



WHAT TO DO TO IMPROVE THE INTERNATIONAL SAUDI INNOVATION RANK/SCORE

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ABSTRACT:

The purpose of this paper is to identify the factors that contributed positively towards improve the international rank of Saudi Arabia. By international rank we mean the annual score that issued by the Global Innovation Index for countries. A systematic methodology have been used to conduct the research starting by collected data from the last reports, conducting the literature review, analysing the data statistically and concluding the significant factors. The analysis suggests that the most significant factors are Infrastructure, Market sophistication, Business sophistication, Creative Output. The author have selected to discuss the score rather than the rank because the score is driven by the 80 factors that represent the capability of the country; whereas the rank is always subject to other countries weather they are good or bad.

Keywords: innovation, Saudi Arabia, GII

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1. INTRODUCTION:

Simply and briefly the objective of this research is to study the current international score/rank of Saudi Arabia by grouping and identifying the pillars that contribute positively on the innovation performance of Saudi Arabia. This innovation performance collected from the GII report that issued annually for different countries including Saudi Arabia. This report is published by Cornell University, INSEAD, and the World Intellectual Property Organization, in partnership with other organisations and institutions. This index is measuring the capability of a country and its success to achieve the innovation.

The important of this report comes from many different dimensions. The 1st dimension is because this report discussing and comparing the innovation performance of Saudi Arabia for many years rather than one year or one discipline as I have seen in other research as you will see in the literature review.

The 2nd dimension: This report discuss the innovation in a country that have a strategic position either economically or strategically because it is the 2nd country in the World that producing oil. In addition to other feature the importance of Saudi Arabia this research is important.

The 3rd dimension: This report discussing the innovation in a time that Saudi Arabia now trying to improve and develop the country by setting up a vision till the year 2030 and also through national transforming programs that aiming to diversify the income of the country and also to encourage the knowledge based economy systems and other developing visions through which the innovation is an important pillar of any development program.

The 4th dimension: The importance of this report because this research is talking about innovation which is currently most of the academics, Government and also Industrials are talking about it because they noticed the strong relation between the competitiveness and the innovation and it's sustainability.

The 5th dimension: that approves or chose the importance of innovation is this study which is discussing around 80 indicator that represent many different discipline; political discipline, Economical discipline, Educational discipline, Trade and Business discipline in addition to the infrastructure. Those 80 indicators have been classified and group into 7 pillars as we will see in later.

Moreover, the importance of this report comes from the comprehensiveness of the factors that considered in this research. Therefore any conclusion that this report can reach or unveil the reader can feel confident that the recommendation is based on so many factors that have been considered on this analysis.

Finally this report ends up with indicating or listing the factors that can contribute positively in improving and increasing the score that Saudi Arabia can achieve in the future; especially that this analysis gone through an accurate and statistical analysis which tarts with testing the normality and the variation of the data and then investigates the correlation model between the dependent and independent factors and then thirdly couple of unit through test have been done before regression model in order to avoid the spurious regression problem and when these two tests have shown that there are no unit route process problems the analysis went through to develop regression model confidently. Finally after the result of regression model another two tests have been done to investigate the fitness of the model and again the results of the two techniques which are residual analysis and the diagnostic test again have shown that the fitness for this type of data is very accurate and confident.

2. LITERATURE REVIEW:

One paper was issued on Dec 2011; the purpose of this conceptual-paper is to examine the current efforts towards organizational creativity and innovation particularly in the context of Arab world especially Saudi industry; which ranked at 41 ahead of Italy, Poland, Turkey and China and its innovation output index was low at '98' place; according to the global innovation index (Adnan Iqbal, Innovation: Management, Policy & Practice, 2011). This theoretical paper also aims to identify and comprehend the barriers towards creativity and innovation in terms of organizational effectiveness; and has found that Saudi Arabia is doing well in attracting and retaining innovation factors (such as human skills, government support and investment in R&D, and increasingly knowledge through education-industry linkages); but still, there is a need for combination of right policies and good human capital to improve 'creative outcomes'(Adnan Iqbal, Innovation: Management, Policy & Practice, 2011).

Another paper aims to assess creativity and innovation at the educational system from the perspective of its customers. From the literature review a theoretical research framework was developed and a survey questionnaire was designed for this purpose (M. Aichouni, M. Touahmia, A. Al-Ghamdi, N. Ait-Messaoudene, R. M. Al-Hamali, A. Al-Ghonamy, and E. Al-Badawi, 2015). The statistical analysis of the results show some positive trends towards the student's perception on creativity and innovation, and some opportunities to improve the environment of creativity and innovation within the Saudi educational system. The present empirical study highlights the weakness of training and awareness programs on innovation and creativity within the educational system at the basic level and the higher education level-

Other paper have evaluated the role of universities in building a culture of innovation and entrepreneurship in Saudi Arabia, employing a literature review and gap analysis method to design an approach for universities (Nadia Yusuf and Huda M. Atassi, 2016). The Research carried on through an empirical study designed for the purpose. One hundred business organization of all types (E.g.: Public, Private, Semi-government, Partnership firms, etc.) were chosen randomly. From each organization two respondents were chosen totalling to the sample size of two hundred (Nisar Ahamad Nalband, Saad Alkelabi & Dafieah Awad Jaber, 2016). Since the main objective of the research is to find the practices of innovation in Saudi Arabian business organizations a few practices were asked to the respondents through the structured questionnaire to know the level of perceptions of the respondents on a Likert's five point scale(Nisar Ahamad Nalband, Saad Alkelabi & Dafieah Awad Jaber, 2016). At the outset, the results are promising in Saudi Arabia, the business organizations are paving the way for innovation in their businesses. Within the study when compared with the practices it is found that practices touching upon teams and team work are measuring low. Regarding the types of innovation there is mixed results (Nisar Ahamad Nalband, Saad Alkelabi & Dafieah Awad Jaber, 2016).

Furthermore, another study was conducted to provide a theoretical progression in the area of knowledge-sharing and innovations together, as well as to identify practical contributions for the management of knowledge within Saudi Arabia from organizational prospective (Fahad Assad Al. Othman, and Osama Sohaib, 2016). The study provides empirical evidence of the socio-technical factors have an influence on staff preferences concerning knowledge-sharing processes. Furthermore, the socio-technical factors (STF) that are statistically significant influence on knowledge-sharing processes (KSP) (donation and collection) (Fahad Assad Al. Othman, and Osama Sohaib, 2016). In conclusion, the relationships among knowledge-sharing enablers, processes, and firm innovation capability provide information regarding how Saudi firms can promote knowledge-sharing culture to sustain their innovation performance (Fahad Assad Al. Othman, and Osama Sohaib, 2016).

3. METHODOLOGY:

In light of the above literature review, the methodology that have been followed in this paper, to find out how to improve the international index of Saudi Arabia by improving the score and consequently the rank, entails some steps that will be shown below.

1. First Step:

Collecting the historical score/rank of Saudi Arabia for the last seven years as show in the below table

Table 1 Historical Score/Rank of Saudi Arabia for the last seven years

	SUB-PILLARS	2011	2012	2013	2014	2015	2016	2017
1	Institutions	67.5	63.8	58.4	60	60.4	57.9	52.4
2	Human Capital & Research	40.4	44.8	39.8	35.6	39.8	44.7	46.5
3	Infrastructure	27.8	42.6	40.6	47	50.2	51.4	53.3
4	Market Sophistication	52.7	47.5	53.5	59	50.3	49.6	49.4
5	Business Sophistication	41.3	47.5	37.2	37.6	35.8	31.3	35
6	Knowledge And Technology Outputs	18.3	15.3	24.8	25.7	25.1	22.4	21.6
7	Creative Outputs	35.6	43.4	48.2	45	42.9	34.6	28.4
	GII	36.4	39.3	41.2	41.6	40.7	37.8	36.2

2. Second Step:

Calculating the descriptive statistics: The below table 1 presents summary of descriptive statistics for the both “dependent” and “independent” variables for the last seven years (2011 to 2017).

It can be noted that the data does not have large variation and distributed normally because the probability value (p-value) of Jarque-Bera test greater than 0.05

Table 2 Descriptive statistics of variables and test of normality

Variable	Mean	Max.	Min.	SD	Skewness	Kurtosis	Jarque-Bera	p-value
GII	39.029	41.600	36.200	2.259	-0.167	1.403	0.777	0.678
Institutions	60.057	67.500	52.400	4.753	0.002	2.564	0.055	0.973
Human Capital & Research	41.657	46.500	35.600	3.824	-0.207	1.914	0.394	0.821
Infrastructure	44.700	53.300	27.800	8.768	-1.012	2.972	1.196	0.550
Market Sophistication	51.714	59.000	47.500	3.804	0.961	2.968	1.078	0.583
Business Sophistication	37.957	47.500	31.300	5.175	0.747	2.842	0.658	0.720
Knowledge And Technology Outputs	21.886	25.700	15.300	3.872	-0.677	2.108	0.766	0.682
Creative Outputs	39.729	48.200	28.400	7.009	-0.430	1.906	0.565	0.754

3. Third Step:

Person’s correlations: The below table presents Person’s correlations between the different variables (dependent and independent variables). It has been found that human capital & research, market sophistication, knowledge and technology output and creative output, have high correlations with the dependent variable y. Moreover, there are some independent variables are correlated with each other.

Although the correlation matrix is an important indicator to understand the relationships between the variables but it is not sufficient to explain the effect of independent variables on the dependent variable, so we need to build a regression model

Table 3 Person’s correlation matrix

	GII	Institutions	Human Capital & Research	Infrastructure	Market Sophistication	Business Sophistication	Knowledge And Technology	Creative Outputs
GII	1							
institutions	0.040	1						
Human Capital & Research	-0.694	-0.353	1					
Infrastructure	0.147	-0.821	0.299	1				
Market Sophistication	0.498	0.092	-0.881	-0.201	1			
Business Sophistication	0.060	0.665	-0.01	-0.574	-0.143	1		
Knowledge And Technology Outputs	0.559	-0.491	-0.568	0.441	0.591	-0.731	1	
Creative Outputs	0.921	0.338	-0.667	-0.203	0.416	0.339	0.284	1

4. Fourth Step:

Multiple regression model: Since the data represent a time series (from 2011 to 2017), a unit root test must be conducted before building up the regression model; in order to avoid the spurious regression problem. Two unit root tests are conducted on the data.

According to the below table, it can be said that the data does not have unit root process because p-values of Levin, Lin & Chu (0.044) and ADF (0.048) tests are less than 0.05. This means that we can build our regression model without any problems.

Table 4 Unit root tests of the variables

Method	Statistic	Prob.**	No. variables	Observations
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-1.70679	0.0439	8	44
Null: Unit root (assumes individual unit root process)				
ADF - Fisher Chi-square	26.4501	0.0480	8	44

5. Fifth Step:

Developing the regression model: In light of the above steps, the below table shows the results of the regression model. Since the dataset is small (the number of observations equal seven only), a variable selection method must be used to determinate the higher significant independent variables. Stepwise regression method has been used to make this; and the results as below

Table 5 The results of regression model

Variable	Coefficient	Std. Error	z-Statistic	p-value
C	16.7815	0.0687	244.1004	0.0000
infrastructure	0.0903	0.0004	221.3800	0.0000
Market sophistication	0.1296	0.0009	144.3622	0.0000
Business sophistication	0.0043	0.0008	5.6528	0.0000
Creative Output	0.2838	0.0005	591.0660	0.0000
Goodness of fit				
R-squared	0.9998	Adjust R-squared		0.9998
F-statistic	671490.0	p-value		0.0000

As shown in the above table, the statistical analysis have selected the infrastructure, the market sophistication, the business sophistication and the creative output as the most contributor pillars towards the positive improvement of the score/rank.

Also, the results indicated that the model is highly significant because the p-value of F-statistic (0.000) less than 0.05 and the selected independent variables are explaining 99% (R-squared value) of change in y.

The estimated regression equation is

$$\hat{y} = 16.7815 + 0.0903 * X3 + 0.1296 * X4 + 0.0043 * X5 + 0.2838 * X7$$

6. Sixth Step:

Testing the data-fitness of the estimated regression model

To do so, two types of tests were conducted; namely the “rssidual analysis” and the “Diagnostic tests”. According to the results of the residual analysis and the diagnostic tests above, we can conclude that the estimated regression model is very fit (suitable) to this data. So that the below results shows that the fitness of the data is very high so that the conclusions can be drawn with high degree of confident.

6.1. Residual Analysis:

Figure 1 shows the fitted values (\hat{y}) based on above equation and the actual values of y are very close. Moreover, the values of residuals are distributed normally because the p-value of Jarque-Bera (1980) test¹ is greater than 0.05 as shown in Figure 2.

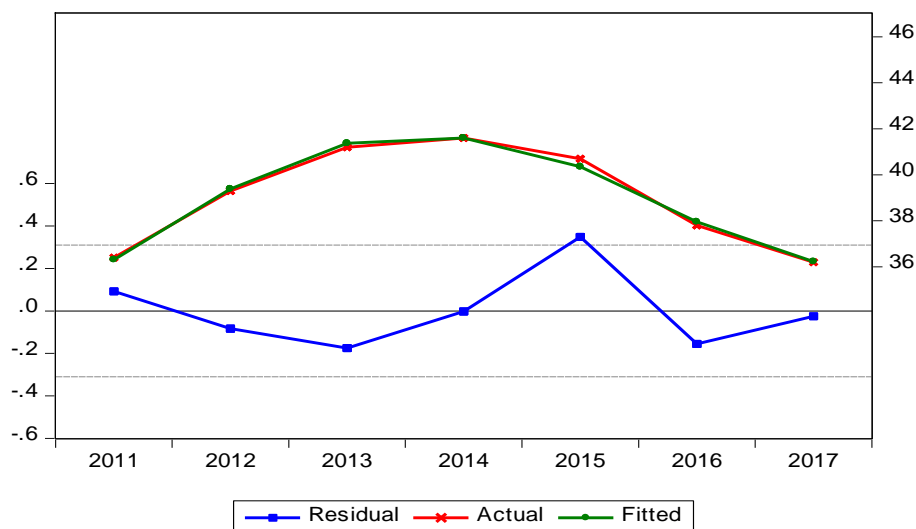


Figure 1 Goodness of fit for the regression model

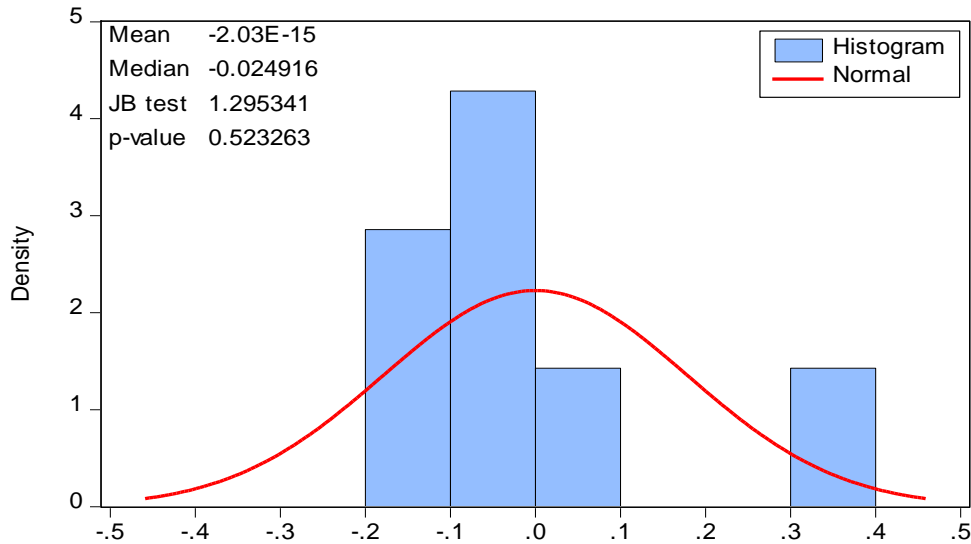


Figure 2 The distribution of the residuals

6.2. Diagnostic Tests of Regression Model:

The below table 5 shows that the model does not have “multi-collinearity” problem between the independent variables because all the values of centred VIF are less than 5.

Table 6 Variance Inflation Factors (VIFs): check the multi-collinearity

Variable	Coefficient Variance	Un-centered VIF	Centered VIF
X3	0.000369	55.40203	1.768604
X4	0.001786	349.3326	1.612772
X5	0.001266	134.9606	2.116207
X7	0.000511	60.30822	1.567210
C	10.47921	762.9972	NA

6.3. Serial Correlation Test:

The below table 6 is showing that the model does not have serial correlation problem between the error term because the p-value (0.4205) of Breusch-Godfrey test¹ is greater than 0.05. Also, there is no “hetero-scedasticity” problem in the model because the p-value (0.5047) of Breusch-Pagan-Godfrey test² is greater than 0.05

Table 7 Serial correlation and Hetero-skedasticity tests

Serial Correlation LM Test: Breusch-Godfrey			
F-statistic	0.10216	Prob. F(1,1)	0.8031
Obs*R-squared	0.648837	Prob. Chi-Square(1)	0.4205
Hetero-scedasticity Test: Breusch-Pagan-Godfrey			
F-statistic	0.452776	Prob. F(4,2)	0.7742
Obs*R-squared	3.326524	Prob. Chi-Square(4)	0.5047
Scaled explained SS	0.286707	Prob. Chi-Square(4)	0.9907

4. RESULT AND CONCLUSION:

The direct conclusion that paper is suggest, in light of the statistical analysis that have been done on historical data regarding the international rank of Saudi Arabia is that: in order to

enhance or increase the international rank/score of the Saudi Arabia in innovation substantial efforts must be paid to “Infrastructure”, “Market sophistication”, “Business sophistication”, and “Creative Output”.

While Saudi Arabia is moving towards the vision 2030, the government is requiring us to pay so much attention towards innovation as a main dimension for this vision.

The other thing is, innovation is a continuous process, and no country can claim that it reaches the peak of it or nothing can be added to improve the innovation. There are so many factors that can be looked upon in order to improve the innovation.

In addition to this Saudi Arabia have a positive and supportive infrastructure that enable Saudi Arabia to improve its international rank for the next years. The author didn't see any difficulties for Saudi Arabia to improve its rank in the near future.

The author is confident of the results of his research because pervious announcement and speeches have pin point towards the need for Saudi Arabia to improve its creative output.

The other thing that makes the author to expect that score will be increase, although it was decreasing for the last three years, by the year 2018 the national transferring program/vision 2030 will start implemented or couple of programs already implemented that contribute positively to the vision.

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