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Effect of External Innovation Capacity on Company Level Innovativeness

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Abstract: This study focuses on the correlation of national innovation inputs and the external innovation environment with the company-level innovation output. Since all companies are aiming at sustainable innovation to ensure sustainable profit growth, the current literature has highlighted the need for a well-structured internal innovation system for innovation success and discussed the factors affecting the performance of organisations. The internal innovation system has its own dimensions that affect the success of the whole system and emphasize the significant impact of firms on innovation results. Do all companies with a high internal innovation competency and a suitable corporate culture have the chance to become worldwide innovative? What are the impacts of the external environment where the companies are located on the innovation success? And how big is the importance of external environmental inputs? This study seeks to answer these questions and draws attention to the appropriate external environment and conditions to increase firms' innovation competencies.

Keywords: *External innovation system, national innovativeness, innovation management, national innovation capacity, strategy, management*

Introduction

Innovation has become an indispensable competitive advantage for companies to achieve sustainable operating profits and gain a greater share of the market. It is clear that global competition has pushed companies as hard as they have in the past decade. This fact forced companies to shorten product and service development life cycles. However, this was not enough for companies to remain on the market with sustainable profitability. Today, companies are always required to be more innovative and stay innovative.

This can only be achieved through the establishment of an effective innovation system. Innovation is a multi-dimensional process involving essential conditions such as company culture, internal processes and external environment. Company culture, internal processes and external environment are the constitutive inputs of the "innovation ability" of the companies (Neely and Hii, 1998). Companies target a successful innovation practice should first create a company culture and climate that encourage innovation by providing incentives and removing barriers. Achieving these conditions encourages innovation and enhances positive motivation among company members. Research in this area has shown that innovative companies in today's business environment, manage their resources in the most efficient way (Dixit and Nanda, 2011). Company culture and internal processes are the dimensions of the innovation, which the companies can intervene. What about external environment?

It is obvious that external environment which, can be described as the location and all the surroundings affecting the companies' innovation ability cannot be controlled by the companies themselves. Many studies have pointed out the relationship between environment and innovation and emphasized the important relationship between them. (Jaskyte, 2004). Analysing all the related literature in detail, this research's objective is to add value to the existing knowledge by identifying the significant relationship between the national inputs and

the company level of innovativeness. We focus on countries' national innovation inputs and their companies' innovativeness. The results will highlight the most important national inputs for company level innovativeness and will provide guidance for the countries which have the target to become more innovative and will also shed light to companies how to select right countries and environment to be innovative and how to try to shape their environment.

Literature Review

IMP³rove (2017) mentioned 'innovation strategy' as a concept that defines companies' stance towards the competitive environment in terms of development plans for new products, services, processes and business models. A successful innovation strategy is based on a systematic planning process involving systematic analysis of search areas - potential business areas for innovation by considering internal and external factors. Regarding to the internal innovation capacity, Okatan and Alankus (2017) investigated the effect of the organisational culture on internal innovation capacity and highlighted their significant effect on the dimensions of internal innovation capacity. Jaskyte (2004) outlined the importance of considering the innovation perspective of the external environment for understanding innovation. Strychalska-Rudzewicz (2016) emphasized the main role of national cultural factors on the level of innovation of the company.

The term 'national innovation capacity' derives from the external innovation conditions (those the companies cannot control). Neely and Hii (1998), described 'innovative capacity' as "the potential to produce innovative outputs of a company, a region, or a nation" and this potential depends on synergistic interactions between company cultures, their internal processes and their external environment. Porter and Stern (2002) emphasized "national innovation capacity" as an element that influences companies' success in innovation. National innovation capacity is the power and infrastructure of a political and economic conditions to generate innovation in a commercial sense. The viability and efficiency of innovation in geography is shaped by the national innovation capacity which is the strength and infrastructure of political and economic conditions to produce commercial innovation.

In addition, another element is the 'innovation ecosystem'. Ecosystems and ecologies are concepts that define the evolutionary characteristics of interactions between individuals, their relationship to innovative activities and their relationship to the environment in which they operate. The factors that support innovation ecosystems can be grouped according to the following dimensions: resources, governance, strategy and leadership, organisational culture, human resources management, people, partners, technology and clustering. The determinants of an innovation ecosystem are 'clustering', 'university-industry collaboration' and 'the development of a new culture to innovate' according to Global Innovation Index (Mercan and Göktaş, 2011). It is clear from the literature that the environment and the conditions in which companies operate, affect their innovativeness. The contribution this study will provide is 'determining which inputs of the external environment significantly affect the innovativeness by defining company level innovativeness measures for the countries and correlating them with national inputs'.

Methodology

This study focuses on the identification of the external innovation capacity effect on company level of innovativeness. Therefore, there is a need to define the most innovative companies in the world. The "Identification of the companies' innovativeness" has been a very complex and hard issue from the beginning of the innovation research area. There are several approaches to measure innovativeness. Ranking organisations use both quantitative and qualitative approaches and this is why there are differences in the listing although some companies are present in more than one list. We have considered all the measurement methods.

Our selection included both quantitative and qualitative approaches, because both financial at product/ process developments' achievements are important criteria set. For this reason, we rely

on the World's 6 respected innovation-ranking organisations' lists starting from 2010 to 2017. We rely on 8 years' data, in order to include the sustainability of the companies' innovativeness into our analyses. Reviewing six organisations' list, has given us the possibility to understand the companies' innovativeness with more than one dimension. A consolidated list was compiled after the review process. All companies who occurred in the lists since 2010 were placed in a pivot chart according to years, rankings and which organisations' lists they were listed. This consolidated view provided us with a clear understanding of the companies' innovation achievement criteria. Since we reviewed the ranking organisations' criteria, we were able to understand companies' qualitative and quantitative innovation achievements.

Data Scope

We have taken into account of the innovation ranking lists of the world's six leading organizations: 'Boston Consulting Group', 'Thomson Reuters', 'Forbes', 'Fast Company', 'Strategy & (former Booz & Co)', 'MIT Technology'. Finally, the data scope consisted of:

- 7 'Top 10'lists,
- 27 'Top 50' lists,
- 6 'Top 100' lists.

We had overall 2.043 appearances. The additional 23 appearances came from Fast Company listings because they gave:

- 19th place to 7 companies,
- 22nd place to 2 companies,
- 32nd place to 2 companies,
- 34th place to 3 companies,
- 44th place to 4 companies in 2013 list and
- 20th place to 3 companies,
- 24th place to 5 companies,
- 43rd place to 5 companies in 2014 list.

In addition, all companies in these places were taken into account and their countries were identified.

Table 1: Rankings Included to Research

	2010	2011	2012	2013	2014	2015	2016	2017
Boston Consulting Group	Top 50	Not Available	Top 50	Top 50	Top 50	Top 50	Top 50	Not Available
Strategy&	Top 10	Top 10	Top 10	Top 10	Top 10	Top 10	Top 10	Not Available
Fast Company	Top 50	Top 50	Top 50	Top 50	Top 50	Top 50	Top 50	Top 50
Forbes	Not Available	Top 50	Top 50	Top 50	Top 50	Top 50	Top 50	Not Available
MIT Techonology Review	Top 50	Top 50	Top 50	Top 50	Top 50	Top 50	Top 50	Not Available
Thomson Reuters	Not Available	100	100	100	100	100	100	Not Available

Scoring

The company who took the 1st place in list, took 50 points and the 2nd placed company took 49 points and all scoring were applied consistently, so that the company in the 50th place took 1 point for the related listing of the related year. This method was used for all rankings and all years. It was also applied to 'Strategy&' rankings those consisted of only top 10. The companies remained in these rankings took 50 to 41points. Our scoring methodology includes an exception for the Thomson Reuters lists. Since Thomson Reuters does not rank the innovative companies within themselves, standard 50 points have been applied to each company. This scoring methodology was applied for all the companies in the lists. After the scoring execution, a consolidated pivot table was provided including the parameters below:

- Company Name
- Company's Origin Country
- Company's Appearances in The Lists
  - According to Years
  - According to Ranking Organisations
- Company's Calculated Score for Each Ranking Organisation
- Company's Sum of Appearances for Each Ranking Organisation
- Company's Overall Appearances
- Company's Overall Score

With the aim of understanding the innovation at the company level, these parameters were calculated for each company. Since we identified the 'origin country' for all companies, we used this consolidated data for national level innovativeness analysis.

The national inputs, which were included to the study as independent variables, are:

1. Global Innovation Index Parameters (Index, G.I., 2017):
   - Global Innovation Index
   - Innovation Efficiency Ratio
     - Innovation Input Sub-Index
       - Institutions
       - Human Capital and Research
       - Infrastructure
       - Market Sophistication
       - Business Sophistication
2. OECD Parameters (https://data.oecd.org/):
   - Government Expenditure on R&D
   - Business Enterprise Expenditure on R&D
   - Total R&D personnel per thousand total employment
   - Total researchers

The content and structure of the constructs can be seen in the table below:

Table 2: Content of the Constructs

Construct	Dimension	Methodology (Data source)	Sub-Items	Output
External Innovation Capacity	Global Innovation Index	Global Innovation Index Data Source	2	Quantitative expression of the average calculated from the input and output sub-index scores
	Innovation Efficiency Ratio		2	Quantitative expression of the ratio of the output sub-Index score on the input sub-Index score
	Innovation Input Sub-Index		5	Quantitative expression of the average calculated from the input components

	Institutions		3	Quantitative expression of the Institutions input components
	Human Capital and Research		3	Quantitative expression of the Human Capital and Research input components
	Infrastructure		3	Quantitative expression of the Infrastructure input components
	Market Sophistication		3	Quantitative expression of the Market Sophistication input components
	Business Sophistication		3	Quantitative expression of the Business Sophistication input components
	Government Expenditure on R&D	OECD (Organisation for Economic Co-operation and Development) Data Source	1	Quantitative expression of the Government Expenditure on R&D from 2000 to 2013
	Business Enterprise Expenditure on R&D		1	Quantitative expression of the Business Expenditure on R&D from 2000 to 2013
	Total Research & Development personnel per thousand total employment		1	Quantitative expression of the Total Research & Development personnel per thousand total employment
	Total researchers		1	Quantitative expression of the Total researchers
Innovation Success	Company Innovation Score	Ranking Data from 6 Organisations From 2010 to 2017, 40 listings including 2.043 appearances 801 individual companies		Quantitative expression according to the company rank
	Company Appearances			Quantitative expression according to the existence of the company in each list
	Countries' individual companies in the lists			Quantitative expression according to the individual company for each country
	Countries' overall appearances according to the companies			Quantitative expression of the company listing count for each country
	Countries' overall score according to the companies			Quantitative expression of the consolidated score of the companies for each country
	Countries' average innovation score according to the companies			Quantitative expression of the average calculated from the countries' score, appearances and individual companies

Results

Consolidated numbers and scores were calculated by country. Scoring calculations were based on our methodology explained for the top most innovative companies' calculations. The other categories were defined as 'appearance' and 'individual company counts'.

These analyses focused on defining;

- which countries provided the most innovative companies?
- how much individual companies existed for each country?
- which countries had the companies with the highest appearances in the lists?
- calculation of the consolidated values for each country
- focusing on the outstanding innovation inputs of the countries with the highest values for all categories

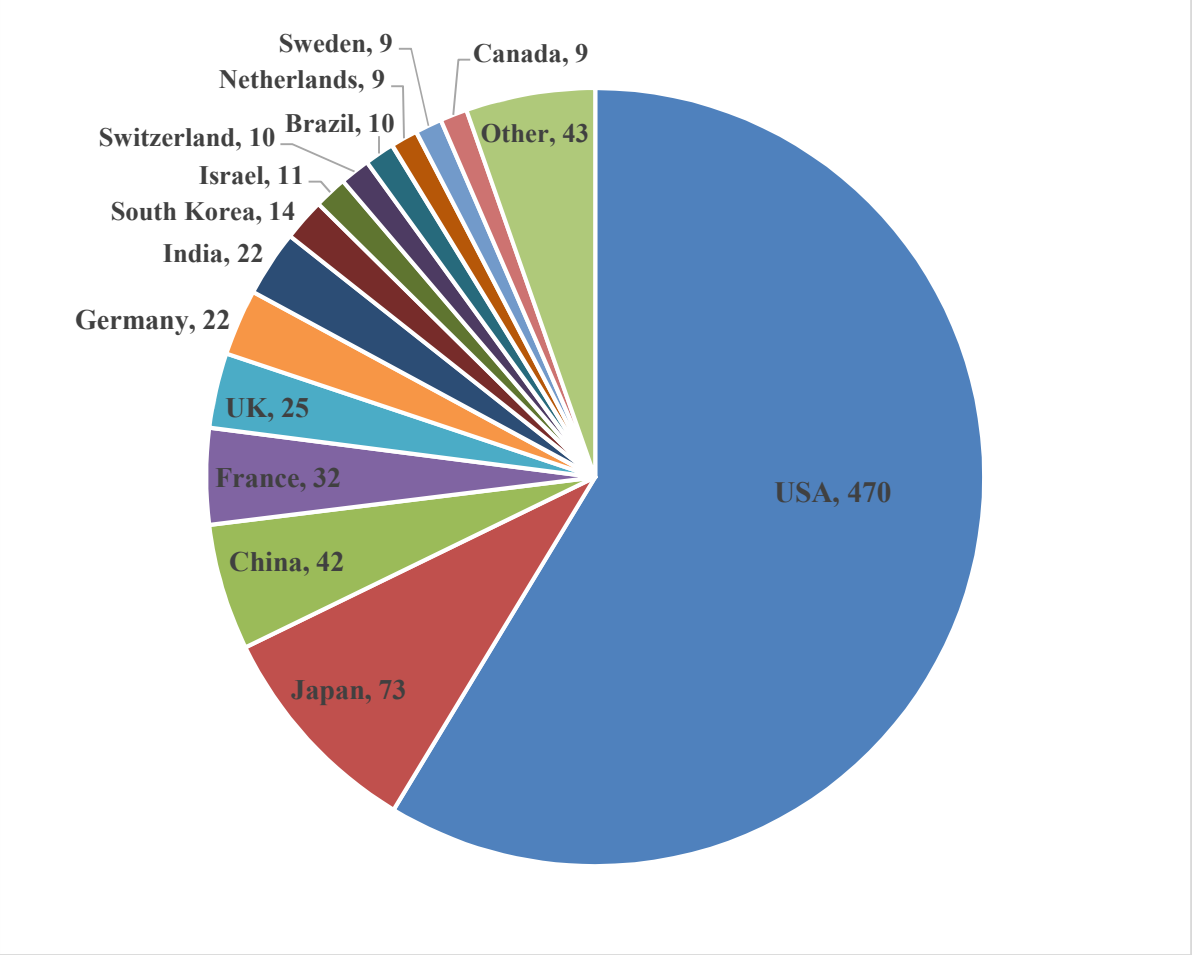
We explored the innovation inputs of the countries using the 'Global Innovation Index' indicators. This gave us the opportunity to review detailed and comprehensive data for the countries in our scope Additional indicators were collected from OECD database. The

'average innovation performance' was calculated following the completion of all consolidated company level calculations.

Most Innovative Companies According to Countries

This analysis according to countries with innovation rankings included to identify the most innovative companies according to the countries. USA took the first place by 470 most innovative companies which took place in the listings. Japan took the second place with 73 companies and China was the third with 42 companies. France, UK, Germany and India were the followers in this category. South Korea had 14 individual companies in the listings. Israel appeared with 11 companies in this category. 10 companies of Switzerland and Brazil and 9 companies of Netherlands and Sweden took place in the innovation ranking organisations' lists. Also, ranking lists included 43 unique companies from various countries.

Figure 1: Most Innovative Companies According to Countries



Overall Score of the Countries

This phase of the study included the calculations for each company in the listings different than the previous analysis which only included the Top Most innovative 30 companies. We identified 801 companies appeared in the 'World's Most Innovative Companies' rankings in this research's scope. Scores were calculated in the same methodology we used for the Top Most Innovative set. Companies' scores were reflected to the origin countries of the companies.

Figure 2: Countries According to Overall Score

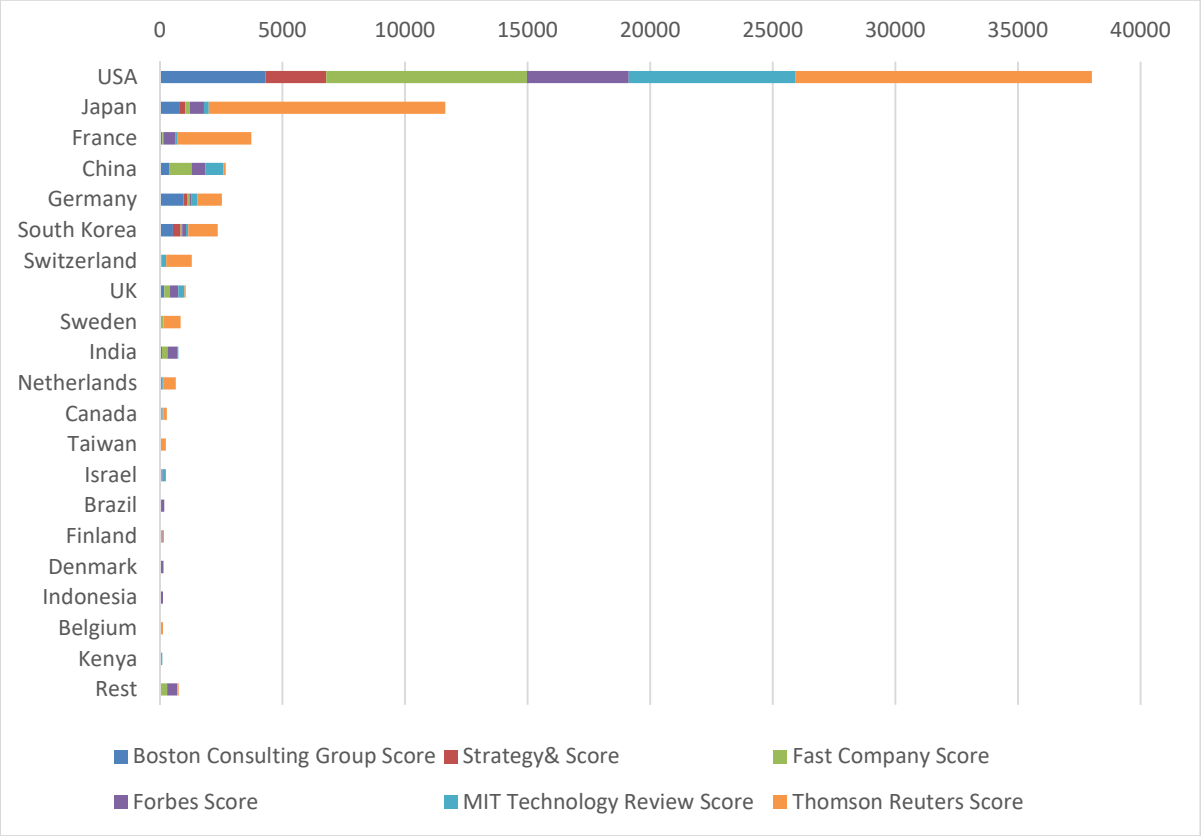


Table 3: Countries According to Overall Score

Country	BCG	Strategy&	Fast Company	Forbes	MIT Tech. Rev.	Thomson Reuters	Grand Total
USA	4311	2475	8194	4142	6786	12100	38008
Japan	821	222	185	572	199	9650	11649
France	108	0	38	484	106	3000	3736
China	375	0	916	576	728	100	2695
Germany	969	170	75	70	244	1000	2528
South Korea	536	318	67	153	85	1200	2359
Switzerland	35	0	43	15	167	1050	1310
UK	184	0	235	343	246	50	1058
Sweden	0	0	148	0	9	700	857
India	89	0	232	382	57	0	760
Netherlands	66	0	8	31	53	500	658
Canada	37	0	65	20	19	150	291
Taiwan	0	0	0	0	5	250	255
Israel	0	0	100	21	131	0	252
Brazil	10	0	46	125	0	0	181
Finland	50	0	25	47	0	50	172
Denmark	0	0	0	127	26	0	153
Indonesia				135			135
Belgium	21	0	0	6	0	100	127
Kenya	0	0	55	0	52	0	107
Rest	38	0	269	401	12	50	770

USA took the first place from the overall score point of view with the score of '38008' which was 3 times greater than the score of the country in second place which was Japan. France appeared to be in the third place and China, Germany and South Korea took the fourth, fifth and sixth places in this ranking category. Switzerland and UK ranked as seventh and eighth places with lower scores than '2000'. The outstanding point in this category can be considered as the scores of USA and Japan. USA presented the highest scores for all categories, but this time we also see huge gap with Japan and the third country which is France. Japan's score is more than 3 times higher than its follower.

Overall Appearances of the Countries

The appearances of 801 companies in the rankings were calculated according to their origin country. These calculations were implemented for each innovation ranking organisation and reflected to the countries of the companies.

Figure 3: Countries According to Overall Appearances

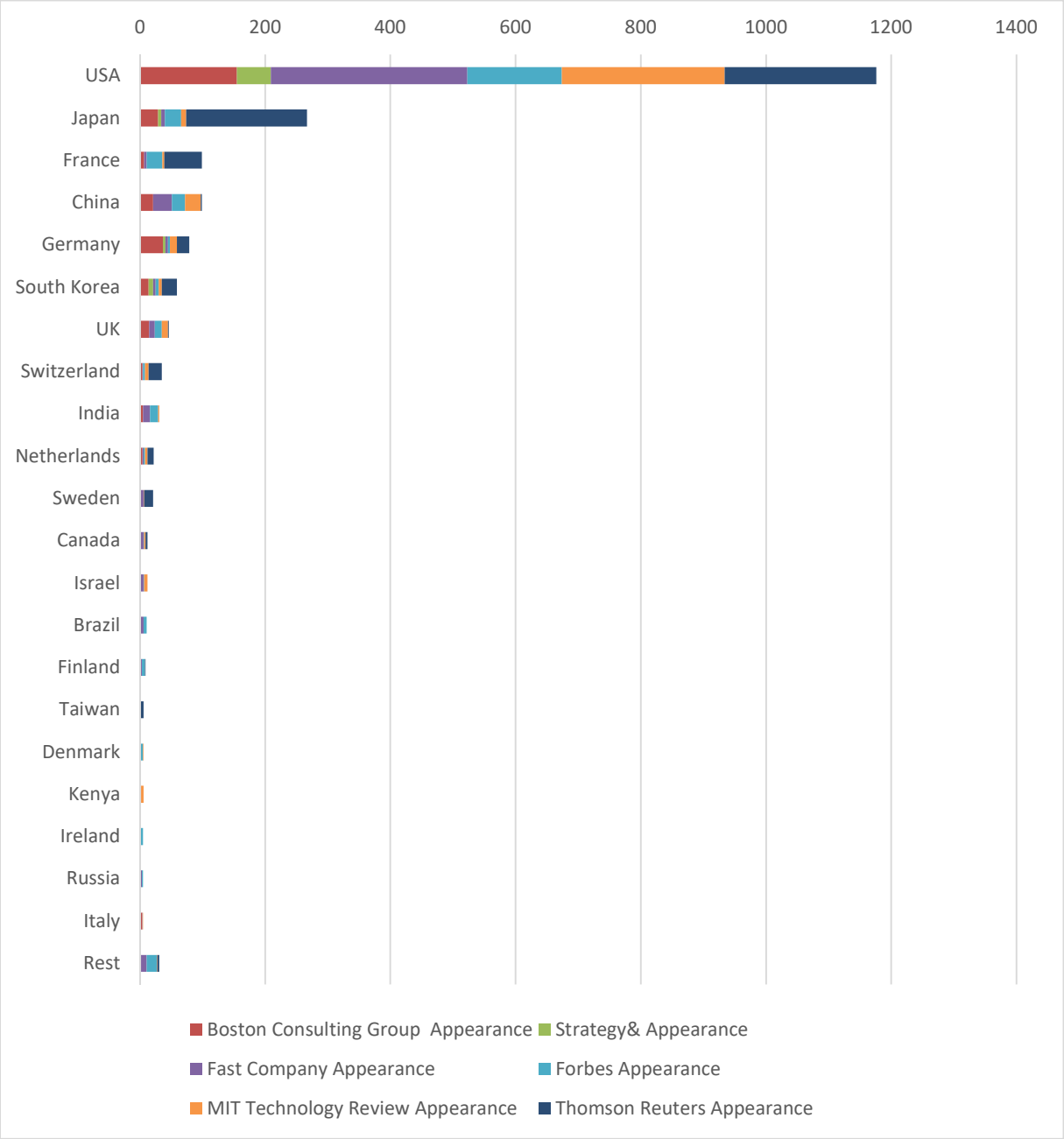


Table 4: Countries According to Overall Appearances

Country	BCG	Strategy&	Fast Company	Forbes	MIT Tech. Rev.	Thomson Reuters	Grand Total
USA	155	54	314	151	260	242	1176
Japan	29	5	6	26	8	193	267
France	7	0	4	25	3	60	99
China	21	0	30	21	25	2	99
Germany	37	4	4	3	11	20	79
South Korea	14	7	4	5	5	24	59
UK	15	0	9	11	10	1	46
Switzerland	4	0	1	3	6	21	35
India	5	0	11	13	2	0	31
Netherlands	4	0	2	2	4	10	22
Sweden	0	0	6	0	1	14	21
Canada	1	0	5	1	2	3	12
Israel	0	0	6	1	5	0	12
Brazil	1	0	5	5	0	0	11
Finland	2	0	1	5	0	1	9
Taiwan	0	0	0	0	1	5	6
Denmark	0	0	0	5	1	0	6
Kenya	0	0	2	0	4	0	6
Ireland	0	0	0	5	0	0	5
Russia	0	0	3	2	0	0	5
Italy	3	0	1	0	1	0	5
Rest	2	0	9	16	1	3	31

The result was same as the other categories from the first-place point of view. USA took the first place again with the 1176 appearances in the innovation ranking lists which was more than 4 times greater than its follower Japan. France and China had the same values as '99' and took the third place. Germany and South Korea were the fourth and fifth in the rankings with the followers which were UK, Switzerland and India.

Consolidated View of Top Performer Countries

The consolidated view on top performing countries based on 4 success indicators which were identified in this study. Countries were assessed according to 3 indicators which were directly figured out from the source data. The other indicator was calculated according to these 3 indicators. The 3 indicators are:

- Individual innovative companies of the countries
- Overall score of the countries based on their companies' performance
- Overall appearances of the companies according to their origin country

These 3 indicators were mentioned in the previous sections, also rankings according to these indicators were presented. The new indicator which was calculated based on these 3 is 'Average'. This indicator is the average of these 3 indicators. It was used to present a balance view of innovation performance. These 4 indicators were used as dependent variables to identify the relationship between countries innovation inputs and their companies' innovative performance. It can be useful to remind here that 'countries' innovation performance' and 'the companies' innovation performance of the countries' are two different indicators. Since this study has focused on understanding the underlying effects of the national inputs on companies' innovation performance, we used all national innovation inputs as independent variables to see the effect of them on the 4 indicators we explained above.

The innovation inputs of the countries were gathered from 'Global Innovation Index' and 'OECD' data sources. The Global Innovation Index, assesses countries innovation inputs according to five main categories building the Innovation Input Sub-Index. These five main input categories also have sub-categories. When we calculate all main and sub categories in addition with sub categories of the sub categories, we identified '74' for national innovation inputs from Global Innovation Index'. The inputs (Index, G.I., 2017) included to the analyses according to the categories and subcategories are below:

- Institutions
  - Political Environment
    - Political stability and absence of violence/terrorism
    - Government effectiveness
  - Regulatory Environment
    - Regulatory quality
    - Rule of law
    - Cost of redundancy dismissal
  - Business Environment
    - Ease of starting a business
    - Ease of resolving insolvency
    - Ease of paying taxes
- Human Capital and Research
  - Education
    - Expenditure on education, % GDP
    - Gov't expenditure/pupil, secondary, % GDP/cap
    - School life expectancy, years
    - PISA scales in reading, math & science
    - Pupil-teacher ratio, secondary
  - Tertiary Education
    - Tertiary enrolment, % gross
    - Graduates in science & engineering, %
    - Tertiary inbound mobility, %
  - Research and development (R&D)
    - Researchers, FTE/MN pop

        - Gross expenditure on R&D, % GDP
        - Global R&D companies, avg. expend. top 3, MN $
        - QS university ranking, average score top 3
- Infrastructure
    - Information and communication technologies (ICTs)
    - ICT access
    - ICT use
    - Government's online service
    - E-participation
    - General infrastructure
    - Electricity output, kWh/cap
    - Logistics performance
    - Gross capital formation
    - Ecological sustainability
    - GDP/unit of energy use
    - Environmental performance
    - ISO 14001 environmental certificates
- Market sophistication
- Credit
    - Ease of getting credit
    - Domestic credit to private sector
    - Microfinance gross loans, % GDP
- Investment
    - Ease of protecting minority investors
    - Market capitalization, % GDP
    - Venture capital deals
- Trade, competition, & market scale
    - Applied tariff rate, weighted mean
    - Intensity of local competition
    - Domestic market scale
- Business sophistication
    - Knowledge workers
    - Knowledge-intensive employment, %
    - Firms offering formal training, % firms
    - GERD performed by business, % of GDP
    - GERD financed by business, %
    - Females employed w/advanced degrees, % total
- Innovation linkages
    - University/industry research collaboration
    - State of cluster development
    - GERD financed by abroad, %.
    - Joint venture/strategic alliance deals
    - Patent families filed in at least two offices
- Knowledge absorption
    - Intellectual property payments, % total trade
    - High-tech imports
    - ICT services imports
    - Foreign direct investment, net inflows
    - Research talent in business enterprise

All these inputs were gathered from 'Global Innovation Index 2017' report and included to the analyses as independent variables. The research and development expenditures were classified into 'Business' and 'Government'. These two types of data were gathered from OECD Data and the average yearly expenditures of the countries were calculated based on the data from 2000 to 2013. This OECD data was used to understand the volume of research and development expenditures on the countries innovation success. Totally '76' independent and '4' dependent variables were included into regression tests.

Average Innovation Performance

Average innovation performance is the average of the values those countries have from the 'innovation score', 'unique companies' and 'appearances in the lists'. This value was calculated to determine a balanced view on innovation performance of the countries. This value was used as dependent variable in the regression tests while the national innovation inputs were independent variables, in search of identifying significant relationships between the variables.

Table 5: Significant Relationships with Average Innovation Performance

Upper Dimension	Independent	Coefficients	P-value	Dependent
Innovation Input Sub-Index	Market sophistication	355,3875	0,0081	Average Innovation Performance
Trade, competition, & market scale	Intensity of local competition	129,6172	0,0324	Average Innovation Performance
Market sophistication	Trade, competition, & market scale	123,4640	0,0035	Average Innovation Performance
Innovation Linkages	State of Cluster development	80,1906	0,0388	Average Innovation Performance
Trade, competition, & market scale	Domestic market scale	71,6765	0,0058	Average Innovation Performance

All the significant correlations appeared to be from 'Market Sophistication' and 'Business Sophistication'. Market sophistication, itself had the greatest positive correlation with Average Innovation Performance. 'Trade, competition, & market scale', which is also an element of market sophistication had a considerable positive correlation with itself and its elements.

Company Appearances

The results of the regression analyses on company appearances of the countries provided significant relationships again with the 'Market sophistication' and 'Business sophistication'.

Table 6: Significant Relationships with Company Appearances

Upper Dimension	Independent	Coefficients	P-value	Dependent
Innovation Input Sub-Index	Market sophistication	30,4572	0,0108	Company Appearances
Market sophistication	Trade, competition, & market scale	10,5889	0,0043	Company Appearances
Trade, competition, & market scale	Intensity of local competition	10,5474	0,0474	Company Appearances
Innovation Linkages	State of Cluster development	6,8796	0,0428	Company Appearances
Trade, competition, & market scale	Domestic market scale	6,2459	0,0060	Company Appearances

Innovation Score

The results of the regression analyses on the innovation score of the countries showed significant positive effect of Market and Business sophistication on the innovation score.

Table 7: Significant Relationships with Innovation Score

Upper Dimension	Independent	Coefficients	P-value	Dependent
Trade, competition, & market scale	Intensity of local competition	374,6075	0,0316	Innovation Score
Market sophistication	Trade, competition, & market scale	355,7797	0,0035	Innovation Score
Innovation Linkages	State of Cluster development	231,1095	0,0386	Innovation Score

Company Count

Regression analyses based on the company count brought the positive relationship of two new independent variables than the previous analyses. The values of 'Ease of getting credit' and 'Venture capital deals'.

Table 8: Significant Relationships with Company Count

Upper Dimension	Independent	Coefficients	P-value	Dependent
Market sophistication	Trade, competition, & market scale	4,0233	0,0062	Company Count
Credit	Ease of getting credit	2,4510	0,0440	Company Count
Investment	Venture capital deals	1,0660	0,0399	Company Count

Research and Development

The additional national innovation inputs are Business and Government research and development expenditures. The data was gathered from OECD as we mentioned before. Below two figures represent the yearly expenditures of the top research and development spenders of the world since the year 2000.

Figure 4: Business Enterprise Expenditure on R&D (Million USD)

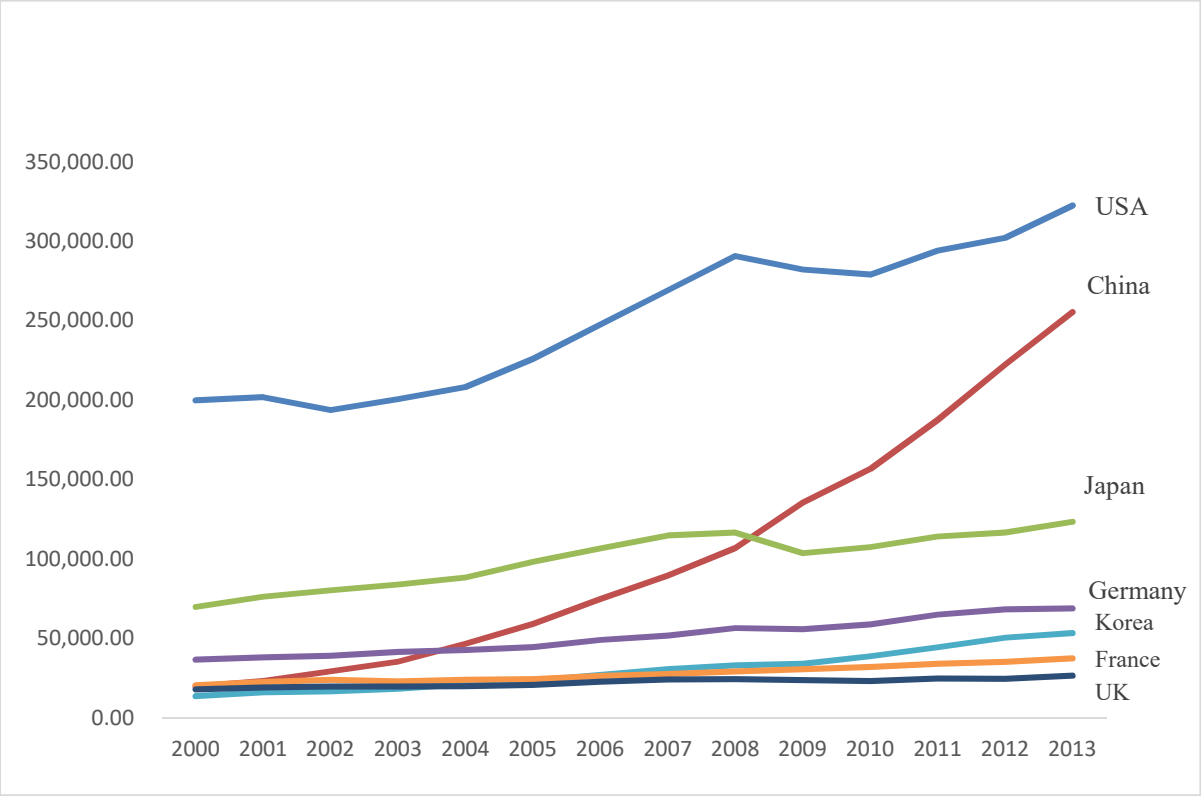
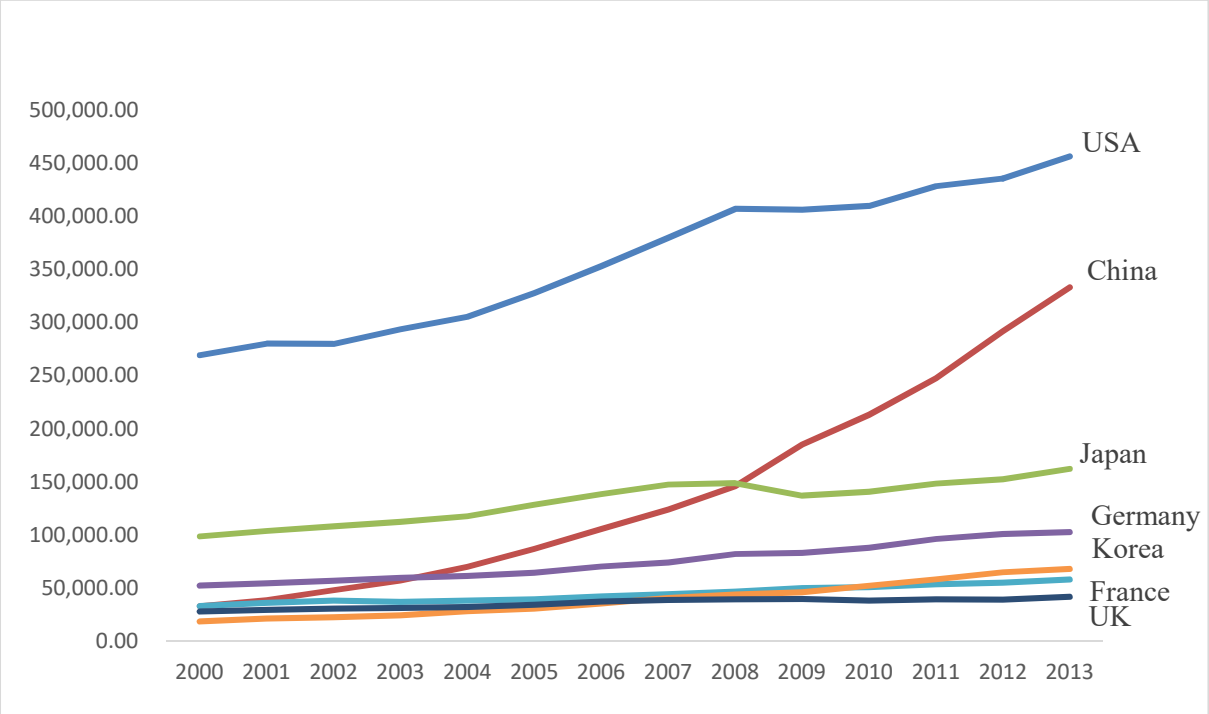


Figure 5: Gross Domestic Expenditure on R&D (Million USD)



With the aim to identify significant relationship, regression analysis was run. The average expenditures of the countries were calculated both for BERD (Business expenditure on research and development) and GERD (Government expenditure on research and development).

The average data stood as the independent variable in the analysis. Dependent variables were same as the previous analyses as:

- Individual innovative companies of the countries
- Overall score of the countries based on their companies' performance
- Overall appearances of the companies according to their origin country
- Average of the three values above

The significance occurred for the GERD and Countries' unique innovative companies since the impact level wasn't high as the previous independent variables we included from the Global Innovation Index.

Table 9: Significant Relationship of Research and Development

Independent	**Coefficients**	**P-value**	**Dependent**
GERD	0,0006	0,0367	Company Count

It can be highlighted that, 'more the countries spend on research and development more innovative companies take place in the market' based on this result.

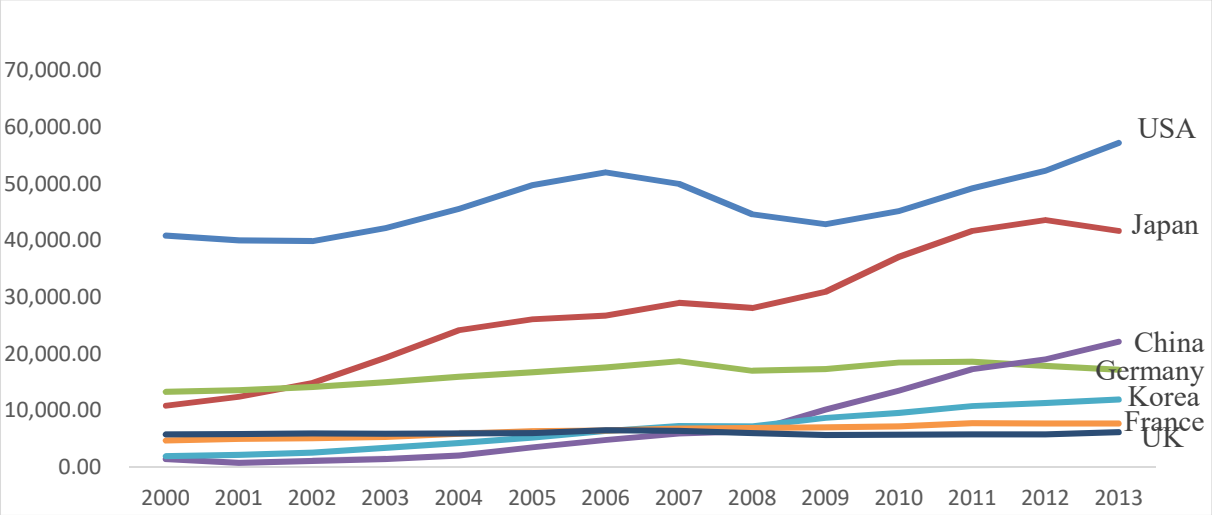
Correlation with National Innovation Outputs

The correlation with national innovation outputs and the 4 innovation success categories defined in this study was also investigated. The only common significant relationship was found on 'Citable documents H index' which can be defined as the number of citations that local research documents receive abroad (Index, G.I., 2017). This correlation, especially appeared to be very high on innovation score which represented the countries with outstanding companies. This result guided us to highlight that the most innovative countries also have shown outstanding performance on creating knowledge.

Table 10: Significant Relationships with National Innovation Outputs

Upper Dimension	Independent	Coefficients	P-value	Dependent
Knowledge creation	Citable documents H index	171,9600	0,0002	Innovation Score
Knowledge creation	Citable documents H index	41,6877	0,0041	Average Innovation Performance
Knowledge creation	Citable documents H index	5,1483	0,0003	Company Appearances
Knowledge creation	Citable documents H index	1,9749	0,0004	Company Count

Figure 6: Number of Patent Applications



Innovation Clusters

Investigating the innovation from national innovative capacity point of view also brings the need to understand innovation clusters. Looking the national innovative capacity from cluster perspective helps better understanding of the dimensions of innovation performance at country level, such as physical and economic geography, subnational politics and institutions, social networks and local labor market links. Collaborating with national partners improves the national innovative capacity. We saw it from the figure of 'Top 100 innovation clusters' (Index, G.I., 2017). Top countries with company innovation success also get the big share in the list with much clusters and much patent productivity.

Figure 7: Top Performer Countries in Top 100 Clusters

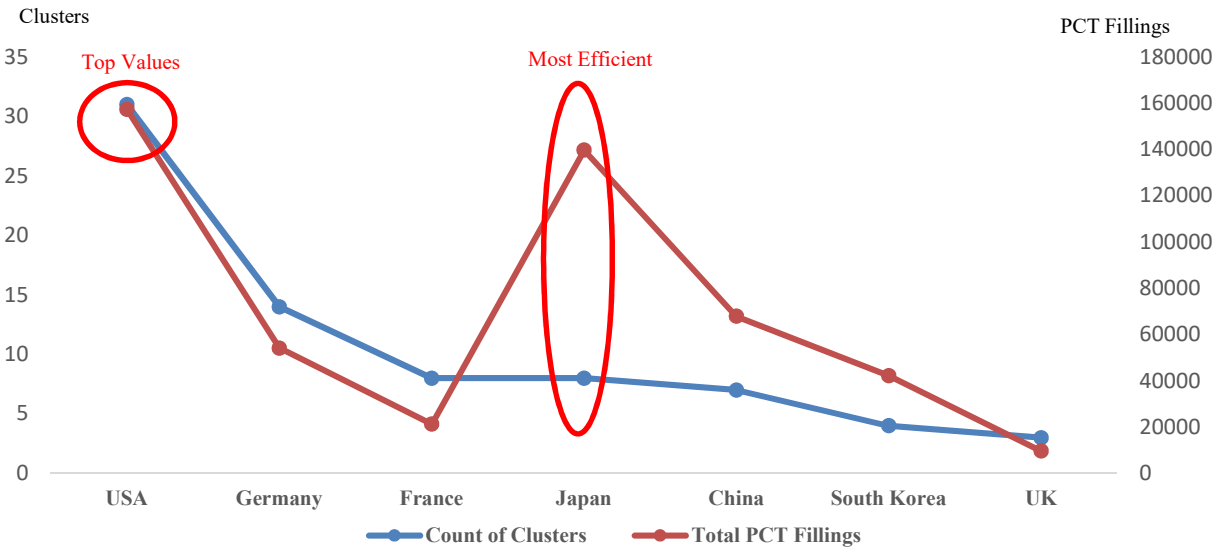
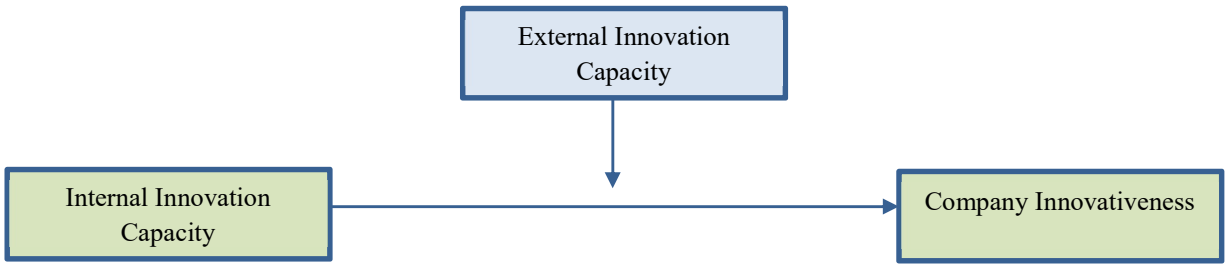


Table 11: Top Performer Countries in Top 100 Clusters

Country	Count of Clusters	Total PCT Fillings
USA	31	157368
Germany	14	54150
France	8	21249
Japan	8	139804
China	7	67911
South Korea	4	42249
UK	3	9666

Figure 8: High Level Relationship



Above figure illustrates the high-level model of the output of this study and highlights that; it is not enough to explain a company's innovation success just by the internal innovation capacity. Company innovativeness cannot be explained just with the internal elements of the company. The external environment of the company has a significant moderating effect on the relationship between the internal innovation capacity and innovation success. This model suggests that the relationship between internal innovation capacity and innovation success may differ in strength at different levels of external innovation capacity. In other words, internal innovation capacity may be more strongly associated with innovation success under conditions of high external innovation capacity compared to conditions of low external innovation capacity.

Figure 9: External Innovation Capacity as Moderating Variable on Company Innovativeness

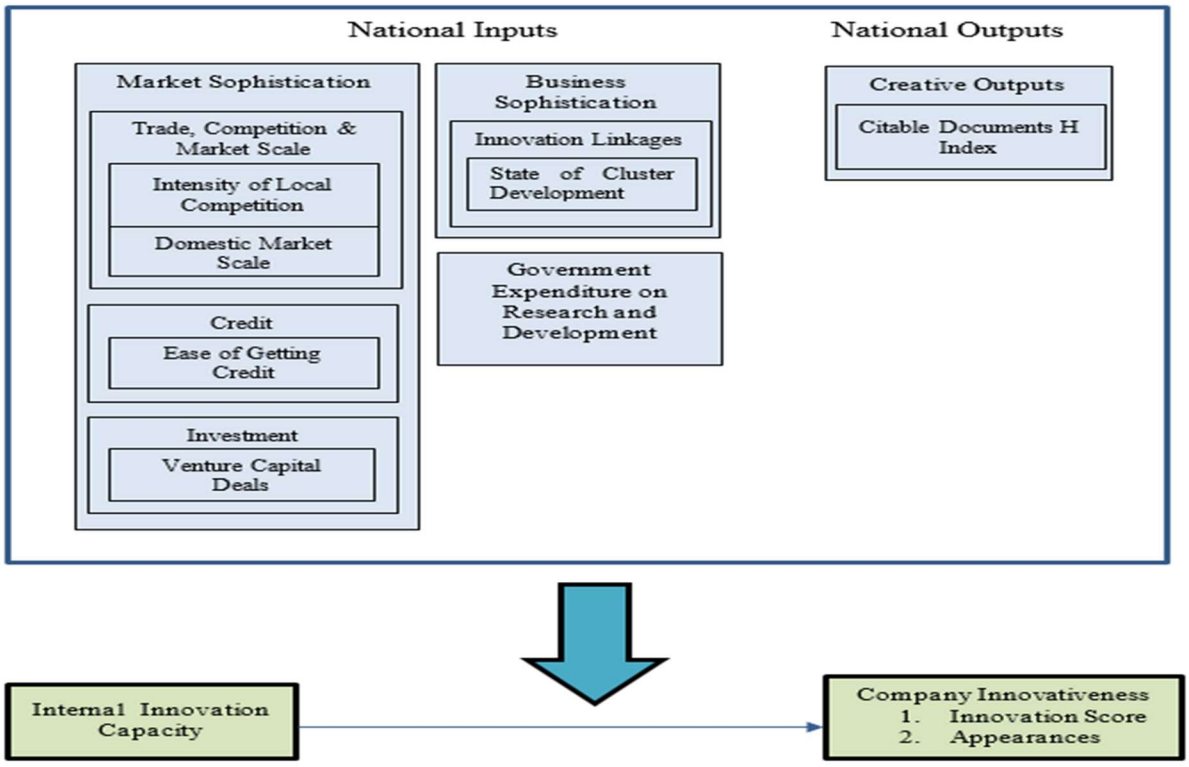


Figure 9 represents the external innovation capacity's moderating effect in details by highlighting the dimensions of the external innovation capacity those have significant effect. Market sophistication, business sophistication and the government expenditure on research and development dimensions stand as the national inputs while the creative outputs of a nation stand as the national output which have significant moderating effect on a company's innovation success. The innovation success of a company is described as the company's innovation score and company's appearances, which form the company innovativeness as a dependent variable.

Discussion

One thing to say from the beginning is that; 'the possibility of being a first-class innovative company is strongly dependent on the environment'. It is very difficult to succeed (but not impossible) if your national inputs for innovation are poor. As we investigated the national inputs and the innovation success correlation, we detected the positive relationship with more than one innovation input of the countries. There isn't a direct relation with 'country innovativeness' and 'company innovativeness' since USA has dominated all the indicators of company innovativeness even it hasn't been the world's most innovative country (Index, G.I., 2017). Company innovativeness strongly depends on the appropriate kneading of commercial and scientific inputs. After running the regression analyses with every innovation input and the company innovativeness indicators of countries those have the companies in our listing, we were able to highlight the outstanding attributes of the countries for company innovation success.

Market Sophistication

Credits and investments have a critical impetus for the innovation of businesses in an environment that supports international market access, competition and market size (Index, G.I., 2017). 'Trade, competition& market scale' dimensions of a country positively affect the companies' innovation success. Especially 'Intensity of local competition' and 'domestic market scale' have an influence on companies' commercialization of their innovation outputs. These two categories under 'Trade, competition & market scale' input column of innovation inputs, presented positive significant relationship with companies' innovation score and appearances in the innovation listings. On the other hand, it is crucial to highlight the other two dimensions of 'market sophistication' which are 'credit' and 'investment'. The importance of credit dimension shows itself with 'ease of getting credit' condition with its influence on providing more innovative companies. Countries which supply funds for investment easily to the business, provides more innovative companies. In the same way, 'venture capital deals' dimension of the 'investment' category, supports the improvement of the innovative company count for a country. It is very crucial for the countries which aim to provide more innovative companies, to ensure more sophisticated market conditions.

Business sophistication

It is very crucial to ensure a suitable business environment that fosters innovation activities for nations. We have been able to see the major impact of 'business sophistication' on innovativeness as one of the major inputs of national innovation system. Significant positive relationship was identified more with 'innovation linkages' category of this input.

Innovation linkages support countries in a positive way on proceeding fast by gaining knowledge of one or more other countries. Especially, the positive correlation showed itself on 'state of cluster development'. The countries having more and efficient innovation clusters in 'top 100 clusters' list (Index, G.I., 2017), have benefitted from these 'innovation collaboration points' as having more innovative companies. Also, it is same from 'innovation score' and 'Average Innovation Performance' point of view.

Our analyses highlighted the fact that; Market and Business sophistication inputs of national innovation system, have outstanding impact on companies' innovation performance and

countries' company level innovativeness. These analyses concentrated on the impact of the 'national innovation inputs'. On the other hand, it is also beneficial to investigate 'if there is a parallel national innovation output in correlation with company level innovativeness'. Regression analyses were done including all national innovation outputs as independent variables to understand the relationship with the company level innovativeness, with this aim. The results have shown the significance with the 'Knowledge & technology outputs'. 'Citable documents H index' which is the scientific and technical published articles in peer-reviewed journals; and an economy's number of articles (H) that have received at least H citations (Index, G.I., 2017), showed the major positive correlation with the company level innovativeness of the countries. 'Knowledge creation' of the institutions and the organisations of a country fosters the company level innovation outputs. Also, this relation can be seen from the 'number of patent applications filled' by the countries.

In addition to all these major inputs, 'government research and development expenditures' appeared to be a significant input. It is obvious that, the volume of research and development expenditures of the countries effect company level innovativeness in a positive way. The volume of government spending on research and development, ensures the suitable economic conditions to provide more innovative companies for the country.

Conclusion

The identification of the top most innovative companies, opened a way to identify their external environment. Investigation of this environment highlighted the effect of 'external innovation capacity' on the companies' innovation success. A company can implement an appropriate internal innovation system and a suitable culture, but the possibility of the success also depends on the external environment. The necessary innovation conditions must exist in that external environment. It doesn't mean that, companies must be in the world's most innovative countries but they must be in the countries feeding the business level of innovation by the necessary inputs. These inputs are mostly market and business oriented inputs. We see this reality in the example of China. The successor countries of the company level innovativeness by having much innovative companies and having the biggest scores, invest in the business environment more than the others. 'Market' and 'business sophistication' are the key inputs with the support of innovation collaboration with the institutes. These countries don't just rely on their own innovation activities, they import talents, they launch innovation clusters, they contribute with the researchers and universities by funding them. They reach the necessary resources anyway even they are not able to provide by their own.

As a company, if your external environment is not one of the top innovative countries, what should you do? Considering the above findings some guidelines can be given as below regarding to this question;

- Some important research and development activities to be developed based on the practices of the most innovative countries.
- Use open innovation methodology extensively to reach creative external environment
- Know innovative countries' environment and prepare an innovation strategy as if you are operating in that country. This will allow you to see different opportunities.
- First, your culture of innovation, resources and internal processes must be compatible with the most innovative companies'.

There are also future research areas on national innovativeness such as the investigation of the national innovation systems and frameworks. The national innovation system applications and the methodologies should be studied. Company level innovativeness can be ranked by industry and business sector according to countries and external environmental factors can be examined in this detail.

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