EXAMINING THE SUCCESS FACTORS OF HIGHLY INNOVATIVE COUNTRIES

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ABSTRACT
Innovation is an important factor in creating and sustaining competitive advantage. Twelve selected input factors are used to examine the nature of innovation in twenty countries with very high global innovation index (GII) scores. Regression results show that only four variables are needed to explain the GII with an R^2_{adj} = .84, in this sample. Developing countries should be cautious in using these findings as a benchmark in terms of their own achievements before considering factors such as infrastructure and stability in their countries as perquisites to innovation and development.

INTRODUCTION

There has been an increased awareness and appreciation of innovation in the last two decades as a means to create and maintain sustainable competitive advantage (Drazin and Schoonhoven, 1996) and as a key element of business success (Johannessen, Olsen and Lumpkin, 2011). The traditional resource based view asserted that competitive advantage rested on basic core values like quality, cost and timeliness (López, 2005; Lee, 2009). However, as a result of increasing global competitiveness and technological advances, innovation has become an important additional factor in creating and sustaining competitive advantage in a rapidly changing business environment (Johannessen et al., 2001; Lee, 2009). Unfortunately, managing the risky and complex process of innovation has been challenging (Hollins, 2000; Bueno et al., 2008) and not always managed well.

Zaltman et al. (1973) provided one of the earlier definitions of innovation as "any idea, practice, or material artifact perceived to be new by the relevant unit of adoption". Different authors have used a variety of factors and approaches to measure innovation at different levels, such as the firm or the country level. Garcia and Calantone (2002) report that the terms "radical, incremental, really-new, imitative, discontinuous, architectural, modular, improving, and evolutionary" have been used to define innovation. Johannessen et al. (2001) have suggested that "the picture that emerges from these diverse approaches underscores the point that a multitude of factors are interacting to induce innovation in economic life". Lee (2009) concluded that "although each factor remains important, it is unlikely by itself to provide a sustainable competitive advantage". This study is based on the definition provided by Mashelkar and Prahalad (2010) that "An innovation is the implementation of a new or significantly improved product, a new process, a new marketing method, or a new organizational method in business practices, workplace organization, or external relations". This definition forms the basis of the Global Innovation Index (GII) developed by INSEAD in 2007 (www.globalinnovationindex.org/gii/main /fullreport/index.html). Given the importance and the

impact of innovation on the development of a country, examining how the countries that are highly ranked based on their innovative capabilities is likely to be informative. Therefore, the purpose of this manuscript is to examine the factors that contribute to the level of innovativeness of the highly ranked countries. Identifying the factors that contribute to their current level of achievement in these countries could provide a benchmark for other countries to emulate and, eventually, to exceed in achieving higher levels of innovativeness and, eventually, development.

THE GLOBAL INNOVATION INDEX

The approach adopted in this study is based on the Innovation Input Sub-Index of the Global Innovation Index (GII) that is the simple average of five pillar scores. We exclude the Output Innovation Sub-Index because the Input sub-index is more instrumental in determining the potential achievements of the N11 countries. The five pillars and the composite variables that constitute the Input sub-index are as follows:

1) Institutions - Political (3), Regulatory (3), Business Environment (3)
2) Human Capital & Research - Education (5), Tertiary Education (6), R & D (3)
3) Infrastructure – ICT access (4), Energy (4), General Infrastructure (3)
4) Market Sophistication - Credit (4), Investment (4), Trade & Competition (5)
5) Business Sophistication - Knowledge workers (4), Innovation Links (5), Knowledge Absorption (4)

To elaborate, the Institutions pillar is made up of the political, regulatory and environment composite variables. The numbers in brackets represent the individual variables that constitute the different composite variables. For example, the political composite variable consists of political stability, government effectiveness and press freedom.

COUNTRY SELECTION

Our initial approach was to examine the level of innovation of the G20 countries, which represent the most developed countries based on GDP. However, the usual considerations regarding population size and the debate between measuring GDP based on nominal values versus purchasing power parity rendered this approach less attractive. Furthermore, G20 includes several of the countries that are part of BRIC's (Brazil, Russia, India and China, later S. Africa) and MIST's (Mexico, Indonesia, S. Korea and Turkey). Clearly, not all of these countries are considered developed. Furthermore, excluding the BRIC's and the MIST's from the G20 left only ten countries that rendered the sample too small for the purpose of this paper. Hence, we decided to include the 20 countries with the highest GII. We excluded Luxembourg and Hong Kong due to their small size both in terms of population and GDP. The GII's and other selected data for these countries are presented in Table 1.

These countries do not just have high GII's and very high GDP per capita; they also have excellent HDI and good GINI ratios. . To digress, "The Human Development Index (HDI) is a comparative measure of life expectancy, literacy, education, standards of living, and quality of life for countries worldwide. It is a widely used means of measuring "well-being" (http://en.wikipedia.org/ wiki/List_of_countries_by_Human_Development_Index). GINI is a measure of inequality of income where a coefficient of zero expresses perfect equality meaning all values are the same (http://en.wikipedia.org/wiki/List_of_countries_by_income_equality). Hence, their low GINI ratios indicate relatively good income distribution within the population. Singapore and the USA have the less desirable scores within the group where a relatively high GINI score indicates a poor distribution of income within the population. In our opinion, the HDI scores, all of which are over 0.85, indicate excellent human development levels, and augment the achievements of these countries beyond economic development based on GDP, GDP/capita and GII. These countries are not merely rated as having "Very High Human Development", they

occupy 20 of the top 30 spots. Therefore, meeting their GII standards suggests *indirectly* achieving other non-economic aspirations. We also include the corruption perceptions index (CPI) because it has a very high correlation with real GDP/Cap (http://en.wikipedia.org/wiki/ Corruption Perception Index). Transparency International (TI) defines corruption as the abuse of entrusted power for private gain, which encompasses corrupt practices in both the public and private sectors. In our sample, the lowest CPI is 6.1 and is ranked 30 out of 178 countries, which is still relatively free from corruption where the median is 3.3. No doubt these countries have set a high standard for others to achieve. The correlation between corruption and GDP/capita highlights the relationship between economic development, through GDP/capita, and the role of corruption and a stable environment in nurturing innovativeness.

Table 1 - Country Data

Country	GDP[1]	GDP/cap[2]	GINI[3]	HDI[4]	Corruption[5]
Australia	$1,488	$65,477	30.5	0.929	8.7
Austria	$419	$49,809	26	0.885	7.9
Belgium	$513	$46,878	28	0.888	7.1
Canada	$1,737	$50,436	32.1	0.908	8.9
Denmark	$333	$59,928	29	0.895	9.3
France	$2,776	$44,008	32.7	0.884	6.8
Finland	$267	$49,350	26.8	0.882	9.2
Germany	$3,577	$43,742	27	0.905	7.9
Ireland	$218	$47,513	29.3	0.895	8.0
Israel	$243	$31986	39.2	0.888	6.1
Japan	$5,870	$45920	37.6	0.901	7.8
Netherlands	$840	$50,536	30.9	0.91	8.8
New Zealand	$162	$36,648	36.2	0.908	9.3
Norway	$484	$97,255	25	0.943	8.6
Singapore	$260	$49,271	47.8	0.866	9.3
Spain	$1,494	$32,360	32	0.878	6.1
Sweden	$538	$56,956	23	0.904	9.2
Switzerland	$636	$81,161	33.7	0.903	8.7
UK	$2,417	$38,592	34	0.863	7.6
USA	$15,094	$48,387	45	0.91	7.1

(1) www.info.org/external/pubs/ft/weo/2012
(2) http://en.wikipedia.org/wiki/List_of_countries_by_GDP_(nominal)_per_capita, IMF data
(3) http://en.wikipedia.org/wiki/List_of_countries_by_income_equality
(4) www.hdr.undp.org/en/media/HDR_2011_EN_Table1.pdf
(5) http://www.transparency.org/cpi2010/results

METHODOLOGY

The GII Input sub-index is based on nearly 60 variables across 15 composite factors, which makes the task of analysis daunting and, perhaps, unnecessarily complicated for our purposes, which is exploratory. Hence, we are guided by the construction of the globalization index that uses practical proxies to calculate it. Furthermore, the number of countries (20) in our sample also necessitates identifying a manageable group of parsimonious variables for statistical reasons. Consequently, we have selected 12 variables based on the collective judgment of several colleagues who are experienced teachers of international marketing and other international courses. The 12 selected variables and the statistics for the 20 countries are presented in Table 2.

Table 2 - GII and Selected Input Factors

Country	GII	PolStab	RuleLaw	StartBus	SchLife	R&D $$	ICTacces
Australia	51.90	85.00	94.70	99.20	97.20	54.70	72.20
Austria	53.10	91.60	95.40	26.60	70.60	64.13	53.10
Belgium	54.30	84.60	84.84	81.20	77.80	45.60	54.30
Canada	56.90	98.10	95.20	98.50	69.30	45.50	56.90
Denmark	59.90	89.70	97.54	84.10	80.24	705.00	59.90
France	51.80	82.20	88.16	86.30	76.06	51.90	51.80
Finland	61.80	98.70	100.00	79.80	80.80	89.90	61.80
Germany	56.20	84.90	91.00	48.90	9.00	65.90	56.20
Ireland	58.70	89.40	94.50	93.50	90.80	41.03	58.70
Israel	56.00	29.40	71.00	78.40	73.10	100.00	56.00
Japan	51.70	86.40	82.60	43.10	69.80	80.50	51.70
Netherlands	60.50	87.90	95.70	61.80	81.00	42.84	60.50
New Zealand	56.60	93.20	97.10	100.00	100.00	27.10	56.60
Norway	56.40	96.44	98.80	79.80	83.80	41.80	56.40
Singapore	63.50	92.50	92.70	97.80	9.00	62.06	63.50
Spain	47.20	61.04	79.40	12.90	78.10	32.04	47.20
Sweden	64.80	91.30	99.40	76.20	73.60	84.70	64.80
Switzerland	68.20	94.50	94.90	56.80	71.40	69.94	68.20
UK	61.20	75.10	94.70	89.20	77.10	42.40	61.20
USA	57.70	72.80	89.75	92.80	80.30	65.00	57.70

Country	Infrastructure	Exports	UBusCollab	HiTimport	R&D Bus	TertEnroll
Australia	56.30	11.30	69.20	38.13	72.70	72.90
Austria	53.44	49.70	66.55	27.70	51.30	57.70
Belgium	46.96	79.80	72.00	19.50	72.65	64.70
Canada	55.20	22.10	70.10	33.70	56.20	59.70
Denmark	56.80	45.80	69.20	30.60	71.20	71.40
France	54.50	17.64	54.00	40.90	60.06	52.20
Finland	62.00	34.30	76.30	29.60	80.60	88.10
Germany	55.20	41.64	69.30	42.00	79.60	9.00
Ireland	45.00	100.00	65.94	59.60	60.20	58.40
Israel	54.20	30.56	73.40	31.40	94.10	59.90
Japan	61.60	6.14	67.60	37.90	92.50	56.50
Netherlands	58.73	76.70	72.10	46.60	57.75	60.10
New Zealand	51.93	21.30	62.20	34.00	47.50	79.30
Norway	64.34	36.15	63.10	31.80	53.60	70.84
Singapore	60.60	100.00	74.50	99.80	75.13	9.00
Spain	59.70	18.53	51.90	23.20	53.20	70.30
Sweden	69.80	45.20	75.30	41.10	69.75	67.90
Switzerland	60.80	49.20	79.60	44.40	80.70	49.20
UK	61.80	22.10	79.20	35.30	53.80	56.04
USA	56.10	3.21	78.50	49.40	79.60	91.20

Our approach is to utilize multiple regression equations that use the smallest number of variables while maintaining a high level of explanatory power based on adjusted R^2 values.

ANALYSIS

Multiple regression analysis with all 12 variables produced an $R^2 = .91$ but a low $R^2_{adj} = .68$ due to the large number of variables in the equation. Further trials resulted in the following more efficient equation (Eq. 1) where $R^2_{adj} = .84$ and beta values of .29, .58, .47 and .34, respectively:

$$GII_{calc.} = -17.08 + .064 \text{ School Life Expectancy} + .564 \text{ ICTAccess} + .316 \text{ UnivBusCollaboration} + .101 \text{ HiTechImports} \quad \text{(Eq. 1)}$$

We note that some politically and socially crucial variables such as rule of law, political stability, ease of doing business and infrastructure are not included in this equation. This suggests that the countries in our sample have largely resolved such issues that would have become obstacles to being innovative or applying innovative ideas.

Next, we compared the original GII values from Table 1 against the calculated GII_c values using (Eq.1). The differences are not significant; confirming that Eq. 1 is a good way to capture the important variables that determine the GII for this sample. In fact, the two sets of GII have a correlation coefficient of .94 that is significant at p = .94. For this group of countries, it appears ICT access followed by collaboration between universities and business are the more important factors in achieving innovativeness. High tech imports and school life expectancy determine GII to a lesser extent.

As can be seen from Table 1, these 20 countries are highly developed in terms of economic standards. They have generally resolved their infrastructure and political stability issues. These are challenging problems that test the resources of many other developing countries and hinder their development. Next, we examine if there are differences in GII in our sample based on the 12 selected variables. We used the median split technique to separate the countries into two groups based on their GII. In order to highlight the differences, we excluded from further analysis countries that were very close to the median (Md = 56.75 +/- 1.00). The difference in GII between the higher versus the lower groups is significant (p = .00) as well as the following six factors: Political Stability (p = .10), Rule of Law (p = .005), ICT Access (p = .003), Exports (p = .10), UnivBusCollaboration (p = .01) and HiTech Imports (p = .1). Therefore, it is important to note that different groupings of countries may have to benchmark and improve different factors to enhance their level of innovativeness, which may influence economic development.

We also conducted dummy variable multiple regression for the two groups. Equation (Eq. 2) with an $R^2_{adj} = .85$ is the most efficient result:

$$GII_{dummy} = -2.55 + .04 \text{ School Life Expectancy} + .43 \text{ ICTAccess} + .29 \text{ UnivBusCollaboration} + .07 \text{ HiTechImports} + 2.29 \text{ Dummy Var (1 for higher group, 0 for low group)} \quad \text{(Eq.2)}$$

The beta values are .13, .44, .42, .23 and .23, respectively. Again, ICT access and collaboration between universities and business are the more important factors in this equation, similar to (Eq. 1). We draw attention to the fact that the dummy variable based on country grouping is as important as high tech imports and more important than school life expectancy, in this sample. This underscores the fact that the two groups are different. The difference is due to the bigger magnitude of the factors for the high group for all the variables in (Eq. 1).

CONCLUSIONS

Innovation as an element of competitive advantage (Drazin and Schoonhoven, 1996) and business success (Johannessen, Olsen and Lumpkin, 2011) is crucial in understanding the economic development process. The 20 developed countries in this sample appear to benefit from high levels of ICT access and collaboration between universities and business followed by the impact of high technology imports and high educational achievement. There are, however, significant differences between the high and the low groups regarding their level of achievement along these factors. Most importantly, even in this highly economically developed group, there are differences based on rule of law and, to a lesser extent, political stability. These are factors that are unresolved in many of the countries that aspire to improve their level of economic development. Therefore, other countries, including the BRIC's and the MIST's, who wish to develop economically need to first resolve their political stability, rule of law and infrastructure issues and then improve ICTAccess and collaboration between universities and business. The message is clear that without political and social stability, good infrastructure and high levels of education, funding of R&D by itself is not likely to be very beneficial. As Lee (2009) advocated "although each factor remains important, it is unlikely by itself to provide a sustainable competitive advantage". Clearly, these 20 countries have firstly resolved their infrastructure and stable environment issues and then have achieved high levels of success along several key factors, such as ICTAccess, collaboration between universities and business and others. It would be unwise to assume that the variables that do not appear in equations 1 and 2 are to be neglected. They are simply not as crucial to achieving high levels of innovation as the four significant variables based on the success that has already been achieved, such as high levels of infrastructure that exists to support all the other activities, including the significant ones in (Eq. 1).

Future research efforts might use other alternative ways, such as the human development index, of identifying developed countries. We selected the top 20 countries but identifying a larger sample is likely to improve the validity and the reliability of the results. Comparative studies between groups that are at different stages of development might reveal further insights and important differences that need to be emphasized by different groups of countries. Naturally, conducting similar studies using other parsimonious variables from the list of 60 that determine the GII scores would be beneficial. In this vein, the possibility of including certain output factors should be investigated.

While the findings in this study explain certain factors associated with innovation, extreme care must be used in generalizing the findings to other countries as a group or individually. Like most studies based on past data, significant changes that occur in international marketing from one year to the next, especially in the case of developing countries, must be recognized as a limitation.

REFERENCES

Bueno, E., Anton, J. M. R. and Salmador, M. P., "Knowledge Creation as a Dynamic Capability: Implications for Innovation Management and Organisational Design", *International Journal of Technology Management*, Volume 41, Number (1/2), Pages 155-168, 2008.

Drazin, R. and Schoonhoven, C.B., "Community, Population, and Organization Effects on Innovation: A Multilevel Perspective", *Academy of Management Journal*, Volume 39, Number 5, Pages 1065-1083, 1996.

Garcia, R. and Calantone, R.J., "A Critical Look at Technological Innovation Typology and Innovativeness Terminology: A Literature Review", *Journal of Product Innovation Management*, Volume 19, Number 2, Pages 110-132, 2002.

Hollins, B., "Why the Resistance to Long-Term Innovation Management?" *International Journal of Innovation Management*, Volume 4, Number 2, Pages 135-148, 2000.

Johannessen, J., Olsen, B. and Lumpkin, G.T., "Innovation as Newness: What is New, How New, and New to Whom?", *European Journal of Innovation Management*, Volume 4, Number 1, Pages 20-31, 2001.

Lee, S., "Developing Hierarchical Structure for Assessing the Impact of Innovation Factors on a Firm's Competitiveness - A Dynamic-Capabilities Approach", *Journal of American Academy of Business*, Volume 15, Number 1, Pages 216-223, 2009.

López, S. V., "Competitive Advantage and Strategy Formulation: The Key Role of Dynamic Capabilities", *Management Decision*, Volume 43, Number 5, Pages 661-669, 2005

.

Luiz, John, "Infrastructure Investment and its Performance in Africa over the Course of the Twentieth Century", *International Journal of Social Economics*, Volume 37, Number 7, Pages 512-536, 2010.

Mashelkar, R. A. and C. K. Prahalad. "Innovation's Holy Grail: India's Quest for Inclusive Growth: Achieving High Performance through Inclusive Business Models: A Research Report", 2010, www.accenture.

Zaltman, G., Duncan, R and Holbeck, J., Innovations and Organizations, Wiley Publishing, New York, NY, 1973.