the knowledge-based economy. Accordingly, the knowledge-based view (KBV), endogenous growth theory, innovation systems theory, and the triple helix model evolved as essential frameworks for understanding the dynamics of the knowledge-based economy. These theoretical frameworks offer conceptual structures for comprehending the dynamics and mechanisms operative within the knowledge-based economy. They provide valuable perspectives on how knowledge creation, dissemination, innovation, and collaboration processes contribute to enhancing economic growth and competitiveness.

Firstly, in recent years, significant emphasis has been placed on acquiring and possessing knowledge as a critical factor in establishing and maintaining a sustainable competitive advantage (Arend & Lévesque, 2010; Eisenhardt & Santos, 2002). Knowledge encompasses its transferability, as well as its ability to be aggregated and appropriated. This perspective suggests that knowledge could potentially be the most crucial resource for a firm (Grant, 1996). This reasoning resulted in the development of the knowledge-based view (KBV) of the firm (Grant, 1997). The theory of the KBV has substantially impacted our comprehension of the knowledge-based

economy, as it offers a framework that emphasizes the strategic significance of knowledge within organizational contexts (Foss & Knudsen, 2003). This theoretical framework has redirected attention away from traditional, tangible resources towards intangible assets, explicitly emphasizing knowledge as the principal driver of competitive advantage within the contemporary economic landscape (Cuthbertson & Furseth, 2022).

Secondly, the endogenous growth theory emphasizes the significance of knowledge and innovation as key drivers of economic growth. It asserts that internal rather than external factors primarily drive a nation's economic development. Enhanced productivity of a country can be achieved through investments made by both the government and the private sector in fields such as human capital, innovation, and knowledge (Romer, 1994). This theory has questioned the neoclassical perspective that economic development depends mainly on external factors such as labor and capital accumulation (P. Romer, 1990). This theory has substantially impacted our comprehension of the knowledge-based economy by elucidating the pivotal role of knowledge and innovation as primary catalysts for economic growth. Endogenous growth theory has emphasized the significance of intellectual capital and intangible assets within the knowledge-based economy by integrating knowledge into the growth equation (Acs & Sanders, 2019).

Thirdly, the innovation systems theory emphasizes the interactive and collaborative nature of innovation within networks of actors and institutions. It highlights the significance of collaborative networks, institutions, and policies in promoting innovation and technological progress (Lundvall, 1992; Malerba, 2002). It underscores the importance of collaboration, knowledge dissemination, and the integration of resources and capabilities among organizations as critical drivers of innovation and economic development. This theory has profoundly impacted our comprehension of the knowledge-based economy by revealing the interactive and collaborative character of innovation inside networks of individuals and organizations. This approach has changed the emphasis from seeing innovation as an isolated activity inside particular firms to understanding it as a systemic and collaborative process involving several stakeholders (Asheim & Coenen, 2005). More recently, researchers have focused on the dynamics of innovation and the IS functions: entrepreneurial activity, knowledge generation, information transmission and interchange, market formation, resource mobilization, and advocacy coalition support (Bergek et al., 2008; Hekkert et al., 2007).

Fourthly, the triple helix model, although bearing similarities, presents a significant differentiation by not advocating for a national system approach that encompasses a defined objective, inputs, or outputs (Leydesdorff, 2012). The triple helix model posits that the optimal facilitation of innovation and knowledge generation occurs through collaborative engagement and interaction among academia, industry, and government. It acknowledges that these sectors contribute distinct perspectives, specialized knowledge, and valuable resources to the innovation process (Etzkowitz & Leydesdorff, 1995). This model has exerted a substantial impact as well on our comprehension of the knowledge-based economy by underscoring the significance of collaboration and interaction between academia, industry, and government in propelling innovation and fostering economic advancement (Leydesdorff, 2012). It has

broadened our viewpoint beyond the traditional linear innovation model, acknowledging the synergistic and interconnected connections among the three sectors (Ranga & Etzkowitz, 2013).

These theories provide the theoretical foundations that clarify the complex connections and interrelationships among the key pillars and drivers of the knowledge-based economy, namely ICT, innovation, R&D, education, entrepreneurship, and the economic and institutional regime (Arundel et al., 2008). Indeed, ICT is critical in facilitating knowledge acquisition, storage, and distribution. R&D-fueled innovation drives the production and application of new knowledge. Education is pivotal in enhancing human capital, equipping individuals with pertinent skills and knowledge. This enhancement of human capital is imperative for fostering innovation and facilitating economic development. Entrepreneurship acts as a catalyst for transformational development by bringing new ideas and knowledge-based companies to market. The economic and institutional environment provides essential support and incentives for knowledge generation and investment, promoting long-term development. Overall, these pillars are inextricably related to the core theories since they include the essential ingredients required for the knowledge generation, distribution, and usage that drive these theories. The interaction of ICT, innovation, R&D, education, entrepreneurship, and the economic and institutional regime impacts the dynamics and results of the knowledge-based economy, driving economic growth, competitiveness, and social progress. Furthermore, the pillars are "interlinked, and adequate performance on each is considered a prerequisite for achieving a successful knowledge economy." (Hvidt, 2015). For example, a robust education system can contribute to developing human capital, which is crucial for driving innovation and entrepreneurship. Meanwhile, a supportive economic and institutional regime can help create an environment conducive to R&D and innovation.

Consequently, our study is grounded upon a primary hypothesis supported by three subsidiary hypotheses. The primary hypothesis states that various opposing forces influence Lebanon's knowledge-based economy. The education system and entrepreneurial culture enhance the knowledge-based economy, while political instability and inadequate ICT infrastructure hinder its expansion. Subsidiary hypothesis 1 asserts that the high level of education and solid entrepreneurial activities in Lebanon positively impact the country's knowledge-based economy, contributing to its competitiveness and growth. This hypothesis is based on the assumption that a highly educated and entrepreneurial population is more likely to innovate and generate new ideas, which can stimulate the knowledge-based economy. Subsidiary hypothesis 2 posits that the weak performance of Lebanon's innovation system, ICT, and economic and institutional regime pillars negatively impacts the country's knowledge-based economy, hindering its competitiveness and growth. Lastly, subsidiary hypothesis 3 proposes that improving the weak pillars of Lebanon's knowledge-based economy, namely innovation, ICT, and economic and institutional regime, will positively impact the country's overall competitiveness and growth. This hypothesis assumes that by addressing the weaknesses in these pillars, Lebanon can unlock its potential for innovation and development and improve its competitiveness in the global marketplace. Through testing these hypotheses, our paper

aims to gain a deeper understanding of the strengths and weaknesses of Lebanon's knowledge-based economy and identify potential areas for improvement.

Methodology

Our methodology is based on two rounds of interviews conducted in person or over the phone, with two semi-structured questionnaires. The interviews were conducted in July and August 2016 and October 2021. Two groups of stakeholders were polled: ministries and organizations as well as companies.

The first group consisted of a sample of 15 experts and representatives from ministries and organizations involved in the various pillars of Lebanon's knowledge-based economy, such as the Ministry of Economy and Trade, Kafalat, INJAZ Lebanon, the Centre for innovation and technology (CIT), Berytech, UK Lebanon Tech Hub, and others. Secondary data from reports, governmental documents, websites, and newspaper articles from a variety of sources, both domestic (e.g., BankMed, Investment Development Authority of Lebanon (IDAL), Ministry of Economy and Trade of Lebanon, UK Lebanon Tech Hub) and international (e.g., World Bank, Economic and Social Commission for Western Asia (ESCWA), and Global Entrepreneurship Monitor) were used to create the sample. The average length of the interviews with organizations was 48 min.

The second round of interviews was done with a sample of 22 Lebanon-based ICT enterprises.[1] Based on their size and stage of growth, the enterprises were randomly picked from a representative survey sample. Although this cannot be entirely guaranteed in a qualitative study, we aimed to create some variance and a degree of representativity. Based on the number of employees, we used the following definition from Lebanon's Ministry of Economy and Trade (Ministry of Economy & Trade Of Lebanon, 2014) based on the number of employees: Micro companies have 0–10 employees, small companies have 11–50, medium companies have 51–100, and big companies have more than 100 employees. Our sample reflects the business size distribution in the Lebanese software sector, where SMEs account for 90% of registered enterprises (IDAL, 2020). Accordingly, we interviewed a total of 22 firms in Lebanon, divided into four categories according to the number of employees. The interviews lasted an average of 57 min (Table 1).

Questionnaire 1 was used to conduct interviews with organizations, covering aspects such as mission and history, and it has 35 questions distributed into five topics: (1) general information about the organization: history, mission, services, and structure; (2) the strengths and limitations of the knowledge-based economy; (3) the dynamics of innovation and entrepreneurship: issues, players, evolution, knowledge channels, and spatial levels; (4) the characteristics of the

[1] We choose to focus on ICT for several reasons. ICT is viewed as a critical component in a fundamental shift toward a knowledge-based economy. The ICT industry fosters economic diversity, innovation, and entrepreneurship. ICT also contributes to the growth of the other pillars of the knowledge-based economy (European Bank for Reconstruction and Development (EBRD), 2019).

Table 1 Distribution of the interviewed companies in Lebanon

Size in terms of the number of employees	Number of interviewed companies
Micro	8
Small	8
Medium	4
Large	2
Total	22

local network: type of relationships, collaboration, cooperation with competitors, and conflicts; and (5) government policies: programs, services, and governance. We included two new sections about the influence of recent events (the economic crisis and the COVID-19 pandemic) on the transition to a knowledge-based economy.

Questionnaire 2 was used to conduct the interviews with the firms and includes 55 questions divided into seven topics: (1) general information about the company; (2) production: strategic positioning, competitive advantage, and market; (3) the knowledge-based economy's strengths and shortcomings; (4) innovation characteristics: R&D activities, nature, networks, source of new ideas, knowledge channels, and spatial levels; (5) entrepreneurial dynamics: major growth accelerators, strengths, constraints, players, and evolution; (6) the characteristics of the local network: type of relationships, collaboration, cooperation with competitors, and conflicts; and (7) government policies: programs, services, and governance. We have included two new themes about the influence of recent events on the shift to a knowledge-based economy.

The processing of the data was the first step in the data analysis. The interviews were extensively transcribed to aid in analyzing the material gathered. Then, we used an analysis grid to perform content analysis. The grid includes the five knowledge-based economy pillars and several sub-themes. According to these sub-themes, the interviews' findings were grouped into categories (Table 2).

NVivo 12, a qualitative research analysis software, was used to analyze the verbatim. The searching facilities in NVivo can "add rigor to the analysis process by allowing the researcher to carry out quick and accurate searches of a particular type, and can add to the validity of the results by ensuring that all instances of a particular usage are found, this searching needs to be married with manual scrutiny techniques so that the data are in fact thoroughly interrogated" (E. Welsh, 2002). This allowed classification statements made by each respondent based on the research topics (Jackson & Bazeley, 2019). This search was complemented with hand analysis to ensure the data was extensively investigated.

Table 2 The analysis grid

Themes	Subthemes
Education and human capital	Quality of the educational system Quality of human resources
Entrepreneurship	Resources and support Efficiency Nature of the relation Local network
Innovation	R&D efforts Resources Relations industry/universities Local network
Governance/the economic and institutional regime	Leadership Role of associations Role of the government Role of the private sector
ICT	Efficiency Challenges

Results and Discussion

Moving toward a knowledge-based economy in Lebanon is supported by its highly qualified and multilingual labor force due to its solid educational system and robust entrepreneurial spirit. However, several issues, such as the weak ICT infrastructure, incompetent public institutions, and brain drain, hinder this path (Table 3).

Education and Human Capital

Lebanon's higher education system is the oldest in the MENA region, dating back to 1866, when the American University of Beirut (AUB) was established as the Syrian Evangelical College, followed by the University of Saint Joseph (USJ) in 1875 (The European Higher Education Area, 2010). Two Lebanese universities are listed among the world's top 500 institutions, making Lebanon one of the most highly ranked countries in the Middle East.

Regarding the quality of the educational system, Lebanon was placed 4th internationally regarding math and 9th regarding business schools and 18th regarding science in 2018 (Schwab, 2019). Regarding the active population's digital abilities, Lebanon came in 23rd out of 141 countries in 2019 and was placed 10th in finding qualified employees (Schwab, 2019). The Lebanese labor force has competitive technical skills compared to the area in the ICT industry. Fresh graduates in Lebanon are typically highly trained, bilingual, and cost-competitive. The typical Lebanese software developer is trilingual (Arabic, English, and French) and is flexible, problem-solving, and creative (Schwab, 2017). Despite the high qualifications, this sector's salary scale is considered competitive (BankMed, 2015). Average Lebanese software engineers cost 27% less than those in the Gulf Cooperation Council (GCC) countries and 55% less than those in other industrialized economies in 2019 (IDAL, 2020).

Table 3 Strengths and weaknesses of the knowledge-based economy in Lebanon

KBE pillars	Most representative responses
The education system and human resources	The majority of Lebanese SMEs rely on the export of expertise. We establish a firm in Lebanon, employ personnel, and then send them to France or the Gulf to work on projects. Finally, we play with taxes and salary differentials. Human resources in this area are competent and much less expensive than the rest of the region. (Company no. 4. Questionnaire 2. Interview, 2016)
Entrepreneurship	Furthermore, Lebanese culture is distinguished by an international, commercial, and business mindset. After living through more than 25 years of civil war and not knowing what tomorrow will bring, it is simpler to engage in business without fear of failure, all relative to the danger of war. (Company no. 16. Questionnaire 2. Interview 2021) Circular 331 implementation was one of the rare government initiatives in Lebanon. The industry appreciated this intelligent approach. There is always a higher likelihood of success when there is money. As a result of Circular 331, many entrepreneurs have opted to start their businesses. There are also established businesses that have opted to extend their operations. Circular 331 thereby electrified the industry by resolving access to funding. (Company no 7. Questionnaire 2. Interview 2016) In Lebanon, companies are suffocated by the crisis or crises. Yes, after two years of multiple crises, there is a lot of debt in companies. We have a lot of receivables from our customers who sometimes pay over 12 months! It can be complicated for a new business to survive because there is always a risk of running out of cash during the first years of its creation, which can limit investments, jobs for example and sometimes even lead to the collapse of the start. -up. (Company no. 22. Questionnaire 2. Interview 2021)
Innovation	In general, we get our information from the Internet, our suppliers, and our customers. This is usually internal work. In terms of research and innovation, we have no collaboration with local institutions. This culture does not exist in Lebanon. At the level of the business-industry connection, this issue affects all organizations in Lebanon's IT sector. There have been a few efforts to develop collaborative business-industry ventures, but nothing solid has yet been developed. (Company no. 1. Questionnaire 2. Interview, 2016) The number of patents, publications and R&D is generally low in Lebanon whether in IT or even in other sectors. At the business level, there are some good new ideas, but it's not Silicon Valley yet. However, in general, there is no R&D in IT companies in Lebanon. Innovation is more about business solutions. We're not good at inventing something visionary. (Company no 1. Questionnaire 2. Interview, 2016)
The economic and institutional regime	Our governments were never up to the task of solving the country's problems. We have a very weak public sector. There are just scattered efforts here and there of a few individuals within governments. In fact, there is no vision in Lebanon, how to manage the country, not just for the ICT sector. We are in a system that does not work at all. It is clear. What we always do is wait for a few people here and there, windows of opportunity, to be able to pass something. So you just have to have that window of opportunity. (Company small size no. 1. Questionnaire 2. Interview, 2016)
ICT	The Internet in Lebanon is terrible. With the slowest and most expensive Internet connection in the world, Lebanon has become a haven for shady Internet service providers that provide a desperate populace with a faster connection. More recently, the quality of internet connection has deteriorated, although the number of people using telecommuting has increased in this country as a result of the Covid-19 pandemic. (organization no. 13. Questionnaire 1. Interview 2021)

As a result, most Lebanese TI firms are based on the exports of skills and know-how, particularly to countries in the Gulf region (Ben Hassen, 2018). The sector's exports have more than doubled in the last several years, rising from 329 million USD in 2002 to 640 million USD in 2017, with a 6.9% annual growth rate. The Gulf market accounts for 52% of exports (IDAL, 2020).

> The majority of Lebanese SMEs rely on the export of expertise. We establish a firm in Lebanon, employ personnel, and then send them to France or the Gulf to work on projects. Finally, we play with taxes and salary differentials. Human resources in this area are competent and much less expensive than the rest of the region. (Company no. 4. Questionnaire 2. Interview, 2016)

There are, however, many obstacles, such as restricted access to talent due to brain drain. Many young graduates enter the labor market annually and encounter difficulties seeking suitable employment related to their study field (Saleh, 2014). Based on the latest available statistics, the youth unemployment rate in Lebanon as of January 2022 is alarmingly high, standing at 47.8%. This figure is near twice the adult unemployment rate of 25.6% (Central Administration of Statistics Lebanon, 2022). As a result, many graduates and well-educated young people seek employment prospects outside Lebanon (UK Lebanon Tech Hub, 2016). In 2018, Lebanon ranked low, i.e., 105th/137 globally, for its capacity to retain talent. According to De Bel-Air (2017), the brain drain in Lebanon is due to numerous reasons: the concentration of economic activities in the tertiary sector; the increasing commitments to neo-liberal economic policies since 1990, the high prevalence of informal employment; and above all, the limited size of Lebanon's labor market coupled with the widespread corruption. Moreover, the current economic crisis, as well as the resulting rise in poverty rates, will almost certainly result in increased student dropout rates, particularly among the most marginalized households. Indeed, during Lebanon's escalating political and economic crises, there is a growing belief that a significant new wave of emigration has emerged, characterized by a 4.5-fold increase in the number of Lebanese emigrants between 2020 and 2021, mainly driven by the high youth unemployment rate (Maddah & Akar, 2023).

Furthermore, the predicted austerity measures adopted by local universities would further reduce higher education quality, possibly worsening the brain drain as young graduates seek employment overseas, especially in vital sectors such as ICT (World Bank, 2021b). According to a recent report published by the Konrad Adenauer Foundation and Arabnet (2022), the direst consequences of this recent brain drain have been the loss of specific skill sets and the depletion of know-how. Furthermore, this significant migration of experienced talent has led to an experience gap, warning that its quality is declining while labor has become cheaper. Meanwhile, start-ups that wish to keep their human resources must pay them in dollars, further burdening their already precarious finances (Arab News, 2022). Accordingly, the talent drain has been particularly harmful to early-stage start-ups (Konrad Adenauer Foundation & Arabnet, 2022). Furthermore, the explosion at Beirut's port dealt another blow to the Lebanese start-up's ecosystem. Buildings in Beirut's Digital District, a hub for the digital and creative industries in Lebanon, including incubators and accelerator Parks, were

severely destroyed, including the headquarters of prominent start-ups such as Schedex, Sympaticus, and Moodfit (Arab News, 2022).

The Entrepreneurship Ecosystem

Like education, entrepreneurship is a strong base for the knowledge-based economy in Lebanon. The entrepreneurial spirit is embedded in Lebanese culture. Sayigh (1962) underlined that "the Phoenicians' heritage is abundant in Lebanon. Lebanese kept their eyes on the far seas for better business opportunities." Moreover, according to Bejjani (2012), the Lebanese are confident in their abilities to start a company. They have no fear of failure, and having one's own business is regarded highly by the community and seen as an ideal, as highlighted by one of the entrepreneurs:

> Furthermore, Lebanese culture is distinguished by an international, commercial, and business mindset. After living through more than 25 years of civil war and not knowing what tomorrow will bring, it is simpler to engage in business without fear of failure, all relative to the danger of war. (Company no. 16. Questionnaire 2. Interview 2021)

According to the 2018 report of the Global Entrepreneurship Monitor (2018), among the 48 countries surveyed, Lebanon rated fourth for entrepreneurial spirit. In addition, 40% of Lebanon's adults still believe that establishing a new company locally is a good opportunity, and just 25% are deterred by the fear of failure in Lebanon (the third lowest proportion globally). More than two-thirds of individuals in Lebanon, the fifth-highest percentage globally, said they could start a company. Lebanon ranked fifth in terms of new business ownership in 2018, first in terms of total early-stage entrepreneurial activity (TEA), first in terms of current company ownership, and third in terms of beginning a new business (out of eight MENA countries, namely Saudi Arabia, Turkey, Iran, Egypt, United Arab Emirates, Morocco, and Qatar).

These findings ranked Lebanon second globally for new and well-established activities (Global Entrepreneurship Monitor, 2018). For Bejjani (2012), this performance can be explained by a "well-educated and multilingual workforce; a reputation for individualism and a sense of opportunity coupled with a strong family and social support system." Indeed, unlike several developing countries, 82% of Lebanese entrepreneurs are driven by opportunities. These companies usually have high-employment potential (Global Entrepreneurship Monitor, 2018; Ministry of Economy & Trade of Lebanon, 2014).

Recently, Lebanon was marked by an "entrepreneurship buzz," especially in the technological sectors (Ben Hassen, 2021). Circular 331, released by the Central Bank of Lebanon (BDL) in August 2013, has significantly impacted Lebanon's innovation and entrepreneurship in the last few years (Ben Hassen, 2018; Choucair & Flynn, 2017). The circular aims to inject financing capital into Lebanese technological sectors, especially ICT, and encourages commercial banks to finance start-ups in technological sectors such as ICT by securing up to 75% of these investments (UK Lebanon Tech Hub, 2016) (Box 1).

Box 1. Characteristics of Circular 331

Circular 331 was released by the Central Bank of Lebanon on August 22, 2013.
The Circular encourages commercial banks to participate in Lebanon-based start-ups, incubators, accelerators, and venture capital firms, covering these investments up to 75%.
The circular authorizes banks to invest up to 3% of their funds in the digital economy, which represents an amount of $ 400 million, then 4% from 2016.
A bank's overall involvement in start-ups cannot exceed 3% of its total capital, provided that a bank's participation in a single start-up does not exceed 10% of the aforementioned 3%.
Banks may keep up to 80% of a company's capital for the term of the loan. The firm must be a Lebanese joint-stock firm with a registered address in Lebanon. At the conclusion of the maximum loan period of seven years, the bank should liquidate all of its shares.

Source: Choucair & Flynn (2017)

Many start-ups and science parks have been sponsored directly by local banks or venture capital funds, thanks to Circular 331. Circular 419, also released in 2016, enabled banks to jointly invest up to $600 million in Lebanese technology start-ups. Over 100 investments were made from 2013 to 2016, thanks to Circular 331, and Beirut became one of the booming digital innovation hubs in the MENA region (Arabnet, 2018). Circular 331 has significantly lessened the funding obstacle that challenged Lebanese entrepreneurs in the past, as confirmed by an entrepreneur:

Circular 331 implementation was one of the rare government initiatives in Lebanon. The industry appreciated this intelligent approach. There is always a higher likelihood of success when there is money. As a result of Circular 331, many entrepreneurs have opted to start their businesses. There are also established businesses that have opted to extend their operations. Circular 331 thereby electrified the industry by resolving access to funding. (Company no. 7. Questionnaire 2. Interview 2016)

Before Circular 331, most entrepreneurs relied on their funds or family and friends or could access guaranteed bank loans, usually by *Kafalat*. The banks, which issue the loans, often require collateral. As a result, young entrepreneurs without personal capital had difficulty accessing commercial banks' financial services (Choucair & Flynn, 2017). The situation changed with circular 331. According to Arabnet (2018), 162 investments were made in the digital economy between 2013 and 2017 — most of them funded by the circular. In 2016, the number and value of transactions were 40 and 56 million dollars, respectively, allowing Lebanon to move from fifth to second rank regionally regarding the value of transactions in the digital economy (Arabnet, 2018). Circular 331 has improved the support ecosystem for entrepreneurs, as evidenced by the creation of several entrepreneur support organizations. Thus, as observed in most

developed countries, after 2013, we saw several spaces for innovation and creativity: accelerators; incubators; co-working spaces; fab labs; venture capitals such as the UK Lebanon Tech Hub, AltCity Bootcamp, and Speed; and also the consolidation of the programs of already existing organizations. For Girasella et al. (2018), Circular 331 was the central policy that triggered the creation of an ecosystem of Lebanese start-ups. In contrast, Lebanon was previously a country that was not very attractive to entrepreneurs. For the former Minister of State and CEO of AM Bank, Marwan Kheireddine, who participated in writing the circular: "The circular has energized the ecosystem, whereas Lebanon was previously an unattractive country for entrepreneurs" (Babin, 2018). Consequently, according to a survey conducted in Lebanon by Arabnet (2018), entrepreneurs identified the availability of start-up support services and access to markets and customers as a critical strength of the local ecosystem.

However, Lebanon's tech start-up ecosystem is still an early-stage ecosystem that has passed its nascent growth phase but is far from maturity (World Bank, 2017b). Despite recent initiatives such as Circular 331, access to funding remains difficult at the seed stage. Sixty-eight percent of tech start-ups depend on their savings (Consultation & Research Institute, 2019). Additionally, Lebanon's current economic and financial crisis, coupled with the containment measures linked to COVID-19, has severely handicapped almost all sectors, including the ICT (L'Orient-Le Jour, 2020). In 2017, BDL (Banque of Lebanon) also became more vigilant. It modified the circular to require quarterly instead of annual investor reports (Babin, 2018). As a result of the COVID-19 pandemic, start-up activity in Lebanon declined by 78% in 2020 compared to 2019 (MAGNiTT, 2020). However, this trend was already observed in 2019 due to the banking limitations imposed by the BDL. In Lebanon, investments in start-ups plummeted from 55 to 19 million dollars in one year, a 65% decline. Lebanese banks have thus radically limited the banking operations carried out from dollar accounts. These restrictions posed significant operational challenges for companies in the technological sectors with financial commitments abroad. On the other hand, containment measures linked to COVID-19 have severely impacted tourism and restaurants, two important sectors for several ICT companies, especially the small ones (L'Orient-Le Jour, 2020).

In Lebanon, companies are suffocated by the crisis or crises. Yes, after two years of multiple crises, there is a lot of debt in companies. We have a lot of receivables from our customers who sometimes pay over 12 months! It can be complicated for a new business to survive because there is always a risk of running out of cash during the first years of its creation, which can limit investments, jobs for example and sometimes even lead to the collapse of the start. -up. (Company no. 22. Questionnaire 2. Interview 2021)

The worsening crisis and the lack of funding forced several start-ups and whole co-working spaces to shut down permanently. Some funding organizations, such as regional accelerator Flat6Labs, have suspended financial assistance to their Lebanese branches. Meanwhile, over half of the start-ups have relocated their headquarters or

parts of their operations outside of Lebanon, such as the UAE, to escape financial transaction limitations (Konrad Adenauer Foundation & Arabnet, 2022). In January 2021, Anghami, a music streaming company, transferred its headquarters from Beirut to Abu Dhabi, which was considered a setback to Lebanon's start-up ecosystem (Al Jazeera, 2021). Another illustration of the challenges faced by knowledge industries in Lebanon is the case of Yayy and YallaPlay, two well-known gaming publishers and developers based in Beirut. Prior to 2020, they boasted a high number of monthly active users for games like Conqueror of The Realm, Domino Hit, and Mess It Up. However, they are currently grappling with various issues, such as payment for servers, publishers, and talent, and are struggling to secure sufficient funding (Executive Magazine, 2020).

The Innovation System

The innovation system is an essential pillar of the knowledge economy (Casadella & Uzunidis, 2018). In the Global Innovation Index (GII) from 2020 (Cornell University et al., 2020), with a score of 26.02, Lebanon is ranked relatively low at the 87th position globally and 10th position among Arab countries. In 2021, out of 132 economies, Lebanon fell to 92nd place. The ranking was based on the seven pillars of the Global Innovation Index (GII), which were broken down as follows: business sophistication (64th), human capital and research (87th), market sophistication (90th), knowledge and technology outputs (91st), creative outputs (92nd), infrastructure (100th), and institutions (112th). The GII also identified significant weaknesses in sub-pillars, including the political environment (129th), government effectiveness (121st), education (123rd), and e-participation (120th) (The World Intellectual Property Organization, 2022).

Firstly, these results can be explained by the low level of internal R&D within companies in Lebanon. Most companies in the industry combine existing knowledge, often generated elsewhere, and adapt it to a problem often identified by their customers (Ben Hassen, 2018). A company manager highlighted:

> The number of patents, publications and R&D is generally low in Lebanon whether in IT or even in other sectors. At the business level, there are some good new ideas, but it's not Silicon Valley yet. However, in general, there is no R&D in IT companies in Lebanon. Innovation is more about business solutions. We're not good at inventing something visionary. (Company no 1. Questionnaire 2. Interview, 2016)

Secondly, these results can be explained partly by the lack of coordination between the technology sectors, such as the ICT and the academic research community (Ben Hassen, 2018) (Ben Hassen, 2018). Indeed, most companies rely on their internal efforts to innovate without ties to public R&D structures or universities. The links responsible for transferring information and technology and cooperation between institutions and companies are essential to the innovation chain (ESCWA,

2016). To the question: "Do you call or contact universities during your innovation process?" a R&D manager replied:

> In general, we get our information from the Internet, our suppliers, and our customers. This is usually internal work. In terms of research and innovation, we have no collaboration with local institutions. This culture does not exist in Lebanon. At the level of the business-industry connection, this issue affects all organizations in Lebanon's IT sector. There have been a few efforts to develop collaborative business-industry ventures, but nothing solid has yet been developed. (Company no. 1. Questionnaire 2. Interview, 2016)

Due to weak contacts with public R&D structures or universities in Lebanon, most technology firms count on their internal resources to innovate. Indeed, Lebanon has no regulated university/industry cooperation (European Commission, 2017). Universities in Lebanon are not used for industry cooperation purposes. Two explanations clarify this situation. First, companies argue, on the one hand, that university outcomes are primarily theoretical. As explained above, Lebanon's education levels are high and comparable to international norms (BankMed, 2014). On the other hand, many businesses stress the gap between graduates' skills and the market's demands (Ben Hassen, 2018) due to a lack of cooperation between the government, universities, and businesses (Dibeh et al., 2019). For example, in the engineering and science curriculums, project management and entrepreneurship education are missing (Oukil, 2011). Like in the rest of the MENA region, entrepreneurship and innovation education in Lebanon is nascent and restricted to a few universities (Oukil, 2011). Traditionally, "Lebanese students have been educated in social norms to allow them to enter the labor market as employees but not as entrepreneurs or innovators" (Saleh, 2014). However, numerous Lebanese universities have recently created entrepreneurial programs (e.g., AUB's Center for Innovation Management and Entrepreneurship, LAU's Institute of Family & Entrepreneurial Business, and BAU's Center for Entrepreneurship) (Ministry of Economy & Trade Of Lebanon, 2014). In addition, some universities have introduced entrepreneurship in their programs. The University of Saint Joseph created Berytech to support start-ups. Some other universities cooperated strongly with the industry and built innovation parks (European Commission, 2017).

In addition, the legal status of R&D forms critical barriers to the cooperation between industry and universities in Lebanon. There are several laws on Intellectual property rights (IPR) in Lebanon. Nevertheless, because of many actual and perceived obstacles to using the system, such as the patenting processes' expense and difficulty, Lebanon's IPR system is primarily unused by entrepreneurs and scholars. As a result, businesses frequently employ alternative tools to protect their ideas and innovations, including secrecy, leveraging lead-time advantages, rapidly ascending the learning curve, etc. (ESCWA, 2016). Second, universities point to a lack of confidence in improving local knowledge on behalf of companies. In Lebanon, innovation is usually considered improvised and personal instead of systemic and collaborative (Ben Hassen, 2018). Entrepreneurs generally concentrate on the company's core area: its staff and clients, instead of externally (Chidiac El Hajj, 2017).

The Economic and Institutional Regime

Developing the knowledge-based economy in Lebanon is hindered by poor governance, systemic corruption, and weak institutions. The World Bank (2017a) highlighted that inadequate governance and underdeveloped institutions impeded Lebanon's economic and social development. Institutions are weak and prone to ineptitude and corruption. The country is caught in a governance trap in which political stability is maintained by subordinating national prerogatives to sectarian leaders' consensus at the expense of robust institutions focused on the common good. Consequently, Lebanon ranked 154 out of 180 countries in 2021 in the Corruption Perception Index (CPI), a drop from 149 in 2020. Lebanon's CPI score has fallen from 28 in 2019 to 24 in 2021, owing to rampant corruption in the public sector, ranking Lebanon among the 50 most corrupt countries globally (Transparency International, 2021). Companies in Lebanon confront several investment and business environment challenges, such as high transaction costs, which impede productive investment and restrict job generation. To get government contracts, investors are required to pay bribes, which are often granted to corporations related to powerful politicians (Transparency International, 2017). In general, Lebanese do not rely on the government for their well-being (Chakour, 2001). In recent years, Lebanon and international organizations have worked together to promote openness, innovative management approaches, and information technology in the public sector. Despite these attempts, Lebanon's public institutions continue to be plagued by monopolizing power, corruption, obsolete institutional configurations, and administrative knowledge deficiencies (Haase et al., 2018). The 2015 waste crisis in Lebanon, in which hundreds of civilians protested the visible presence of garbage piles on the streets, is a prime illustration of how "privileged" relationships lead to service failure and its severe repercussions on citizens (Smith Galer, 2018; Verdeil, 2018).

There are three causes behind Lebanon's government's poor performance. Firstly, there have been numerous internal and external conflicts in Lebanon over the last fifty years (such as the Syrian civil war, the Israel-Hezbollah conflict in July 2006, and the 1975–1990 civil war) that have weakened its government and set it on a course toward political and economic instability (Leenders, 2012; Raphaeli, 2009). Furthermore, Lebanon's internal politics, more than those of other countries in the region, have been influenced by developments on the global stage (Bayeh, 2017).

Second, more recently, the mass influx of refugees escaping the continuing civil war in Syria has aggravated Lebanon's economic and social situation by draining resources. Thus, public services are overburdened, and demand exceeds available institutional and infrastructure capacities (World Bank, 2017a; World Food Programme, 2020a). Thirdly, Lebanese society is divided into 18 recognized religious groups. Each community has its political leaders, parties, and institutions (schools, hospitals, and charity organizations). Despite the conclusion of the civil war in 1990, the religious, regional, feudal, and cultural tensions that precipitated it are still present (World Bank, 2003). Historically, citizens have depended more on their political leaders and institutions to protect and provide for them than on the government. This fosters an environment where corruption is prevalent (D. Welsh & Raven, 2006).

Moreover, the political system in Lebanon is based on a precariously balanced power-sharing agreement among these sectarian parties. Accordingly, the Lebanese government has been paralyzed by such issues and has not promoted development. In the last decade, just 4% of the budget was earmarked for capital spending. Due to poor tax collection, government funds are mostly limited. While salaries made for 33% of all expenditures in 2016, interest payments accounted for 32% of total spending (Nasnas, 2016). Consequently, due to the low level of investment, the infrastructure and the business climate have deteriorated. As a result, Lebanese citizens face frequent power and water outages, necessitating costly private providers. The lack of adequate physical infrastructure obstructs businesses, especially reasonable communications costs and accessibility. In 2018, Lebanon rated poorly in terms of the quality of electricity (134th out of 137 countries), roads (121st), air transport (100th), and ports (9th) (Schwab, 2019). The collapse of infrastructure and the interruption of public services are indications of the Lebanese government's inability to meet the needs of its citizens (Verdeil, 2018). According to the World Bank's Ease of Doing Business Index, Lebanon's overall business climate has worsened, and the country has dropped 56 ranks between 2007 and 2020, falling from 87 to 143 (World Bank, 2020). Consequently, international and domestic investments decreased, with foreign direct investment (FDI) declining by around 30% and gross capital formation reducing by 6% between 2010 and 2017 (Consultation & Research Institute, 2019).

Besides Circular 331, public measures supporting R&D, innovation, and entrepreneurship have been rather timidly established (Hadhri et al., 2016; Hanafi & Arvanitis, 2015). No ministry is in charge of national science and technology (S&T) policy-making in Lebanon, a specific national strategy for technology, or a clearly articulated and government-sponsored national strategy for the knowledge-based economy (Ben Hassen, 2018; ESCWA, 2016). Furthermore, Chakour (2001) points out that government officials are seen as inept and inefficient in helping new and growing businesses in Lebanon. Furthermore, the technology industry lacks critical regulatory standards and is plagued by a flawed legal system. The majority of new companies have issues with the company registration procedure. Shareholder-related legislation is either non-existent or inadequate. The court system is under-trained and under-aware, and the judicial proceedings are lengthy (Consultation & Research Institute, 2019).

> Our governments were never up to the task of solving the country's problems. We have a very weak public sector. There are just scattered efforts here and there of a few individuals within governments. In fact, there is no vision in Lebanon, how to manage the country, not just for the ICT sector. We are in a system that does not work at all. It is clear. What we always do is wait for a few people here and there, windows of opportunity, to be able to pass something. So you just have to have that window of opportunity. (Company small size N°1. Questionnaire 2. Interview, 2016).

ICT

The ICT sector in Lebanon is identified as the central pillar of the knowledge economy and one of the sectors with the highest growth potential. The sector has witnessed extensive government attention and reform over the last decade, which has supported its growth over the last decade. Although Lebanon is currently facing challenging economic times, the ICT sector has weathered the crisis more efficiently than other sectors and has proven its resilience (IDAL, 2020). ICT contributed around 2.1% of the nation's GDP in 2018, the equivalent of USD 1.1 billion, and has grown at a 4.8% annual pace since 2004, when valued at USD 565 million. Its entire economic effect, direct and indirect, is expected to reach USD 7 billion by 2025 (IDAL, 2020). In 2018, the ICT industry employed around 10,700 employees, the great majority of whom are qualified professionals, and the vast majority of ICT enterprises remained SMEs, with 63% employing between 6 and 50 people (IDAL, 2020). Lebanese ICT firms are very export-oriented. Exports of ICT services more than doubled over the previous decade, rising from USD 329 million to USD 640 million between 2002 and 2017, representing a 6.9% growth rate. The GCC continues to be the most critical market for Lebanese ICT businesses, with 55% stating that they export their products and services to this area. This is explained by Lebanon's and the Gulf nations' common cultural and linguistic affinity (IDAL, 2020). Compared to other sectors, the ICT industry is defined by its vitality, innovation, and ability to anticipate future developments and growth prospects (Hadhri et al., 2016).

However, Lebanon's transition into a knowledge-based economy is significantly slowed by poor ICT infrastructure. In reality, the low quality of the Internet is one of the most critical problems for the knowledge-based economy in Lebanon. In 2020, Lebanon ranked 163rd out of 176 countries in terms of internet bandwidth, with an average speed of 7.94 Mbps, compared to an international average of 74.32 Mbps (Speedify, 2020). Lebanon ranked sixty-fourth in the IT Growth Index in 2017 (International Telecommunication Union, 2017). The Internet is not yet delivered by fiber optics, which implies weak transmission to homes and businesses, lacking bandwidth, reliability, and ubiquity (Zain, 2016). Consequently, companies have to pay for costly connections to get fast and reliable speed (Bejjani, 2012). Lebanon was 95th out of 141 countries on the ICT adoption criteria in businesses and households in 2019. Regarding fixed-broadband Internet subscribers, it was placed 128th out of 141 (Schwab, 2019). As a result, the telecommunications market in Lebanon is characterized by high mobile charges and poor fixed network quality.

> The Internet in Lebanon is terrible. With the slowest and most expensive Internet connection in the world, Lebanon has become a haven for shady Internet service providers that provide a desperate populace with a faster connection. More recently, the quality of internet connection has deteriorated, although the number of people using telecommuting has increased in this country as a result of the Covid-19 pandemic. (Organization no. 13. Questionnaire 1. Interview 2021)

Internet and phone pricing are too costly, particularly compared to area standards. They are around two to three times more expensive than Morocco and Egypt. Consequently, according to a survey conducted by the Konrad-Adenauer-Stiftung Foundation in Lebanon, nearly all of the start-ups surveyed reported that the deterioration of infrastructure services harmed their productivity, with 40% failing to meet their targets as a result. This sentiment was echoed by support service providers such as business incubators, NGOs, and educational institutions, who have all reported facing infrastructure-related challenges that hinder their ability to operate effectively (Konrad Adenauer Foundation & Arabnet, 2022).

Furthermore, Lebanon ranks 130th out of 133 countries globally regarding broadband speed (the average broadband speed is roughly 6 Mbps), behind only Pakistan, Iraq, and Syria regarding internet access. Although 3G and 4G mobile network coverage achieved 99% and 98%, respectively, per capita telecommunications investment is around 2.5 times lower than in peer countries (Consultation & Research Institute, 2019). Indeed, the Ministry of Telecommunications in Lebanon has a monopoly on Lebanon's telecommunications industry. As a result, Internet and digital service have minimal competition in the Internet and data sector. Furthermore, the telecommunications industry is an essential source of income for the Lebanese government (International Bank for Reconstitution and Development/The World Bank, 2018). More recently, in January 2022, Ogero, the state provider, announced that internet connections were suspended in Lebanon due to fuel shortages. As explained above, the Lebanese rely on a network of private generators that run on diesel fuel since they only get a few hours of state electricity daily (Al Arabiya, 2022).

Conclusion

The knowledge-based economy has become a central topic for policy-makers and researchers worldwide, as it has proven to be a key driver for economic growth, job creation, and social development. This paper aims to examine the state of the knowledge-based economy in Lebanon. It finds that Lebanon's knowledge-based economy is marked by several opposing factors: firstly, the education system and culture of entrepreneurship and, secondly, the country's political instability and vulnerability.

Lebanon's primary assets in establishing a knowledge-based economy are linked to its highly skilled and multilingual human capital due to a solid educational system and a thriving entrepreneurial culture. In the Middle East, Lebanon's universities are among the best. Lebanese entrepreneurs play a vital role in the country's knowledge-based economy. Lebanese culture has a strong entrepreneurial streak. Moreover, Lebanon has recently been characterized by an "entrepreneurship buzz," especially in technology. Due to the private sector's strength and various organizations' participation, Lebanon has made significant gains in innovation and entrepreneurship over the past few years. This sector's recent history is shaped by Circular 331, issued by the Central Bank of Lebanon in August 2013. This circular has helped several start-ups and accelerators secure funds from banks and venture capital firms. Nevertheless, Lebanon lacks some crucial elements that sustain the knowledge-based economy. Inadequate

ICT infrastructures, dysfunctional institutions, an inefficient innovation system, and a considerable brain drain currently characterize Lebanon. Our findings have demonstrated the lack of cooperation between technology fields, such as ICT, and universities or R&D centers. Indeed, there is no formal collaboration between Lebanese universities and the non-academic community.

Furthermore, poor state governance, institutional corruption, and weak institutions impede Lebanon's knowledge-based economy's development. The country suffers from a trap of governance in which political stability is preserved by subordination to consensus among sectarian representatives of national prerogatives at the expense of solid institutions based on the common good. This, among other issues, such as the general economic situation, translates into inadequate provisions of public utilities in Lebanon. The Internet's low efficiency is one of the most critical problems faced by the knowledge-based economy in Lebanon. With minimal government engagement, the development of Lebanon's knowledge-based economy has relied chiefly on a bottom-up model, with significant contributions from the private sector, organizations, and non-governmental organizations (NGOs). As a consequence of the civil war, Lebanon's reduced state competence has stepped up a resurgent civil society comprised of non-governmental organizations (NGOs) and a broad phase of "NGO-ization" (Chaaban & Seyfert, 2012). The paper has also highlighted the impact of recent political and economic crises on the development of the knowledge-based economy. The country's economic decline, currency depreciation, and inflation have severely affected the ICT sector, innovation, and R&D capabilities, making it more challenging to develop a knowledge-based economy.

The Lebanese case confirms the importance of government involvement in the knowledge-based economy, which Lebanon lacks. Furthermore, from a macroeconomic viewpoint, despite achieving positive financial flows to the country through remittances, youth emigration represents a brain drain that adversely affects economic development and the accumulation of human resources (Dibeh et al., 2018).

Developing the knowledge-based economy in Lebanon requires a set of policy actions and reforms at various levels involving the different public, private, and civil society organizations and institutions. At the education and human capital level, Lebanon needs to implement policy initiatives to deal with the brain drain problem. Issues like youth employability, the rigidity of labor laws, skill mismatch, and poor governance in public institutions need to be tackled (Dibeh et al., 2018). The interventions must improve young people's education-to-work transitions and address the labor market's skills gap by creating a dynamic economy based on productive sectors that generate demand for skilled workers (Fakhoury, 2016). Furthermore, the Ministry of Education and Higher Education should spearhead efforts to incorporate digital skills and online learning tools into the curriculum throughout public schools and universities to improve digital literacy and decrease the "digital gap" between the public and private education sectors (Merhej & Baroud, 2020).

At the entrepreneurship level, the interventions have to focus on facilitating access to funding, new markets, and relevant networks and developing an interconnected chain of resources and stakeholders to promote and develop entrepreneurial spirit among youth in a sustainable way (Ziane-Cherif, 2016).

At the innovation level, Lebanon needs to set up a national technology transfer office to organize technology transfer, initiate successful cooperation between universities and industries, and provide legal guidance on regulatory mechanisms for research collaboration between universities and industries. In the same rationale, the UK Lebanon Tech Hub (2016) recommends creating a national resource center and an international R&D facility. The Center will house Lebanese start-ups, SMEs, incubators, students, and entrepreneurship projects with multinationals and mid-sized firms. This facility will be a leader in research that will be a crucial help to local universities. It will form networks to improve investment and facilitate the technology transition from academia to industry. The government also must eliminate regulations prohibiting faculty members from collaborating or developing new businesses with the private sector and local communities. Finally, as ESCWA (2016) suggested, the IPR law must be updated with a clear IPR policy.

At the ICT level, Lebanon needs a shared vision for the ICT sector and a clear consensus on government policy, including reforming the sector's fiscal accountability and governance. The Lebanese government also needs to introduce competition in the market and increase the private sector's involvement by ensuring that all digital service providers have a common legal framework to extend internet broadband service by fiber (International Bank for Reconstitution and Development/The World Bank, 2018).

Our findings also suggest that a holistic approach is necessary for developing a knowledge-based economy, encompassing ICT and innovation, education, entrepreneurship, and institutional and economic frameworks. This approach would require collaboration and coordination between various stakeholders, including the government, private sector, universities, and civil society. This approach should define the legal and regulatory frameworks required for such transition. Partnerships must also be formed among key stakeholders, including higher education institutions, nongovernmental organizations, civil society groups, the corporate sector, the Lebanese diaspora, the government, and international organizations (Merhej & Baroud, 2020).

Overall, our findings show that sound and consistent policies adapted to the local conditions promoting the knowledge economy, such as promoting education and human resources, the innovation system, and ICT, would assist Arab countries in achieving inclusive growth and sustainable development. Despite a growing amount of research on the knowledge economy indicating that its efficiency in allowing change depends on how effectively it adapts to socio-spatial and institutional settings, governments often pursue models that have proven successful elsewhere.

Regarding the theory, our results are consistent with the abovementioned theories, emphasizing the pivotal significance of knowledge accumulation, innovation, and collaboration among academia, industry, and government in facilitating the shift towards a knowledge-based economy. Indeed, the knowledge-based view, which emphasizes the strategic value of knowledge as a valuable resource, resonates with Lebanon's assets, such as its skilled human capital and entrepreneurial spirit. Additionally, several challenges, such as limited collaboration among stakeholders and institutional deficiencies, hamper the flow of ideas, expertise, and resources needed to fuel innovation. This highlights the significance of tackling the barriers identified within the framework of innovation systems theory. Furthermore, the paper

emphasizes the importance of the knowledge-based economy pillars in generating economic growth and inclusive development. The integration of these pillars with the economic and institutional system is consistent with the triple helix model, which emphasizes collaborative efforts among multiple stakeholders. Accordingly, the connections between these theories and the empirical findings of the paper offer valuable insights into the country's present status as well as guidelines for future action. In addition, the study shows that the transition to a knowledge-based economy is a complex process that relies upon several economic, cultural, and institutional elements. These variables are essential to all stakeholders (decision-makers, industry, academia, R&D, interest groups, etc.) and all KBE pillars, regardless of whether they are in government or industry. Furthermore, there was a strong correlation between the findings and a need for a holistic solution to understand better the possible issues in the Arab region's transition to a knowledge-based economy.

Overall, our analysis added value to the existing literature on this topic by providing a detailed evaluation of Lebanon's knowledge-based economy, identifying its strengths and weaknesses, and offering recommendations for policy-makers and stakeholders to improve its competitiveness and enhance its growth. Furthermore, our study contributed to the literature on the knowledge-based economy in the Arab world, as the dynamics of the knowledge-based economy in this region are still under-researched. By highlighting the state of Lebanon's knowledge-based economy and its potential for improvement, we hope to inspire further research in this area and contribute to a better understanding of the factors that drive growth and competitiveness in the Arab world.

Finally, we must point out a few limitations of our study. The main limitation is that we may not have had access to all ICT enterprises in Lebanon or a representative sample since this is difficult to do. The dynamics of the innovation system are one of the intriguing aspects of Lebanon's ICT industry that need further study. Additionally, it is difficult to apply the findings to other Arab nations because of Lebanon's socio-economic and political specific characteristics. Indeed, the region is politically heterogeneous, consisting of countries at various levels of economic development and endowed with substantially dissimilar natural resources (ESCWA, 2017). Accordingly, the region's economies can be classified into three distinctive groups: the Gulf Cooperation Council (GCC) natural resource-rich and high-income countries; labor-rich and middle-income countries (e.g., Tunisia, Morocco, Egypt, Lebanon); and conflict-affected countries such as Syria, Iraq, and Yemen (United Nations Development Programme (UNDP), 2016). However, it would be helpful to compare the position of Lebanon's knowledge-based economy to that of other Arab nations with similar situations, such as Tunisia or Morocco. Future studies might also concentrate on the dynamics of the entrepreneurial ecosystem and its development, particularly with Circular 331. In general, prospective studies on the Arab world's knowledge-based economy should concentrate on the dynamics of emerging sectors and industries such as AI, agritech, fintech, and smart cities, as well as their role in addressing the region's many issues (water security, food security, sustainability, etc.) and its link to creativity and creative sectors (Ben Hassen & Tremblay, 2019).

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Data Availability The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics Approval and Consent to Participate This study was performed according to the Helsinki Declaration guidelines. Participation in the research was voluntary. At the beginning of the study, each participant was informed of the study objective and context and provided their written informed consent regarding privacy and information management policies.

Consent for Publication Not applicable.

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