مصرف لبنان
BANQUE DU LIBAN

Innovation in Lebanon: The Role of the Central Bank

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I. Introduction

Alan Kay[i] once said: "The best way to predict the future is to invent it". To invent is to discover an idea for a new product, a new technology, or a new material, or new methods and processes. But, can an invention transform the future? No, it is rather the attempt to carry out the discovered idea into practice – the commercial application of this idea that would trigger a transformation. This is the difference between an invention and an innovation as per Fagerberg's definition – "Invention can occur anywhere, while innovation occurs mainly in firms that need to combine several different kinds of capabilities, knowledge, resources, and skills"[1].

This is how industrial revolutions were brought up leading to fundamental transformations of the global production system. After using water and steam power to mechanize production at the end of the eighteenth century (Industrial Revolution 1.0), then using electrical energy to create mass production starting the twentieth century (Industrial Revolution 2.0), and later using electronics and information technology to further automatize production starting the seventies (Industrial Revolution 3.0), the current industrial revolution combines information technology, communications, data, as well as biological and physical elements to create cyber-physical production systems (Industrial Revolution 4.0)[2]. These innovations have not only changed the face of industrial productions, they have fueled an unprecedented rise in economic growth and led to incessant renovation of all aspects of people's and businesses' life[3].

In particular, the fourth industrial revolution is expected to further disrupt both developed and developing economies deeply, yet unevenly, powered by a number of technological innovations including mobile internet, automation of knowledge work, the Internet of Things, Cloud technology, advanced robotics, autonomous and near-autonomous vehicles, next-generation genomics, energy storage, 3D/4D printing, advanced materials, advanced oil and gas exploration and recovery, and renewable energy[3].

The fourth industrial revolution has already achieved several improvements in different areas. Mobile internet technologies have pushed down the price of the fastest supercomputer from USD five million in 1975 to a mere USD 400 for an iPhone4 with equivalent performance; the automation of knowledge work has created a workforce of more than 230 million knowledge workers (9% of global workforce as at 2012); the number of connected machine-to-machine devices increased threefold over the past five years; more than 300,000 miles were driven by Google's autonomous cars; advanced gas exploration and recovery technologies increased the efficiency of North American gas wells threefold between 2007 and 2011; and renewable energy provoked an 85% drop in cost per watt of a solar photovoltaic cell since the year 2000 – to name a few[3].

The scope, scale and ubiquity of these disruptions are unprecedented. By 2025, the share of solar and wind global electricity generation is expected to reach 16%; hydraulic fracturing and horizontal drilling are expected to increase North American oil production by 100-200%; 1.5 million driver-caused deaths

[i] American computer scientist and innovator.

from car accidents will potentially be addressable by autonomous vehicles; sequencing a human genome is expected to be achieved in one hour for a USD 100 cost; the automation of knowledge work is expected to generate an economic impact of USD five to seven trillion; and two to three billion additional individuals will have access to the Internet[1]. The latter alone could result in a productivity upsurge by as much as 25%, and the resulting economic activity could generate USD 2.2 trillion in additional GDP and more than 140 million new jobs[3].

Eight of these twelve economically disruptive technologies are identified for digital transformation, thus baptizing the fourth revolution as The Digital Revolution or Tech Revolution. Today, six out of the world's ten largest companies by market capitalization are technology companies[4].

Unlike previous revolutions powered by land, labor, capital, energy, materials, and trust, the current one is driven by knowledge and progress in technology, as well as creativity and specialization in production. The Global Innovation Index (GII)[5] measures innovation using these new factors as actual evidence of innovation outputs in a national economy, and compares them to the five input factors that enable innovative activities (institutions, human capital and research, infrastructure, market sophistication, and business sophistication). Each of these factors is divided in sub-factors, combining a total of 81 indicators.

According to the GII ranking 2017, Switzerland had the highest score. In 2016, out of the USD 279 billion total goods exports, Switzerland (GDP totaling USD 659.8 billion) exported USD 35.3 billion machines including computers, electronics and other Information and Communications Technology (ICT) products (5.35% of GDP). Lebanon was only 81/127 on the GII ranking. This country of roughly USD 52 billion in terms of GDP (BDL estimates as at year 2017) exported goods for a value of USD 3.76 billion in 2016, including USD 424 million only from manufacturing exports (0.82% of GDP) including ICT and high-tech products. These are topped up by exports of services of around USD 8.96 billion, including USD 3.29 billion from ICT services exports (high importance of software creation and exports). While it imported USD 19.7 billion, out of which 10.36% – the equivalent of USD 2.04 billion were spent on manufacturing imports[6,7].

Despite this rank, Lebanon enjoys a competitive edge relative to economies of similar size and compared to its neighboring countries. This competitive edge is underpinned mostly by its share of innovative manufacturing firms[8], its high share of knowledge-intensive and cost-competitive workforce, and the strategic support from Banque du Liban – the central bank of Lebanon for technological innovation and the knowledge economy.

In what follows, I will firstly address the challenges, strengths and opportunities of Lebanon's innovation ecosystem. Secondly, I will present Banque du Liban's role in accelerating innovation. Lastly, I will conclude with the necessity of supporting innovations that foster inclusiveness and social good.

II. Innovation in Lebanon: Challenges, Strengths and Opportunities

One of the reasons that could justify Lebanon's GII rank is its relatively low level of high-tech and ICT-enabled production and export, which reflect the *innovation paradox*. The latter arises from "the coexistence of great potential gains from innovation catch-up in developing countries with low innovation investment by firms, and the surprising lack of effectiveness by governments in increasing these investments by several orders of magnitude"[8].

It is argued that in order to profitably drive innovation, developing countries should first support production and management capabilities at the firm level; second, increase the focus on supporting technological adoption capabilities; and third, support invention and technology-generation capabilities (the three stages of the capabilities escalator) – "firms need to walk before they can run". Many advanced countries, including the United States, Singapore and Japan have invested and continue to invest heavily in the first stage of the escalator[8]. Lebanon may need to refocus on that stage as well.

The GII 2017 ranking captures five input factors. Here are the results for Lebanon:

1. The institutions factor captures the institutional framework of the country (overall rank 100/127). It embraces three sub-pillars: political environment (rank 121/127), regulatory environment (rank 83/127), and business environment (rank 88/127). This pillar reflects a weakness that can clearly be improved.
2. The human capital and research factor evaluates the human capital of the country (overall rank 78/127). It includes three sub-pillars: education (rank 111/127), tertiary education (rank 37/127), and research and development R&D (rank 49/127). Lebanon has an excellent global rank in terms of graduates in science and engineering and tertiary inbound mobility, yet it has to expand the share of investment in R&D.
3. The infrastructure factor (overall rank 88/127) gauges ICT (rank 70/127), general infrastructure (rank 115/127), and ecological sustainability (rank 76/127). Lebanon has to enhance its logistics performance, its environmental performance, and its e-government portals and services.
4. The market sophistication factor measures market conditions and the total level of transactions (overall rank 96/127). It includes three sub-pillars: credit (rank 86/127), investment (118/127), and trade, competition and market scale (rank 63/127). Lebanon provides relatively adequate credit and equity financing solutions for the private sector and business ventures, yet two aspects could be improved those being the ease of getting credit and ease of protecting minority investors.
5. The business sophistication factor measures how conducive firms are to innovation activity (overall rank 61/127). It includes enablers related to knowledge workers (rank 47/127), innovation linkages (rank 60/127), and knowledge absorption (rank 83/127). Lebanon enjoys a relatively good share of knowledge-intensive employment, a good level of university/industry research collaboration, a high share of ICT services imports, and high FDI net inflows. The share of high-tech imports less re-imports scores low. And there is no data relative to gross expenditures on

R&D performed and financed by businesses, and R&D financed by foreign economies.

Two output factors are taken into consideration in the GII:

1. Knowledge and technology outputs cover all those variables that are traditionally thought to be the fruits of inventions and/or innovations (overall rank 82/127). Lebanon produces a relatively good number of scientific and technical articles. The country enjoys relatively good level of high- and medium-high-tech manufacturers, as well as FDI net outflows to GDP and ICT services exports. However its score for high-tech exports less re-exports is low. All other variables can be improved: knowledge creation (rank 57/127), knowledge impact (rank 110/127), and knowledge diffusion (rank 44/127).
2. Creative outputs measure the role of creativity in innovation (overall rank 81/127). All elements of creativity can be improved: intangible assets (rank 98/127), creative goods and services (rank 32/127), and online creativity (rank 76/127). However, some of these results may not be caused by a lack of creative content, rather than a lack of statistical information and monitoring of innovations in general, and of online creativity in particular.

Innovation is recognized as a key building block of competitive and dynamic economies. The Global Competitiveness Index (GCI) 2017-2018 has ranked Lebanon 105 out of 137 with a score of 3.8/7. Low quality of institutions and infrastructure and the declining macroeconomic environment were the main factors impeding competitiveness.

The contribution of the "innovation" factor in the GCI (score 3.4/7 – one of the best in the MENA region) improved the overall competitiveness score, and ranked Lebanon 58/137 in innovation alone. The positive factors affecting this rank were the availability of scientists and engineers (rank 15/137), the capacity for innovation (rank 41/137), the university-industry collaboration in R&D (rank 48/137), and the share of Patent Cooperation Treaty applications (rank 59/137). The negative factors hindering Lebanon's rank were the gap in terms of government procurement of advanced technology products (rank 114/137), the relatively low quality of scientific research institutions (rank 81/137), and the little company spending on R&D (rank 75/137)[9].

An economy with a favorable ecosystem has higher chances to innovate and prosper. The strengths of the Lebanese innovation ecosystem include:

- *A multilingual, qualified and entrepreneurial workforce*: The Lebanese workforce is knowledge-intensive – out of a population of roughly five million resident Lebanese, around 5,000 engineers graduate each year, 2,000 of which are specialized in ICT-related activities, and most of them work in the Arab region. Also, Lebanon is ranked sixth worldwide for the quality of its Math and Sciences education and 19th for the quality of its overall educational system[10].
- *A cost competitive knowledge workforce*: The Lebanese human capital possesses very high competitive technical skills and is less expensive than neighboring countries and developed economies[11].

- *A well-reputable higher education system and scientific community*: Lebanon has the oldest higher education system in the region dating back to 1866. Currently, the country has the highest number of per universities capita in the region with a total of 42 higher education institutions. Four of its universities are ranked among the top 25 universities in the Arab region[12], including the American University of Beirut in the first position. Lebanon also conveys public and private vocational institutes and university- and non-university-based research centers, including the National Council for Scientific Research (NCSR).
- *A supportive funding setting*: Lebanon was ranked second in the MENA region in terms of investment in Tech startups in 2016[13]. Its ranking has steadily improved over the past four years in both number of deals (from 11 deals in 2013 to 37 in 2016) and value of deals (from USD 7 million in 2013 to USD 56 million in 2016). Lebanon is also reported to host 13% of the total number of investors in the region.
- *Innovative Tech manufacturers*: Lebanese high-tech and ICT firms and startups capitalize on the aforementioned competitive advantages to expand and export to foreign markets. A spectacular rise of high-tech exports took place in 2010 when the share of high-tech exports reached 12.8% of total manufactured exports mounting USD 278.5 million – the highest in the region. Constrained by the regional calamities and local political instabilities, this share then dropped and stabilized at 2% between 2011 and 2014. The global financial crisis had also a negative impact on Lebanon's share of ICT service exports, which dropped from 61.2% in 2008 to 24.7% in 2014, equivalent to USD 10.9 billion and USD 3.7 billion respectively[14]. Moreover, the number of Tech startups is growing steadily with a compound growth rate of 24% annually between 2009 and 2015[15], and around 9,000 direct and indirect jobs were created in the Tech sector[ii].

Capitalizing up on the aforementioned strengths of the Lebanese innovation ecosystem, and in order to overcome its weaknesses, the following actions ought to be taken:

1) Establish a national innovation strategy coordinating innovation among industry, academia and government[16];
2) Set up key performance indicators to assess and monitor innovation progress and achievements at the national level, as well as by each partner of the national innovation strategy;
3) Establish a nexus between the national innovation strategy, the national scientific research strategy and the national sustainable development plans, and encourage coordination among parties;
4) Improve the digital skills and literacy of all types of organizations and individuals;
5) Enable digital adoption by individuals, public institutions and private companies through legal and administrative reforms;

[ii] See: Section III, Paragraph "Equity Financing" of the present document.

6) Improve digital infrastructure through expanding cheaper access to internet as a universal resource, and creating fiscal incentives on Tech hardware imports;
7) Support the creation of Application Programming Interfaces (APIs), electronic ID systems, and digital platforms to allow access to various digital services including e-commerce, banking, investment, insurance, healthcare, and education;
8) Develop strong cybersecurity policies and safeguards to protect data, systems and organizations;
9) Increase the motivation of researchers and innovators through financial and non-financial incentives (higher salaries, grants, awards, recognition);
10) Raise awareness on the significance and impact of the outputs of R&D and innovation, especially those matching with the needs of the industry or the needs of the society, tackling socio-economic development;
11) Improve the quantity and quality of databases, which are vital for scientific research and innovation;
12) Protect the rights of innovators through a modernized intellectual property law;
13) Encourage local, regional and international cooperation in R&D and innovation;
14) Increase government spending on R&D and innovation;
15) Create a public-private fund for innovation;
16) Encourage the private sector, especially small and medium enterprises, to invest in R&D and innovation through tax incentives;
17) Develop policies and regulations that enable companies to leverage digital technologies to innovate, compete and export;
18) Encourage and promote technological specialization in specific high-growth areas, such as ICT manufacturing, agro-technologies, and bio-medical technologies.

III. Accelerating Innovation: The Role of Banque du Liban

Technological innovations are disrupting industries and adding up new challenges such as eliminating jobs (displacement of workers by machines), growing skill gap (digital divide), and loss of control of personal and government data (privacy and security). Governments and regulators have three choices. The first choice is to do nothing. The second choice is to adopt a defensive position against technological innovation. The third choice is to implement policies and upgrade regulatory frameworks and standards to fuel the development and adoption of new technologies.

Banque du Liban (BDL) was a pioneer, not only in the country or the region, but also globally, in taking the position of a catalyst and supporter of knowledge economy and digital and technological innovation since 2013. It has been only a couple of years since similar actions and formal supportive

policies were taken by central banks such as France, the UK, Bahrain and the UAE.

The World Bank compares innovation policy to gardening[17]. From this perspective, there are four main tasks to be performed in order to promote innovation in an economy:

> *Task 1: Preparing the ground and planting the seed.* This is the mission of the educational system in inspiring the curiosity, the creativity and the innovation of young talents, as well as building their capacity and incubating them.
>
> *Task 2: Enhancing the soil* by nourishing the knowledge-base by improving R&D structures and encouraging the collaboration between industry, universities, and R&D centers.
>
> *Task 3: Removing all sorts of weeds* that keep innovation from spreading, such as providing technical and managerial trainings, mentorship, infrastructural support, connecting innovators to markets, enhancing quality of institutions and infrastructures, upgrading regulations, etc.
>
> *Task 4: Watering* is what keeps the garden alive and flourishing. And this is where central banks can support innovation by indirectly providing financial support through the banking industry. BDL has been keen on such initiatives and we will discuss them shortly.

Based on this gardening analogy, here are the main players driving change in that the ecosystem provides a series of services to innovators and innovative companies and startups (*Task 3: Removing all sorts of weeds* – Spreading innovation culture):

- Education and research institutions: universities and research centers;
- R&D cooperation between academia and industry : Lebanese Industrial Research Achievements Program (LIRA);Government support: the Industrial Research Institute (IRI) and its divisions Euro-Lebanese Centre for Industrial Modernization (ELCIM), Lebanon Soft Shore and Centre for Innovation and Technology (CIT); the SMEs Unit and Qualeb at the Lebanese Ministry of Economy and Trade; the Business Support Unit (BSU) for startups at the Investment Development Authority of Lebanon (IDAL);
- Foreign support: the "Partnership for Research and Innovation in the Mediterranean Area" (PRIMA) project funded by the European Commission; the "Innovation and Development of Academic-Industry Partnerships through Efficient Research and Administration in Lebanon" (IDEAL) project funded by the TEMPUS IV program of the European Union;
- Support services: incubators; science and technology parks; clusters; training and capacity building hubs; mentor organizations; co-working spaces; professional associations; networking platforms; networking events, awards and competitions;
- Fiscal, investment and export incentives: Lebanese tax rates are among the lowest globally. To further encourage innovation, IDAL offers tax breaks for up to ten years and other incentives to local and foreign companies

operating in the ICT sector meeting specific requirements, as well as assistance in the support, promotion and marketing of Lebanese products;

- Access to finance: banks; financial institutions; microcredit institutions; financial cooperatives; bank guarantors; accelerators; angel networks; venture capital firms.

The upsurge in the number of startups, incubators, accelerators and VC funds was triggered by the uninterrupted stream of watering (*Task 4: Watering* – Financing) that BDL has been providing since the year 2013, which was a turning point for the development of the innovation ecosystem.

Here is how the central bank is contributing to accelerating innovation and knowledge economy, promoting sustainable development, and boosting economic growth and employment directly and indirectly in Lebanon:

- *Credit incentives*: In the past few years, Banque du Liban has been providing incentives for Lebanese banks in order to secure adequate financing in the economy. It has issued circulars to encourage bank lending at a lower cost by setting exemptions from mandatory reserve requirements. The purpose of this strategy is to lower the cost of borrowing significantly to encourage investments in vital and productive economic sectors. This helps creating new job opportunities for the Lebanese youth and ensuring the necessary financing for SMEs. Also in 2013, a stimulus package has been introduced, consisting of around USD one billion annually in the form of soft loans extended to Lebanese banks in order to boost lending activity and fuel economic growth. In addition to supporting productive sectors, housing, education and renewable energy projects, this new package targets loans to entrepreneurs in order to help them finance new projects in the field of knowledge and innovation, as well as loans to finance R&D ventures in productive sectors between the Lebanese private sector and a university, a research center or an business incubator[iii]. The package proved to be successful contributing to around 50% of real GDP growth.

- *Equity Financing*: In 2013, BDL issued a regulation[iv] through which Lebanese banks were allowed to dedicate up to 3% of their shareholders' equity, up to 10% of which can be invested in a single company, to equity investments into startups, incubators, accelerators, and Venture Capital funds operating in the technology sector in Lebanon. In 2016, the banks' participation limit was raised to 4%, or about USD 650 million, and this trend is expected to continue in the coming years[v]. Each of these investments are 75% guaranteed by the central bank in exchange for 50% of any profits. So far, this initiative enabled Lebanese banks to invest around USD 400 million in the equity capital of startups, incubators, accelerators and VC funds working in the knowledge economy. To date, the Lebanese knowledge economy has attracted 800 startups, created 9,000 jobs, and is expected to reach a target of 25,000 jobs by 2025[18]. Since the issuance of this circular, the Lebanese Tech sector has grown 8% a year,

[iii] BDL Circular no.313/2013.

[iv] BDL Circular no.331/2013.

[v] Lebanon's GDP was estimated at USD 40.06 billion in 2013, and 49.5 in 2016 (World Bank).

and increased national wealth by around USD 1.5 billion. BDL expects this sector to grow by around 7 - 9% annually in the coming three years.

- *Crowdfunding*: In 2013, the Capital Markets Authority of Lebanon has set the regulation for the establishment of crowdfunding companies in Lebanon. Crowdfunding consists of startup companies and MSMEs raising many small amounts of capital from a large number of investors, usually through the Internet.
- *Innovation Hub*: Avaling financing is not enough. The key lies in matching supply of ideas to the demand of funds and export markets. In that spirit, since 2013, BDL funds and hosts an annual international innovation hub on knowledge economy and technological innovation. In 2016, the BDL Accelerate[19] forum attracted more than 20,000 attendees, 100 speakers from 50 countries including Steve Wozniak (co-founder of Apple) and Tony Fadell (father of the iPod and founder of Nest), in addition to 100 startups from 40 countries, and one of the largest hackathons in the world.
- *Sponsorship*: Last but not least, BDL has been sponsoring various private-sector innovation initiatives, such as the Little Engineer Foundation and the ArabNet conference, as well as various R&D initiatives such as the LIRA program and the AUB-USJ Joint Bio-Medical Research Conference.

IV. Conclusion

The potential disruptions of the digital revolution are countless. In the financial industry for instance, the combination of several technologies including mobile payment, Blockchain distributed ledger, digital identities, big data analytics, etc. could help to better understand, serve and protect consumers by making financial products and services more convenient, ubiquitous, cheaper and faster. This would definitely accelerate and achieve financial inclusion[20].

Also, in the context of developing countries, various existing technologies, or not yet discovered innovations, could help solving problems that global policies often fail to anticipate or address adequately, like alleviating poverty, reducing inequalities, providing clean water and low-cost electricity to everyone, expanding healthcare and sanitation everywhere to all, improving agricultural processes, advancing combatting pollution and protect the environment, and create safer and more rewarding jobs for the youth, women, disabled persons and the billions living in rural areas. The well-prepared economies would be able to overcome the challenges of this new digital revolution and profit from the opportunities that it would enable, namely promoting social, economic and financial inclusion, and prompting brain regain[21]. Social innovations are actually direct solutions to the UN's Sustainable Development Goals (SDGs)[22].

These innovations can emanate from visionary individuals, researchers, innovative organizations from all market sectors, or even government officials.

Le Défi Cisco is a prime example:

> *A group of Cisco employees launched Le Défi Cisco – a competitive contest and employee mentorship, to apply technology to social and environmental issues. Through this initiative, Cisco France has*

helped, with mentoring and support, a group of students to develop a prototype device to transform the urban experience for visually-impaired persons. Baptized " Sherpa", the traditional white stick uses proximity captors with ultrasonic waves that sense a wider spectrum of area and convey the information to user through vibration. The stick also incorporates GPS technology that provides local guidance, prioritized for real time conditions and a sightless traveler[23].

On a final note, the government of Lebanon has reached a milestone exatly three days ago, this past Monday, March 12th, 2018. It has launched the national strategy towards digital transformation that is expected to play a crucial role in accelerating digital adoption and facilitating technological innovation in Lebanon.

Thank you.

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