VIII SINGEP
Simpósio Internacional de Gestão de Projetos, Inovação e Sustentabilidade
International Symposium on Project Management, Innovation and Sustainability
ISSN: 2317-8302
8TH INTERNATIONAL CONFERENCE
CYRUS Institute of Knowledge
MAKE A DIFFERENCE

Indicators of Innovation: A new Proposal based on patent production

Indicators of Innovation: A new Proposal based on patent production

GIULIANO CARLO RAINATTO
CENTRO UNIVERSITÁRIO SENAC

ORLANDO ROQUE SILVA

NORBERTO ALMEIDA DE ANDRADE
UAM - UNIVERSIDADE ANHEMBI MORUMBI

Nota de esclarecimento:
Comunicamos que devido à pandemia do Coronavírus (COVID 19), o VIII SINGEP e a 8ª Conferência Internacional do CIK (CYRUS Institute of Knowledge) foram realizados de forma remota, nos dias **01, 02 e 03 de outubro de 2020.**

Agradecimento à orgão de fomento:
not had been used

VIII SINGEP
Simpósio Internacional de Gestão de Projetos, Inovação e Sustentabilidade
International Symposium on Project Management, Innovation and Sustainability
ISSN: 2317-8302
8TH INTERNATIONAL CONFERENCE
CYRUS Institute of Knowledge MAKE A DIFFERENCE

Indicators of Innovation: A new Proposal based on patent production

Objetivo do estudo
This study aims to create, indicators of innovation based on patent production. these indicators will analyze the investment that has been made on the creation of new products and how much of them have reached the consumers

Relevância/originalidade
this work is new and had never been published before, and it relevant to manage innovation with a new perspective.

Metodologia/abordagem
the methodology is based on the BSC(balanced scorecard), and SMART proposal to create the indicators e show his efficiency on the analysis of patent products.

Principais resultados
the results are a creation of indicators and a quick analysis made with them, show the difference of efficiency of the usage of the money n the production o patent products. the difference between application and patents granted show us the efficiency of the money invested.

Contribuições teóricas/metodológicas
The theoretical contribution is new indicators of innovation to be used to governments and companies to set new metrics of innovation

Contribuições sociais/para a gestão
To management this study is crucial do measure innovation, and set new marks for the companies and his investors, to how efficiency theirs money had been used.

Palavras-chave: Patent, Indicator, Performance, Managment

VIII SINGEP
Simpósio Internacional de Gestão de Projetos, Inovação e Sustentabilidade
International Symposium on Project Management, Innovation and Sustainability
ISSN: 2317-8302
8TH INTERNATIONAL CONFERENCE
CYRUS Institute of Knowledge MAKE A DIFFERENCE

Indicators of Innovation: A new Proposal based on patent production

Study purpose
This study aims to create, indicators of innovation based on patent production. these indicators will analyze the investment that has been made on the creation of new products and how much of them have reached the consumers

Relevance / originality
this work is new and had never been published before, and it relevant to manage innovation with a new perspective.

Methodology / approach
the methodology is based on the BSC(balanced scorecard), and SMART proposal to create the indicators e show his efficiency on the analysis of patent products.

Main results
the results are a creation of indicators and a quick analysis made with them, show the difference of efficiency of the usage of the money n the production o patent products. the difference between application and patents granted show us the efficiency of the money invested.

Theoretical / methodological contributions
The theoretical contribution is new indicators of innovation to be used to governments and companies to set new metrics of innovation

Social / management contributions
To management this study is crucial do measure innovation, and set new marks for the companies and his investors, to how efficiency theirs money had been used.

Keywords: Patent, Indicator, Performance, Managment

Introduction

Performance index exist since the early days of accounting created by Frei Luca Pacioli in the mid-1450s (Silva & Cavalcanti, 2004), the focus of adjusting and reflecting the performance of a company by number has been instrumental in creating a system. modern management systems based on performance and optimization of the resources applied in a given system.

Innovation is embedded in companies as vitally important (Marc, Marston, & Roth, 2018) for business continuity, but there is a management gap between how much we can invest in innovation and how it is performing and performing. researchers or collaborators working to produce innovation. Optimizing Resources (Pagar, 2017) is described as a way to adjust processes and their methods with the resources available to their collaborators or managers.

The introduction of innovation management index approached as a factor of facilitation and control by managers not only of companies but of countries to the point of understanding how their country 's scientific - economic production is based on the investment that is being made over the years. of time. This tool in line with economic figures extracted from World Bank reports become a tool for managing investment and where to allocate resources compared to other countries.

As a country's research structure grows, it must be measured based on its productions, and a point of production measure that generates competitive advantage (Porter, 1985) is the patent, which guarantees its holder a exclusivity limited to time to explore your innovation. And patent also gives a way for managers to understand what has been produced of innovation with investments applied in the country.

Methodology

This article represents a manner of represents the rate of the innovation, compressed in a group of indicators based on premises developed by the researchers, the exploratory method had been used collect the data about the researchers per million, the rate of investment in R&D (research and development) and as to based all the calculus we used the total patents deposits and the total patent grants made only by local researchers and companies.

The research is primarily based on the 10 biggest patentees appointed on the WIPO 2019 Intellectual Property indicators, in order : China, United States of America "U.S", Japan, Republic of Korea, Germany, Russian Federation, France, United kingdom "U.K", India[1], Italy, and all of this data has been collected from the WIPO database for researchers.

To understand about the creation of the indicators, the use of Quantitative Indicators that can reflect the output about the activities according to a plan executed by governments and companies that could invest in innovation as a way of living. The Methodology created

[1] The numbers of India was not been totally extracted from the WORDBANK DATA, we use a local source to find it (PTI, 2019)

by George T. Doran (Doran, 1981), that introduces the specification in each letters that the manager could control an specify his order of greatness.

Table 1 - The Smart Proposal

Letter	Definition	Use
S	Specific	Target a specific area for improvement
M	Measurable	quantify or at least suggest an indicator of progress
A	Assignable	specify who will do it
R	Realistsic	state what results can realistically be achieved given available resources
T	Time Related	specify when the result(s) can be achived

Source : Adaptation from the authors (Doran, 1981)

Based on the model , the letter "M" has been chosen to we create the indicators based on simple mathematics, using Split or a fraction to understand the evolution of innovation production based on patents productions of the residents from the countries. our formula is based on mathematical principles.

$$g = \frac{\Delta y}{\Delta x} . t$$

g = Indicator of efficiency

Δy = Variation of the value money spended selected trough time

Δx = Variation of the patent production selected trought time (WORLDBANK, 2019) (MUNDI, 2019)

$t = time\ measured$

And the simple mode to create a visualization of the rate of efficiency, is spliting the economic number selected with the patent production of the same year.

$$g = \frac{x}{y}$$

g = Indicator of efficiency

x = Economic value selected

$y = Patent\ Volume\ produciton\ selected$

All the calculations has been made using the Microsoft® Excell software were all the tables are available to compare and understand the results achieved.

All the patents numbers has been retrieved from the WIPO database (WIPO, 2019)

Results

To start, we need to understand the premises that guided the research. The first one is the comprehension of the numbers of researchers per million in each country studied, this number allow us to see how many is our sample of researchers engaged in each level of study in different areas like basic research, that is focused on understandings of nature an areas of physics and chemistry. This area does not generate a several number of patents because is oriented to investigate the mysteries of the universe.

And we have several researchers based on the applied fields, and that fields generate the patents and provides new products to the markets normally based on the basic research. All the indicators use d with the patent production is in function of the resident application patents and patents granted only.

The First Indicator proposed show the efficiency of the researchers on producing patents, and granting them, generating innovation to the areas of applications they are inserted. This indicators is made using the number of patents granted in every field on the WIPO Databasys split by the numbers of researcher per million of habitants multiplied by the number of habitants in the country. Here we can create a rate of innovation per researcher in each country, and visualize in an easy way how fast and productive are researchers are going.

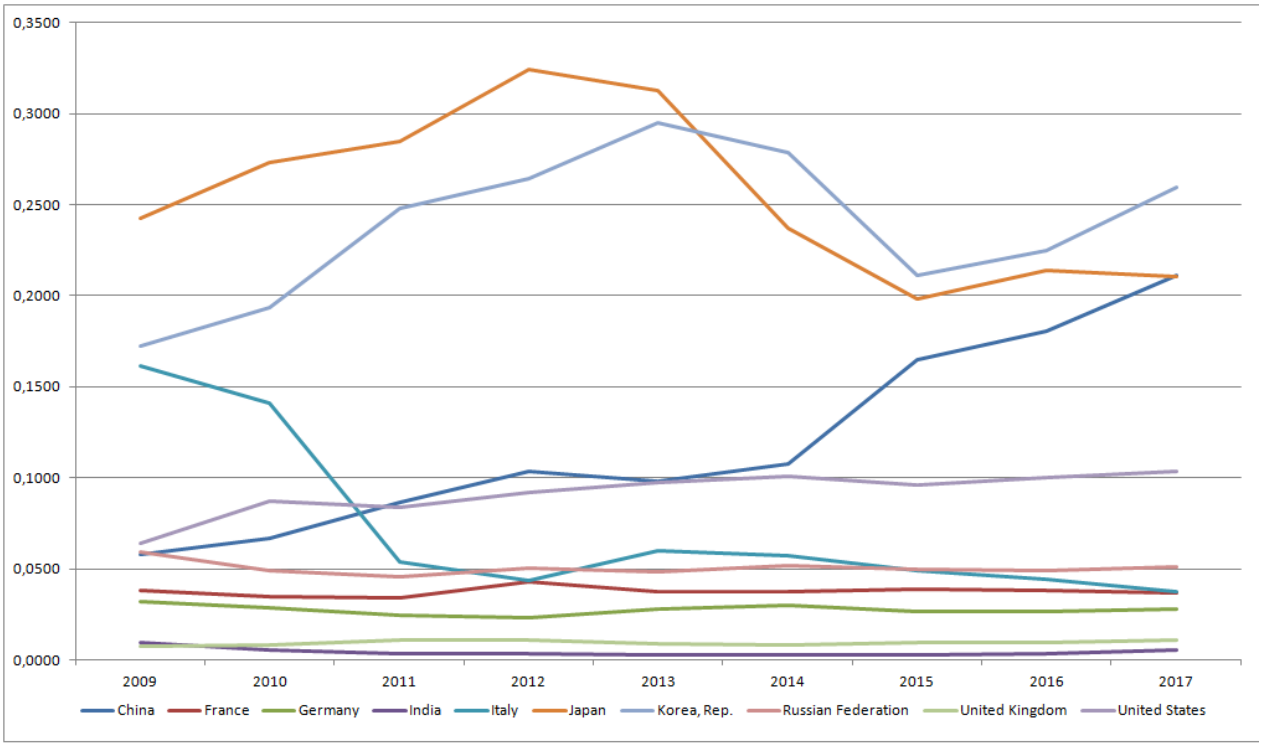
$$\text{Indicator 1 - } \frac{Number\ of\ patents\ Granted}{Researchers\ per\ milliox\ x\ Number\ of\ million\ habitants}$$

Table 2 - Efficiency by researchers generating innovation

Country	2009	2010	2011	2012	2013	2014	2015	2016	2017
China	0,0576	0,0670	0,0863	0,1038	0,0978	0,1078	0,1648	0,1807	0,2110
France	0,0381	0,0349	0,0343	0,0427	0,0373	0,0376	0,0385	0,0384	0,0365
Germany	0,0319	0,0289	0,0243	0,0231	0,0276	0,0301	0,0266	0,0265	0,0278
Índia	0,0094	0,0056	0,0036	0,0032	0,0025	0,0026	0,0028	0,0036	0,0051
Italy	0,1617	0,1408	0,0539	0,0439	0,0598	0,0569	0,0493	0,0440	0,0374
Japan	0,2425	0,2731	0,2847	0,3243	0,3125	0,2368	0,1983	0,2136	0,2104
Korea, Rep.	0,1721	0,1938	0,2483	0,2642	0,2949	0,2786	0,2111	0,2246	0,2595
Russian Federation	0,0595	0,0489	0,0455	0,0507	0,0485	0,0517	0,0500	0,0488	0,0509
United Kingdom	0,0077	0,0084	0,0108	0,0108	0,0086	0,0080	0,0095	0,0095	0,0110
United States	0,0641	0,0873	0,0837	0,0917	0,0971	0,1011	0,0959	0,1004	0,1035

Source : Research from authors

Graph1 - Efficiency by researchers generating innovation



The second proposed indicator, is based on the number of applications to patent protection. This number is normally huge and its used to show the greatness of a country producing innovation, but an application its only used to set who was the first inventor to reach that specific invention.

The number of researchers is used to create an rate of patent requests and provides an indicator that show the volume of innovation without any warranty of exclusivity guaranty by the protection of a patent.

$$\text{Indicator 2} = \frac{Number\ of\ Patent\ applications}{Researchers\ per\ milliox\ x\ Number\ of\ million\ habitants}$$

Table 3 - Efficiency of researchers in patents applications

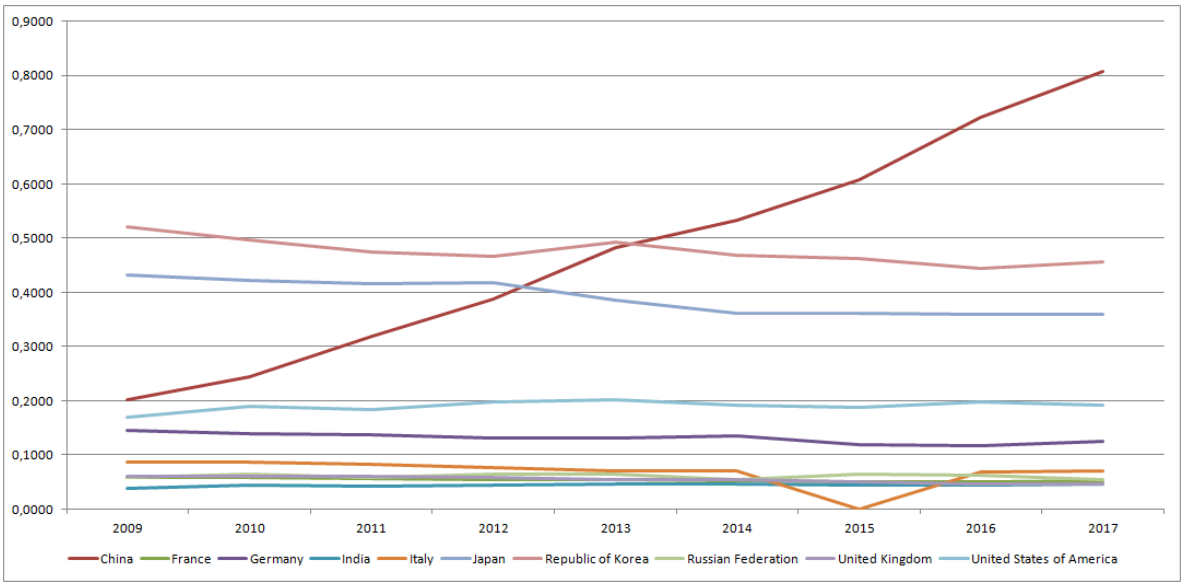
Country	2009	2010	2011	2012	2013	2014	2015	2016	2017
China	0,2014	0,2451	0,3192	0,3867	0,4819	0,5335	0,6073	0,7222	0,8083
France	0,0583	0,0587	0,0570	0,0544	0,0536	0,0516	0,0499	0,0513	0,0516
Germany	0,1459	0,1392	0,1378	0,1307	0,1317	0,1353	0,1198	0,1174	0,1247
India	0,0384	0,0446	0,0428	0,0438	0,0466	0,0455	0,0440	0,0440	0,0470
Italy	0,0873	0,0865	0,0834	0,0765	0,0708	0,0713	0,0000[2]	0,0685	0,0712
Japan	0,4325	0,4225	0,4159	0,4190	0,3847	0,3618	0,3612	0,3600	0,3598
Republic of Korea	0,5210	0,4977	0,4747	0,4657	0,4923	0,4690	0,4629	0,4452	0,4554
Russian Federation	0,0579	0,0650	0,0592	0,0647	0,0651	0,0539	0,0649	0,0621	0,0551

[2] WIPO database does not have this number

United Kingdom	0,0614	0,0597	0,0603	0,0593	0,0549	0,0540	0,0514	0,0467	0,0461
United States of America	0,1699	0,1897	0,1845	0,1979	0,2025	0,1926	0,1881	0,1972	0,1919

Source : Authors research

Graph 2 - Efficiency of researchers in patents applications



The third Indicator, is based on how much the country invest in R&D (Research and Development), and the volume of the patents applications requested. This indicator will provides an overview about the cost of the production of a Innovation that could be patent as a unique in the world.

$$\text{Indicator 3} = \frac{Spenditure\ in\ USD\ in\ R\&D\ in\ country}{Number\ of\ patent\ applications}$$

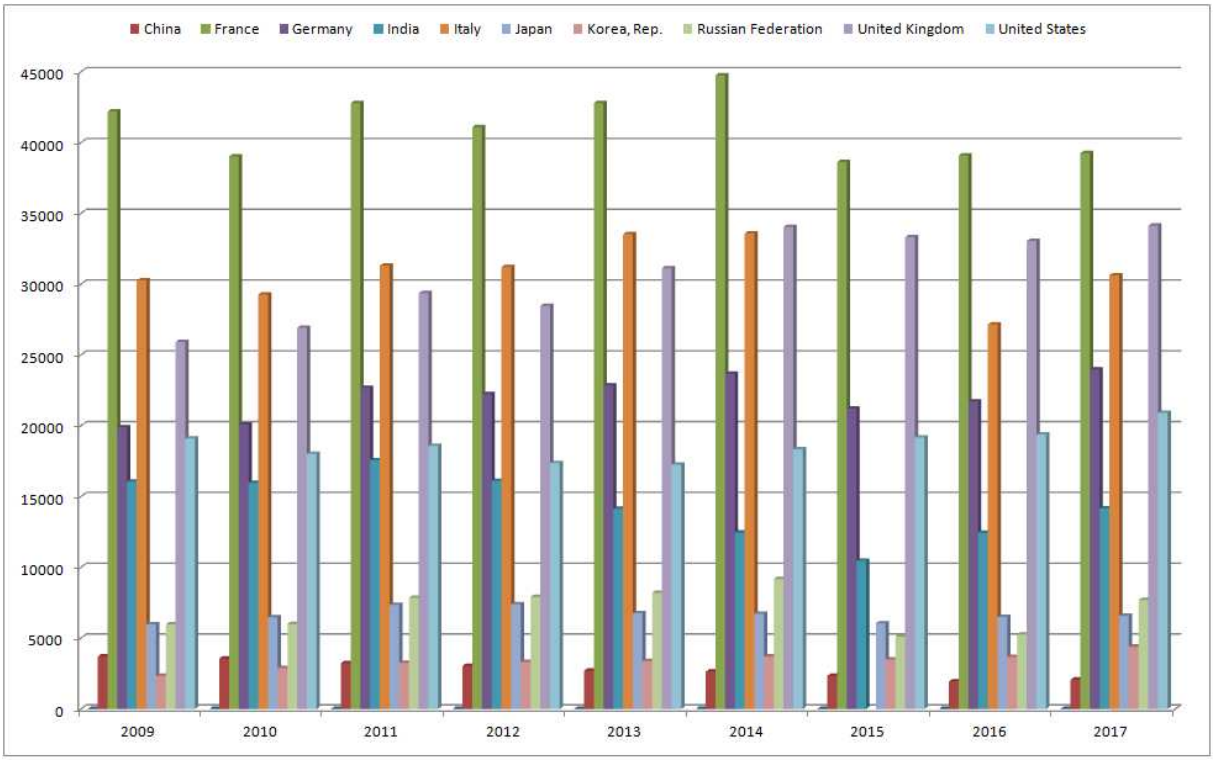
Table 4 - Spenditure in USD per patent application

Country	2009	2010	2011	2012	2013	2014	2015	2016	2017
China	$ 371.169,5	$ 356.511,9	$ 324.197,4	$ 304.942,3	$ 271.321,4	$ 264.358,1	$ 234.709,6	$ 195.618,3	$ 207.598,2
France	$ 4.220.539,0	$ 3.903.654,7	$ 4.279.147,6	$ 4.110.774,9	$ 4.280.779,6	$ 4.476.759,4	$ 3.863.756,8	$ 3.910.723,4	$ 3.926.847,8
Germany	$ 1.989.365,9	$ 2.009.637,0	$ 2.269.115,4	$ 2.224.981,7	$ 2.285.806,7	$ 2.367.894,0	$ 2.122.884,0	$ 2.171.862,6	$ 2.398.413,8
India	$ 1.606.611,1	$ 1.596.631,5	$ 1.756.997,4	$ 1.610.426,7	$ 1.415.049,7	$ 1.246.114,2	$ 1.047.434,7	$ 1.245.276,6	$ 1.416.558,8
Italy	$ 3.027.7	$ 2.927.	$ 3.131.6	$ 3.121.56	$ 3.353.	$ 3.359.		$ 2.716.04	$ 3.063.6

	38,5	993,7	23,4	5,1	799,1	840,4		6,4	35,5
Japan	$ 598.694,9	$ 647.520,4	$ 735.399,0	$ 739.659,6	$ 677.163,4	$ 672.221,1	$ 605.566,3	$ 649.700,6	$ 659.296,1
Korea, Rep.	$ 233.903,1	$ 288.562,3	$ 326.979,2	$ 333.287,7	$ 340.119,9	$ 370.919,2	$ 350.479,9	$ 368.521,9	$ 440.601,6
Russian Federation	$ 599.222,1	$ 600.970,0	$ 785.219,3	$ 792.215,8	$ 821.109,9	$ 919.116,8	$ 512.335,8	$ 526.039,2	$ 769.730,4
United Kingdom	$ 2.592.802,6	$ 2.693.782,4	$ 2.937.771,0	$ 2.847.204,6	$ 3.113.777,5	$ 3.405.341,0	$ 3.333.272,5	$ 3.305.879,2	$ 3.414.647,5
United States	$ 1.911.166,4	$ 1.802.714,3	$ 1.858.460,0	$ 1.737.596,1	$ 1.726.402,2	$ 1.835.492,0	$ 1.918.313,4	$ 1.939.508,9	$ 2.091.797,6

Source : Authors research

Graph 3 - Spenditure in USD per patent application



And the fourth indicator, uses the same methodology as the third but instead of uses the Number of applications of the patents, uses the patents granted. This indicator show how much cost a patent in each country studied and the efficiency in produces innovation based on the spenditure in USD in R&D in the country

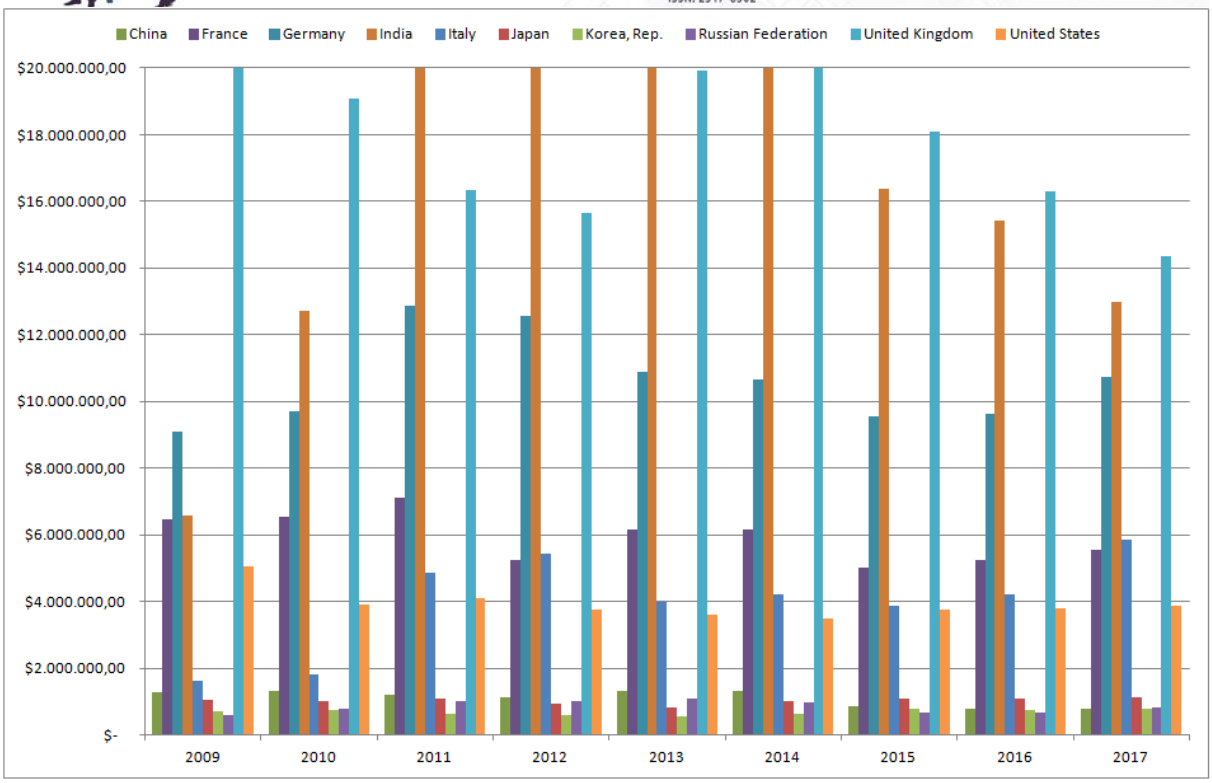
$$\text{Indicator 4} = \frac{Spenditure\ in\ USD\ in\ R\&D\ in\ country}{Number\ of\ patents\ Granted}$$

Table 5 - Efficiency based on money Spenditure

Country Name	2009	2010	2011	2012	2013	2014	2015	2016	2017
China	$ 1.296.751,94	$ 1.304.886,25	$ 1.199.418,34	$ 1.136.084,84	$ 1.337.287,34	$ 1.308.467,43	$ 864.956,50	$ 781.940,90	$ 795.430,75
France	$ 6.448.807,98	$ 6.557.819,67	$ 7.114.113,17	$ 5.235.233,99	$ 6.144.079,34	$ 6.141.249,86	$ 5.005.424,66	$ 5.229.759,59	$ 5.540.868,39
Germany	$ 9.105.907,32	$ 9.690.528,79	$12.886.526,58	$12.561.303,22	$10.893.216,94	$10.640.900,99	$ 9.570.486,74	$ 9.620.747,51	$10.746.760,79
India	$ 6.568.943,79	$12.731.733,98	$21.164.947,66	$22.334.769,66	$26.860.356,19	$21.815.330,78	$16.382.615,04	$15.414.282,21	$12.967.298,58
Italy	$ 1.635.301,63	$ 1.798.242,69	$ 4.848.502,82	$ 5.437.128,52	$ 3.970.358,97	$ 4.210.693,22	$ 3.880.216,55	$ 4.229.422,49	$ 5.837.522,42
Japan	$ 1.067.768,03	$ 1.001.751,43	$ 1.074.319,00	$ 955.647,11	$ 833.715,25	$ 1.026.986,14	$ 1.103.053,22	$ 1.094.717,70	$ 1.127.471,23
Korea, Rep.	$ 708.088,17	$ 741.230,42	$ 625.198,61	$ 587.356,62	$ 567.691,17	$ 624.435,87	$ 768.398,22	$ 730.405,65	$ 773.107,83
Russian Federation	$ 582.972,59	$ 798.305,49	$ 1.023.163,35	$ 1.011.175,58	$ 1.102.784,96	$ 957.523,09	$ 664.820,44	$ 670.090,50	$ 832.805,04
United Kingdom	$20.660.403,51	$19.090.172,16	$16.329.527,14	$15.648.718,40	$19.933.100,83	$22.976.764,37	$18.076.449,69	$16.285.981,72	$14.349.305,50
United States	$ 5.064.052,69	$ 3.919.288,82	$ 4.097.148,46	$ 3.748.277,40	$ 3.600.381,33	$ 3.498.028,66	$ 3.762.780,42	$ 3.810.562,04	$ 3.880.172,31

Source : Authors Research

Graph 4 - Efficiency based on money spenditure



Discussion

Performance indicators are being used since 1990's (Gibbons & Kaplan, 2015) , with the implementation of the BSC (balanced Score card) system in the world of management and business. There are two forms to measure an firm or an efficiency based on production , the informal that type is beyond the agency control with the executives giving adjustments all the time with a lot of adaptation, and adjustments that can be measured and the formal that has an manner to understand about all the information that the companies or the countries has and format to an indicator system.

(Kaplan & Norton, 1992), gives an overview about the creation of the informative based on indicators, representing the customer experience and measuring "works" inside the firms that can be measured normally. This evolution of understanding drives to a creation of a bunch of economic indicators, and had been used since the comprehension of the importance of this KPI(Key performance indicators).

Innovation is not so far away from all the quality measurement proposed by Kaplan and Norton, and the great opportunity to create value in quality issues to secure the costumers of a company that provides creations and understand the meaning of delivering innovation as a KEY-FACTOR to assure perpetuity on the relations (Liping, Huiyang, Zuogong, & Yunlong, 2019).

The importance of innovation in countries is based on the same premises that had been used for years in regular business, create a relationship based on products that can be sell with higher value and can change the environment where the company is inserted (Sangiovanni-

Vicentelli, 2005), so we can understand that the innovation had to be measured as an important factor of country evolution based on the money invested on research , and the volume of researchers focused to create and develop products to the society.

Knowing the model of SCP (Structure, conduct and performance), (Lopes, 2016) is obligatory to economists connected to analyze and observe how the strategy of countries and companies are developed to the users and workers to arrange a new model and correlate industrial concentrations and performance, being used as a reference to comprehended competition between then. The structure imports on the differentiation of the products made and on the introduction of the Innovation on the market, bringing investments, technology and creating know how to the countries evolved.

The fact of the conduct in the companies affect the strategy, (Kupfer, 1992) can modify the sizes and the power against the competition between firms and companies creating a GAP o technology that can be settled and used to produce new products and guaranty the prosperity of the nations. Innovation is a tool to empower the companies to provide resources to the countries, but we have to analyze how much we invest in R&D, how many researchers are involved and how many products or patents are granted with all the investments made in these areas.

Indicators as propose in this study, came to explain the differences between efficiency and productivity, using two different ways to understand and provide a creation of this new terms for reach a new level of management innovation using the governments money. The actual means for measure innovation is based on the OSLO Manual (EUROSTAT, 2018), including all the definitions and measurements for all the types of innovation. But to define and measure innovation in which countries are investment money from the contributors is important to create data about the rate and the efficiency of all the researches using data available to all the citizens.

If we look to the results of the indicators , we can analyze which country invest better, and which country has the best team of researchers based only in a few numbers. China has the best total number of patent application, but don't have the best production indicator based on the number of researchers , USA have the major amount of money invested but don't have the major numbers in total applications, total patents granted even efficiency stay behind other countries.

The WIPO has an Scale that put all the countries and their volumes of patenting, we gave that number in the beginning of this article, but we have to introduce a new way to compare who spend better the money and has the best researchers. If we can comprehend that we can lean with the results and improve de production o innovation with less spenditure, not only in money but in time and resources too.

Table 6 - Resume of Indicators (2017)

Country	1 - Efficiency by researchers generating innovation	2 - Efficiency of researchers in patents applications	3 - Spenditure in USD per patent application	4 - Efficiency based on money Spenditure
China	0,21	**0,81**	**$ 207.598,22**	$ 795.430,75

France	0,04	0,05	$ 3.926.847,83	$ 5.540.868,39
Germany	0,03	0,12	$ 2.398.413,78	$ 10.746.760,79
India	0,01	0,05	$ 1.416.558,81	$ 12.967.298,58
Italy	0,04	0,07	$ 3.063.635,51	$ 5.837.522,42
Japan	0,21	0,36	$ 659.296,08	$ 1.127.471,23
Korea, Rep.	**0,26**	0,46	$ 440.601,58	**$ 773.107,83**
Russian Federation	0,05	0,06	$ 769.730,42	$ 832.805,04
United Kingdom	0,01	0,05	$ 3.414.647,54	$ 14.349.305,50
United States	0,10	0,19	$ 2.091.797,64	$ 3.880.172,31

As we can see in table 5, the countries that invest more money on the R&D area (USA and CHINA), does not have the best efficiency and the best number, China has the biggest to numbers when involve the total number, because they produce a lot of patent applications, and when they as used splitting other numbers they create great results, instead of Korea Republic, has minor numbers but the conversion efficiency rate in patents of innovation products is higher and with less money per patent of innovation.

Table 7 - Resume of indicators (2009)

Country	1 - Efficiency by researchers generating innovation	2 - Efficiency of researchers in patents applications	3 - Spenditure in USD per patent application	4 - Efficiency based on money Spenditure
China	0,06	0,20	$ 371.169,53	$ 1.296.751,94
France	0,04	0,06	$ 4.220.539,01	$ 6.448.807,98
Germany	0,03	0,15	$ 1.989.365,89	$ 9.105.907,32
India	0,01	0,04	$ 1.606.611,09	$ 6.568.943,79
Italy	0,16	0,09	$ 3.027.738,51	$ 1.635.301,63
Japan	0,24	0,43	$ 598.694,92	$ 1.067.768,03
Korea, Rep.	0,17	0,52	$ 233.903,07	$ 708.088,17
Russian Federation	0,06	0,06	$ 599.222,06	$ 582.972,59
United Kingdom	0,01	0,06	$ 2.592.802,59	$ 20.660.403,51
United States	0,06	0,17	$ 1.911.166,40	$ 5.064.052,69

When we Compare a historical series we can see the changes that reflects in the future of innovation, Japan in 2009 has the best rate of researchers producing innovation(patents granted), when Republic of Korea has the best rates investing the money on applications that will be transformed in patents years ago, and Russia had the best number in comparison of efficiency of the money invested producing patents with less money than the other.

Conclusion

Innovation management is currently in question, tools have been sought to measure advances in research and development that bring resources and differentiate countries in the

world market. The road to an extremely agile market is innovation followed by its main patent control tool. The composition of indicators for more agile monitoring assists in creating value in how long-term investment and follow-up of innovative processes help managers improve their resource allocation decisions at both the micro and macro levels.

The proposal to create economic indicators portrays a way of understanding the past to study the future, translating into numbers and comparing what was done in each moment of the country's economy, and how the resources and work of the researchers were allocated. These numbers are an important tool and highlight what has been much addressed about efficiency, investment and the growth of the eastern market against western competitors.

When comparing the rates and the results of the proposed index we can see that in the 10-year historical analysis, CHINA, JAPAN and KOREA REP, have always been ahead of the world competitors, and now reap the fruits of the investments made over the years. The work had the limiting factors of data specifically oriented to an analysis in front of researchers and their numbers, and is guided by a further study on the separation between researchers from basic science and applied science.

References

Doran, G. T. (1981, november). There's a S.M.A.R.T. way to write managements's goals and objectives. *Management Review,*, pp. 70 - 85.

EUROSTAT, O. (2018). *Oslo manual 2018 : guidelines for colleting, reporting and using data on innovation.* Luxembourg: OECD publishing.

Gibbons, R., & Kaplan, R. S. (may de 2015). Formal measures in informal management: Can a balanced Scorecard change a culture? *American Economic Review*, pp. 447-451.

Kaplan, R. S., & Norton, D. P. (Jan/Feb de 1992). The balanced Scorecard: Measures that drive Performance. *Harvard business review*, pp. 71-79.

Kupfer, D. (1992). Padrões de concorrencia e competitividade. *Encontro Nacional de Economia* (p. 20). Campos do Jordão: ANPEC.

Liping, Y., Huiyang, L., Zuogong, W., & Yunlong, D. (AGO de 2019). Technology imports and self-innovation in the context of innovation Quality. *Internation journal of production Economics*, pp. 44-52.

Lopes, H. C. (09 de Aug de 2016). O modelo estrutura-consuta-desempenho e a teoria evolucionária Neoschumpteriana: Uma proposta de integração teórica. *Revista de Economia contemporanea*, pp. 336 - 358.

Marc, d. J., Marston, N., & Roth, E. (2018). The eight essentials of innovation. *Mackinsey Quarterly*, 77-81.

MUNDI, I. (26 de nov de 2019). *India - researchers in R&D (per million people)*. Fonte: Index Mundi: https://www.indexmundi.com/facts/india/indicator/SP.POP.SCIE.RD.P6

Pagar, F. (2017). *Resource optmization: Techniques in Scheduling.* Oulu, Finland: Universitatis ouluensis.

Porter, M. E. (1985). *Competitive Advantage; Creating and Sustaning Superior performance.* Toronto: Maxwell Macmillan.

PTI. (26 de nov de 2019). *THE ECONOMY TIMES*. Fonte: Economy times - india times: https://economictimes.indiatimes.com/news/economy/finance/indias-rd-spend-stagnant-for-20-years-at-0-7-of-gdp/articleshow/62697271.cms?from=mdr

Sangiovanni-Vicentelli, A. (Jan/Feb de 2005). The importance of the innovation in the economy of advanced countries. *IEEE Design & test Computers*, pp. 14-16.

Silva, A. M., & Cavalcanti, G. A. (2004, Oct/Dec). a lucratividade inerente e implicita no estoque na analise de liquidez estática. *Revista de Administração Contemporanea - RAC*, pp. 139-160.

WIPO. (2019, 11 27). *Statistics for Researchers*. Retrieved from DATABANK: http://ipstats.wipo.int/ipstatv2/index.htm

WORLDBANK. (2019, nov 26). *WORLDBANK* . Retrieved from MICRODATA: https://data.worldbank.org/indicator/sp.pop.scie.rd.p6