EVALUATING INNOVATION-DRIVEN ECONOMIC GROWTH: A CASE OF JORDAN

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Abstract: The aim of the research was to examine the role of innovation in promoting economic growth in Jordan. Innovation is a key factor for businesses and a significant element of growth. However, in the case of promoting economic growth, its significance differs in terms of region and countries. To explore the innovation-growth link, the study adopted a quantitative approach, using Jordan's macroeconomic data of 18 years (2000-2017). The data was collected from secondary sources using the World Bank database. It was found in the research that the progress in Jordan in relation to technology and innovation does not contribute to GDP growth. Internet penetration in Jordan increased, but GDP saw a persistent decline. However, patent applications (non-residents) has a significant impact on reducing unemployment in the country. Thus, it is recommended to focus more on innovation in the form of promoting patents to reduce unemployment and propel growth in the country.

Keywords: innovation; economic growth; patent applications; Internet; unemployment; Jordan

1. Introduction

The modern contemporary society is witnessing increasingly changing cultural, social, political and economic developments and above all innovation, which is largely becoming widespread in businesses around the world. As a result, the field of innovation is now an emerging area with the publication of numerous leading works. Businesses in the present technological society are likely to become more innovative particularly at the global level (Thomas et. al., 2011, Prodani et al., 2019; Orynbassarova et al., 2019). It is discussed by Pece, Simona and Salisteanu (2015) that the growth of information technology signifies the premises for the improvement in the financial performance of the organisation and for economic growth and development. It is observed that technology and innovation, and increasing expenditures on research and development (R&D) are fundamentals for guaranteeing progress and competitiveness, which leads to sustainable economic growth.

The relation between innovation and economic growth presents increasing interest for scholars; as a consequence, the notion is well-debated and well-researched subject in the financial literature. It was Solow (1956), who originated this concept of research and mentioned the existence of a strong association between innovation and

economic growth. On the other hand, an Australian political economist Joseph Schumpeter makes the peculiarity between economic development and economic growth. Hence, on the basis of his viewpoint, economic growth signifies a progressive and slow transformation of the economic system, consequential from exogenous factors, whereas, the economic development is created by uneven internal changes resulted by economic innovations, originating from the economic system.

This research specifically emphasises on the question, does innovation promote economic growth? In relation to this, Jordan as a case is studied to assess how innovation promotes economic growth in Jordan. According to Jordan Times (2018), Jordan is a country with limited natural resources, and its economy is largely reliant on its ability to enhance products and services value and to develop and use its human capital. Over the years, a number of measures have been introduced by the Jordanian government to assist the development of its economy by increasing its ability and competitiveness new prospects using innovation. Sultan and Soete (2012) assert that the national information system (NIS) of Jordan is not working with full efficiency and it is still underdeveloped. The innovation system lacks synchronisation between its components and is weak. The key challenge faced by Jordan related to economic and sustainable development is weak relation between business institutes and education, low expenditure of R&D, less usage of ICT, limited innovation activities and private sector R&D, non-competitive industry, brain drain and few skilled experts.

According to the recent report of World Bank (2018), in order to create jobs for unemployed people and accelerate growth in the Middle East North African (MENA) Countries, it is important to focus on digital economy that utilises educated and young workforces. This will probably require the implementation of new and innovative technologies and facility of 'digital public goods' such as digital payment solutions and reliable and fast internet. Economic growth in the MENA region has recovered from 1.4 % in 2017 to 2.0% in the year 2018. The slight increase in regional growth shows a positive effect of stabilisation policies and reforms taken in many countries in relation to recent external oil demand and the rise in oil prices. It is projected that economic growth in MENA region will improve slightly, reaching 2.6% by the end of 2019-2020.

2. Literature Review

Innovation and its Significance in Business
Competition among organisations is a lot more different today as it used to be in the past. The organisations are competing domestically as well as globally, and are working to attain competitive advantage so that they can acquire a stable and better position in the market. Innovation is, therefore, the best way to attain a competitive advantage (e.g. Ramadani and Gerguri, 2011; Amraoui et al., 2019).

As per the report of OECD (2010), innovation is vital for economic development and sustainable growth. A number of essential conditions encourage economic growth and enable innovation. Innovation is significant in the modern economy for innovation processes, growth and employment and value creation that take place at organisational, domestic and regional level.

According to Costello and Prohaska (2013), innovation is originated from the Latin term 'innovare' which is viewed as 'into new'. In the simplest term, innovation is perceived as doing something unusual. It is a word that has become common in the world of business and for organisations it usually means something time consuming, costly and risky. Innovation can be elucidated as a new concept, novelty, device or product. It is a way of thinking, a mindset beyond the today and into the forthcoming. For organisations, innovation is significant and when applied correctly it can be a management technique, process and a strategy (Stenberg, 2017). Zhou (2015), assert that innovation at the basic stage can the process of collecting and relating idea to make an association between past experiences and existing accomplishments to address future problems. Usually this is related to

technological achievements and has a significant role to play in the global economy. Similarly, Daugherty, Chen and Ferrin (2011), explain innovation as a specific tool of entrepreneurs to make use of change for a different service or business. Furthermore, this innovation can be viewed as disciplined that can be practised and learned. To be specific, innovation is said to be an object, practice or an idea that is seen as new by businesses or by entrepreneurs (Zawawi, 2016).

Ionescu and Dumitru (2015) have argued in their study that innovation is the governing force behind the profitability, growth, creation of strong values and competitiveness. The organisation witnessing quick growth and success are the ones who have used innovative solutions in their daily activities, and it is specifically for this purpose that a significant ratio for their revenue is generated by improved or new products and services. In the contemporary global markets, only those organisations will survive who can introduce and implement innovation and those who are more efficient than their rivals (Reddy and Reddy, 2014). Urbancova (2013) highlights that still innovation is viewed as a significant force behind economic performance. It helps to attain competitive edge in different aspects. The most significant feature of innovation includes: new products improve profitability and aid maintain market share; a robust relationship between new products and market performance and innovative practices that lead to reducing time of production and speeding up product developed as compared to the competitors.

Theoretical Framework
A country's economy is viewed from different perspectives; similarly, New Growth Theory is an understanding of the economy that involves significant points. Firstly, it assesses technological development as an architect of economic activity. Secondly, it holds different technology, knowledge and physical objects categorised as increasing returns and these returns direct the growth process. Usually, this theory is titled as 'endogenous growth theory' as it incorporates technology to assess how market works (Capello and Nijkamp, 2010, p.355). According to Peet and Hartwick (2015, p.60), New Growth Theory assists in continuing the shift to knowledge-based economy from resource-based economy. It highlights that economic procedure which form and diffuse knowledge significant for shaping individual firms, communities and nations.

On the other hand, Gregersen and Johnson (1997) view that theory needs to incorporate the core concept that accumulation of capital results in technical change and this change gives encouragements for capital investments. Within the economy, there is a sector known as 'knowledge producing' which delivers new technology to other sectors. In addition, innovation is the outcome of deliberate efforts of organisations in an optimisation background. Technology is not an entirely exogenous public good; however, it is produced in the economy and has public and private aspects. In relation to innovation, Venuvinod (2011, p.202) assert that Gabriel Tarde, the French sociologies is said to be a great theorist of entrepreneurship and innovation. According to Sveiby, Gripenberg and Segercrantz (2012, p.62), Schumpeter made significant input to the research of the role of innovation in development. The significance of innovation has been highlighted by Schumpeter who wrote that, innovation exceptional point in the economic history, or in what is entirely economic in that history. Innovation is said to be the entire based of Schumpeter model of economic change.

There are many dissimilar viewpoints in the role of innovation and economic theory (Forssbaeck and Oxelheim, 2014, p.220). Innovation, as seen by some theorist, is a significant aspect, the foundation of the theory; however, there are scholars who do not view innovation to be significant in any way. Innovation as per some theories is an endogenous factor, and it is described as exogenous to the economy (Onyemelukwe, 2016, p.26). It is found that innovation has a significant role in the classical theories, however, a considerably less role is found in neoclassical theories (Eggink, 2013). As per Schumpeter, development and growth can occur when the economy is continuously troubled to an out-of-equilibrium level. Later, in a few neoclassical theories, growth is increased through a factor called innovation; however it was seen as an exogenous factor. Innovation as endogenous factor and new growth theories were advanced later, nevertheless these theories were grounded on the principle of

equilibrium. Innovation is treated as endogenous to the economy in the neo-Schumpeterian and Schumpeterian theories. Further, the role of Schumpeter in contributing to theories related to economic development and through increasing attentiveness of the innovation role in these theories is of immensely significant. The input of Schumpeter has brought momentous change in the way how economic growth was perceived (Eggink, 2013).

Innovation and Economic Growth
In the past few years, policymakers and researchers have become more attentive to assess the relationship between entrepreneurship, innovation and regional outcomes (Wang, Ho and Autio, 2005; Howells 2005; Mitra, 2013, p.268; Galindo and Mendez-Picazo 2013; Tsvetkova 2015). Innovation is viewed as one of the significant aspects of the economy (Santacreu 2015; Bae and Yoo 2015; Andergassen, Nardini and Ricottilli, 2009), specifically since the influential work of Joseph Schumpeter, a political economist. According to Aghion et al. (2005), innovation affects the economy in different channels, i.e., global competitiveness, trade openness, infrastructure development, quality of life, financial system and high economic growth. The above-mentioned studies largely emphasise on the impact of innovation on economic growth, signifying the supply-drive method of innovation and growth relationship. Nevertheless, it is economic growth that in reality enhances the innovation level in the process of development. That indicates the possibility of bidirectional connectedness between innovation and economic growth (Pradhan et al. 2016; Maradana et al. 2017).

It is identified that innovation activities help to enhance economic growth directly through macroeconomic factors, i.e. interest rates, consumer confidence etc. (Van den Berg and Lewer, 2015, p.174; Furman, Porter and Stern, 2002). Nevertheless, it is likely that innovative practices and activities are equally impacted by macroeconomic factors and economic growth. Indicating that in practice, economic growth and innovation activities can cause each other in the process of development, and hence there is the likelihood of response relationship between the two (Hassan and Tucci, 2010). According to Torun and Cicekci (2007), Innovation is the core of the 21st-century economy, constantly driving different invigorating activities through the system. Hubbard, Garnett and Lewis (2012, p.373), assert that economic growth is usually measured by means of changes in the total value of goods and services an economy produces or what is recognised as GDP (gross domestic product). Certainly, as the size of countries differs so is their GDP growth, which offers a measure of well-being of individuals. According to the study of Gerguri and Ramandani (2010), a theoretical relationship between economic growth and innovation has envisaged as since as early as the 18th century by Adam Smith. The productivity gains have been articulated from specialisation via division of labour and also from technological improvements to processes and capital equipment.

Guan and Chen (2012) argue that innovation is largely accepted as a key reason for national economic growth in both developing economies and as well as developed economies. Furthermore, there is a general understanding among economist considering a significant and positive relationship between innovation and growth. Recent studies, i.e. Jainguo (2015), specify that a region or state's innovation policies can add to economic development. It is assumed that innovation activities have not any direct influence on economic productivity, however, economic growth is promoted via encouraging new business development, which promotes economic output and employment growth. On the other hand, Pece et al (2015), studied innovation and economic growth, considering the case of the ECE (Eastern Countries of Europe). It was found that innovation factors fail to influence the growth and to make a significant contribution to ECE. Even though economic growth in these countries is increasing rapidly, but the growth is not driven by innovation, rather innovation is still in an evolving phase.

Broughel and Thierer (2019) discussed that technological innovation is a key instrument behind human progress and economic growth. Economic historians, development economist and growth economists all seem to accept the significance of technological innovation in enhancing long-term economic growth. Certainly, a recent article published in The Economist magazine "*Economists Understand Little about the Causes of Growth"* nevertheless acknowledged that in some ways, growth is related to the use of technologies for becoming productive and for

discovering new ideas. Criscuolo (2008, p.33) studied that technological change is a key element of total factor productivity (TFP), and found that there is a proof that TFP has a significant part in accounting for the cross-country variation in patterns of economic growth and in income per worker. In contrast, supposedly, Çetin (2013) assert that innovation-based growth advocates that there exists a significant and position relationship between economic growth and innovation. In addition, research and development (R&D) have a significant role in raising productivity, innovation and enhance economic growth.

Hence, it can be said on the basis of above-mentioned studies, that innovation and economic growth are interrelated positively; however, limited investigation has been carried out on the role of innovation in promoting economic growth in the context of Jordan. As innovation is increasingly become prevalent and rapid adopted, it will surely be a key factor in increasing the economic growth rate of developing and developed economies in years to come.

3. Research Methodology

There are three different types of research approach, which include qualitative, quantitative and mixed-method approach. Each of these approaches is applied considering the objective and aim of the research. Concerning, the present study which assesses how innovation promotes economic growth, the researcher applies a quantitative research approach. The reason for applying this approach is to investigate innovation and economic growth using statistical, mathematical and computational techniques. In this approach, statistical software is used to analyse the data and present accurate findings (Luiz and Kun-huang, 2015, p.24).

The research design is a flow or strategy of the research which helps the investigator in performing different activities related to the research in a more systematic way. The investigator picks up the research design so that appropriate outcomes can be more understandable. There are dissimilar types of research designs applied in studies, which includes descriptive, correlation, experimental and review based (Kumar, 2019, p.94). In this research, a correlation design is used by the researcher concerning the aim of the study. Correlation design is helpful in finding a relationship between two or more variables (Morra Imas and Rist, 2009, 266). Hence the relationship between innovation and economic growth can be found using this design.

For data collection, the researcher uses secondary data sources, in which information is gathered from previous literature, databases, reports, and other sources (Naoum, 2012, p.49). In this research, data is acquired mainly from the World Bank online database, and literature is reviewed using earlier studies on the same subject. The sample size for the study is 18 years from 2000 to 2017. Further, the variable of the study includes economic growth, patent applications (resident and non-residents), unemployment level, internet penetration, and inflation.

Lastly, data analysis is the concluding phase of research. It interprets and assesses the gathered data by using statistical instruments. Further, there exist different techniques for analysing the data, but the nature of data determines what type of technique should be used. In the case of the present research, descriptive statistics, correlation and regression are used. Descriptive statistics are used in summarizing data which can be a representation of a population (Jackson, 2014, p. 262). The correlational technique can exhibit how strongly variable are interrelated with each other (Forte, 2015, p.240). While, regression analysis is helpful for assessing the impact of one variable over others (Dey, Bhatt, Ashour, 2018, p.104). These three analysis techniques are sufficient to analyse the data and present the results.

The proposed equations of the study are:

$$GDPG = \alpha + \beta_1 PANR + \beta_2 PAR + \beta_3 INF + \beta_4 II + e$$

GDPG	**GDP growth**
PANR	Patent applications (non-resident)
PAR	Patent applications (resident)
INF	Inflation
II	Individuals using the internet

$$UNEMP = \alpha + \beta_1 PANR + \beta_2 PAR + \beta_3 INF + \beta_4 II + e$$

UNEMP	**Unemployment rate**
PANR	Patent applications (non-resident)
PAR	Patent applications (resident)
INF	inflation
II	Individuals using the internet

Here, PANR, PAR, and II are used as innovation's proxies while GDPG and UNEMP show economic growth.

4. Results and Analysis

The objective of the current research study is to examine the impact of innovation on economic growth in Jordan. As mentioned earlier, innovation is measured by patent applications (resident and non-residents) and internet penetration, while economic growth is represented by GDP growth and unemployment.

Table 1. Descriptive Statistics

Descriptive Statistics					
	N	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**
Patent applications, non-residents	18	117.00	535.00	296.0556	139.36557
Patent applications, residents	18	21.00	75.00	44.5000	15.59129
GDP growth (annual %)	18	2.00	8.57	4.7306	2.41522
Unemployment, total (% of total labour force) (modelled ILO estimate)	18	11.90	15.30	13.6506	1.12381
Inflation, consumer prices (annual %)	18	-0.88	13.97	3.3267	3.39885
Individuals using the Internet (% of population)	18	2.62	66.79	28.0661	20.56497
Valid N (listwise)	**18**				

According to table 1, 296 patent applications (non-resident) are filed in Jordan on average during the 18-year period selected in this study (2000-2017), which a standard deviation of 139. However, the number of resident patent applications are relatively low on average (44). The country has recorded significant growth in the GDP during the period i.e. 4.73%, with an unemployment rate of 13.6% on average. This economic performance is comparatively better but inconsistent when compared to other states in the Middle East. Moreover, in terms of internet penetration, the individuals using the internet are 28% of the population on average, with a high standard deviation (20.5%), suggesting an increase in internet penetration over time.

Table 2. Correlation

Correlations							
		Patent applications, non-residents	Patent applications, residents	GDP growth (annual %)	Unemployment, total (% of total labour force) (modelled ILO estimate)	Inflation, consumer prices (annual %)	Individuals using the Internet (% of population)
Patent applications, non-residents	Pearson Correlation	1	0.385	0.075	-.722**	.539*	0.206
	Sig. (2-tailed)		0.115	0.768	0.001	0.021	0.413
	N	**18**	**18**	**18**	**18**	**18**	**18**
Patent applications, residents	Pearson Correlation	0.385	1	.478*	-0.333	0.209	-0.439
	Sig. (2-tailed)	0.115		0.045	0.176	0.406	0.068
	N	**18**	**18**	**18**	**18**	**18**	**18**
GDP growth (annual %)	Pearson Correlation	0.075	.478*	1	0.261	0.357	-.678**
	Sig. (2-tailed)	0.768	0.045		0.296	0.146	0.002
	N	**18**	**18**	**18**	**18**	**18**	**18**
Unemployment, total (% of total labour force) (modelled ILO estimate)	Pearson Correlation	-.722**	-0.333	0.261	1	-0.330	-0.218
	Sig. (2-tailed)	0.001	0.176	0.296		0.181	0.384
	N	**18**	**18**	**18**	**18**	**18**	**18**
Inflation, consumer prices (annual %)	Pearson Correlation	.539*	0.209	0.357	-0.330	1	-0.151
	Sig. (2-tailed)	0.021	0.406	0.146	0.181		0.549
	N	**18**	**18**	**18**	**18**	**18**	**18**
Individuals using the Internet (% of population)	Pearson Correlation	0.206	-0.439	-.678**	-0.218	-0.151	1
	Sig. (2-tailed)	0.413	0.068	0.002	0.384	0.549	
	N	**18**	**18**	**18**	**18**	**18**	**18**

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

The study examines the correlation between the given constructs in order to assess the nature and extent of the relationship. According to table 2, patent applications (non-residents) has a significant and strong correlation between unemployment and inflation only. Its association with unemployment is negative and positive with inflation. However, internet penetration has a significant but negative association with GDP growth. The negative association can be justified by the fact that internet use has grown during the period, while GDP growth has declined as shown in figure 1.
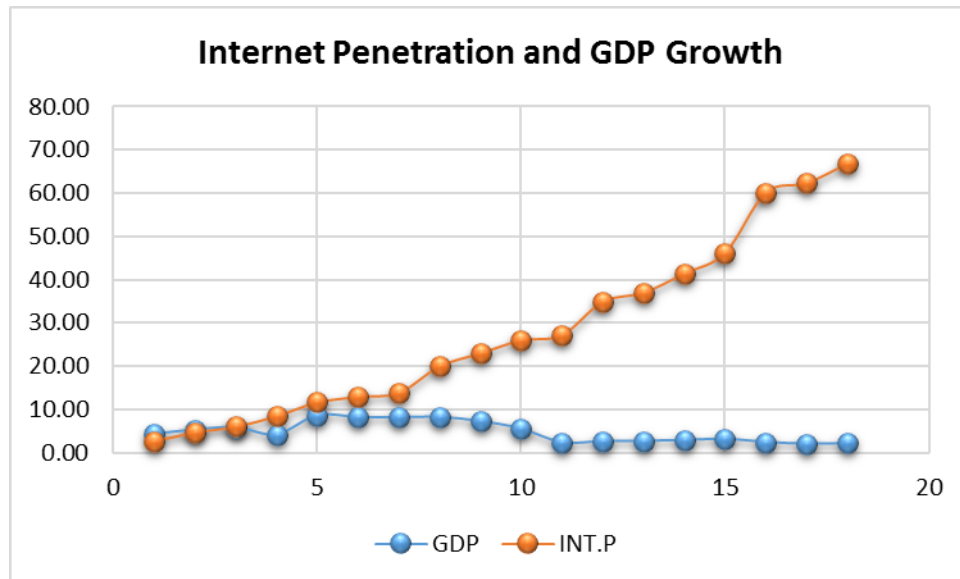
Figure 1. Internet Penetration and GDP Growth

In the following analysis, the paper performs a correlation, using unemployment as a proxy to economic growth. According to table 3, the overall multiple regression model where innovation predicts economic growth is statistically significant at the 0.05 level. It means the set of variables including Inflation, consumer prices (annual %), Individuals using the Internet (% of population), Patent applications, residents, Patent applications, non-residents significantly predict unemployment rate in Jordan.

Table 3. ANOVA

	Model	Sum of Squares	df	Mean Square	F	Sig.
			ANOVA			
1	Regression	11.631	4	2.908	3.842	.028[b]
	Residual	9.839	13	0.757		
	Total	21.470	17			

a. Dependent Variable: Unemployment, total (% of the total labour force) (modelled ILO estimate)
b. Predictors: (Constant), Inflation, consumer prices (annual %), Individuals using the Internet (% of the population), Patent applications, residents, Patent applications, non-residents

The overall model explains 54.2% of the variance in the dependent variable as revealed by the R-squared value, suggesting a good fit (Table 4).

Table 4. Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
		Model Summary		
1	.736[a]	0.542	0.401	0.86997

a. Predictors: (Constant), Inflation, consumer prices (annual %), Individuals using the Internet (% of the population), Patent applications, residents, Patent applications, non-residents

However, individually, only patent applications (non-residents) is significant in predicting the unemployment rate in the country (Table 5). The beta coefficient is negative, suggesting a negative relationship. The value of beta reveals that a unit increase in the number of patent applications reduces unemployment by 0.005%, which is very low. However, it is observed that progress in the country in terms of innovation and technology does contribute to economic growth.

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Table 5. Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	15.895	0.907		17.528	0.000
	Patent applications, non-residents	-0.005	0.002	-0.645	-2.255	0.042
	Patent applications, residents	-0.011	0.018	-0.157	-0.615	0.549
	Individuals using the Internet (% of population)	-0.008	0.014	-0.150	-0.592	0.564
	Inflation, consumer prices (annual %)	0.009	0.080	0.028	0.115	0.910
a. Dependent Variable: Unemployment, total (% of the total labour force) (modelled ILO estimate)						

Based on these findings it can is been confirmed that some of the innovation proxies do have significant impact on the economic growth of the country. More precisely speaking, the patent applications non-resident, does impact the unemployment rate of the country i.e. contributes to economic growth. The findings suggest a focus on non-residents' patent application to propel innovation-led growth in the country. However, it is also important to promote and facilitate residents' patent applications, which are fewer in numbers when compared to non-residents.

4. Conclusion

The aim of this research was to see whether innovation promotes economic growth, considering the case of Jordan. A considerable number of studies has studied the link between innovation and economic growth. Innovation is an emerging phenomenon and is considered as a key element in enhancing productivity and growth. The study was quantitative in nature and collected data from the secondary sources, i.e. World Bank. It was found in the results that 296 patent applications (non-resident) are filed per year on average in Jordan during (2001-2017). Further, internet penetration in Jordan increased, but GDP growth saw a persistent decline. The patent application (non-resident) has a strong and significant correlation with inflation and unemployment. Its association with inflation is positive and negative with unemployment. Moreover, individually, the patent application (non-residents) is significant in reducing the rate of unemployment in Jordan. Therefore, it is suggested that Jordan must focus on growth in innovation and technology with an aim to reduce unemployment in the country.

However, the current study has certain limitations. The study results may not be generalized on a larger population or on similar economies since the sample size is limited to only 18 observations. Moreover, the study methodology also restricts the results to only statistical evidence. A more comprehensive study can be conducted in future using both quantitative and qualitative methodology with larger sample size and inclusion of both primary and secondary data.

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