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Inventions and globalization: Innovation potential by countries

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Introduction

(Technical) **Innovation** (development, advancement) is to make some (technical) novelty come true, come to life and make use of it. The subject, base and the form of legal protection of innovation is the patented invention.
An invention leads to innovation, and the innovation, in turn, leads to further inventions, and to the solution of more and more technical problems.

The **technical innovation potential** is the capacity to develop and advance further. This potential is proportional with the country's available intellectual assets including all public goods and intellectual properties. The number of patent applications reflects well a country's intentions to improve and develop. A country's innovation potential also depends on the material and financial resources provided for these purposes, which corresponds with the size of the GDP.

Intellectual capital is the summary of such accumulated immaterial goods, copyrights, trademarks, other rights, know how, experience, which yield added value to their owners. The significance of intellectual capital is increasing as it promises growing profits. The most important part is the patent. The data connected to patents are secure and public facts, which help us to define and clarify theses resources.

Intellectual property data are public. By using this data we can reach reliable conclusions about the intellectual capital and innovation potential of the world, a country, or a company.
Inventors in the world altogether created 939 006 inventions in 2001. We have collected and analyzed the data about inventions from the last 30 years. This shows that in 1970 there were 427 011 patent applications. Using this as a baseline, today there are 2.2 times more inventions created. Once can ask, whether this increase is sufficient. To judge this, we have calculated the number of inventions for one million people in a given year. The data in *table 1* indicates that even with taking population growth into account, there was a growth in the number of inventions. Population grew by one and a half times from four to six billion between 1970 and 2001. The number of inventions more then doubled in this period.

Years	**1970**	**1980**	**1990**	**1995**	**2001**
Inventions (total)	427 011	528 746	712 577	666 334	939 006
Increase (per cent)	100%	124%	167%	156%	220%
Invention/1 million inhab.	107	120	140	122	154

Table1 – Number of new inventions (world tota1)

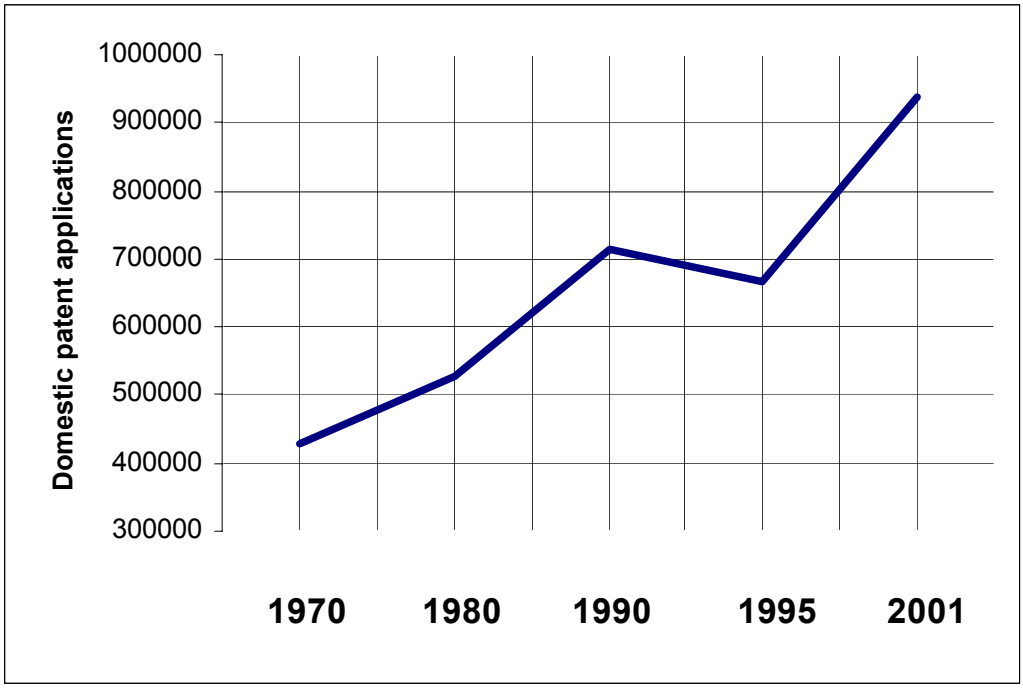

Figure1 – Number of new inventions (world tota1)

Let's turn to measuring the weight of countries in worldwide innovation. Let's start with the most important ones. The following *figure2* shows the percentage share of first ten countries.

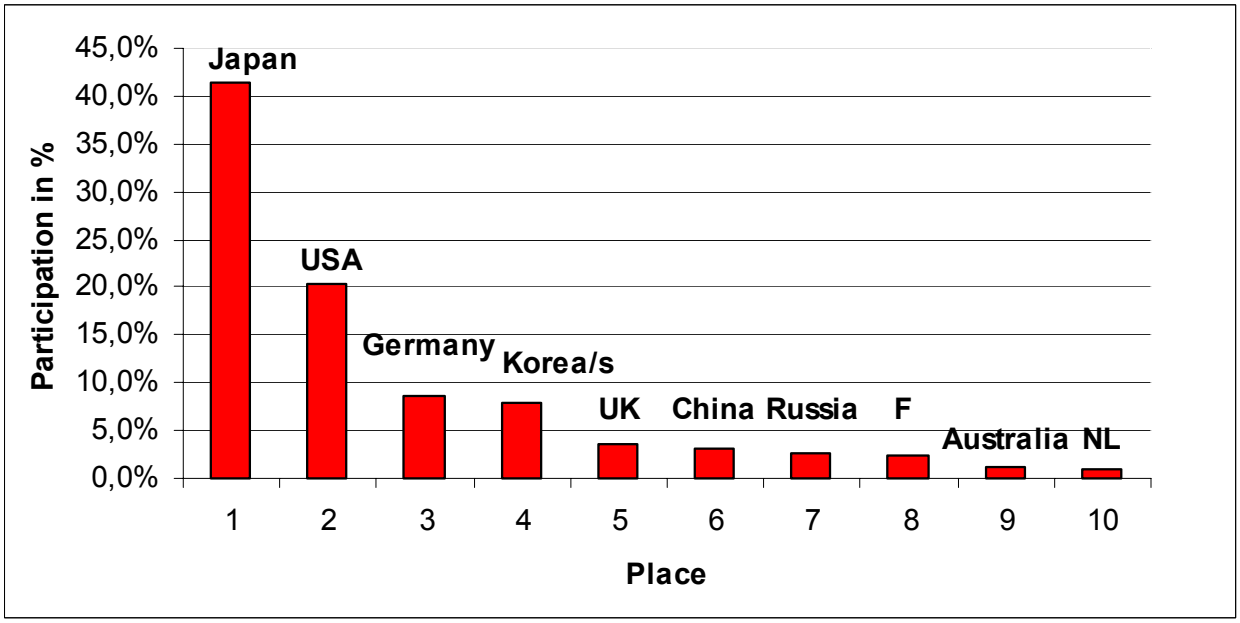

Figure2 – Top ten countries by new domestic inventions (2001)

If we add up inventions from the 25 members of the European Union after the enlargement, we get 178 395 patent applications, 19% of the applications in the world. Inventors in the USA made 190 907 applications, more than 12 000 inventions above the European level.

In the innovation race of the previous century the USA was leading to the half time (See the *figure 3*) Then, after the second world war Japan took over. The USA was late in speeding up, growth only started in 1990.

The activity of Soviet inventors was very similar to the Japanese, and it surpassed the American level, from the sixties to the end of the Soviet Union. With the demise of the Soviet Union the innovation potential of this vast country was also lost. This innovation potential at the moment of collapse was equal to the present level in the USA.

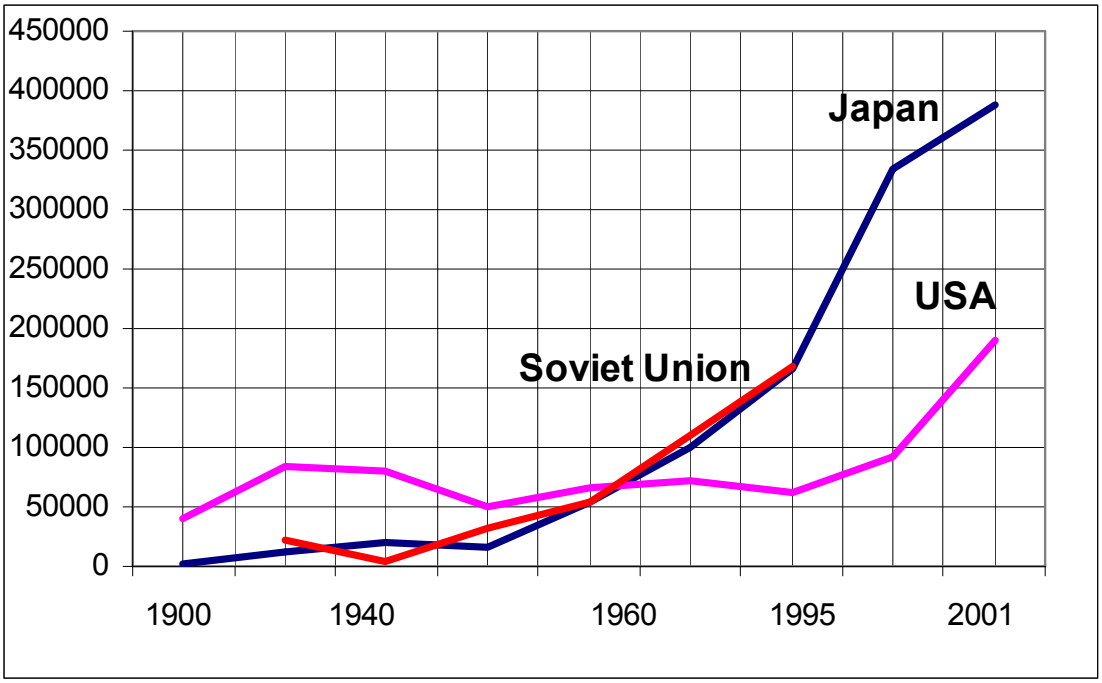

Figure 3 – Activity of "innovation giants" in the 20th Century

Innovation potential by countries

The number of domestic patent applications is the best indicator of innovation potential. To make fair comparisons, we need to take the number of inhabitants into account. For the sake of comparability, in this part of the analysis we use the number of patent applications for one million inhabitants.

From this data we can infer about the amount of intellectual property as a whole. It is impossible to measure the amount of artistic creation, but we can assume that they are proportional to the number of inventions. Innovation potential is also related to the level of material resources, that we can measure by GDP.

The following *table 2* shows patent applications for one million inhabitants (Specific Invention Indicator=SII), and GDP (in thousand USA dollars) per capita. When both of these two measures are high, we can expect a high innovation potential.

Table2 – Invention activity and GDP of countries

Country	2001				1992			
	SII		GDP		SII		GDP	
	Place	Value	Place	Value	Place	Value	Place	Value
Japan	1	3263,8	4	41,2	1	2841,2	3	36,9
Korea (Rep. of)	2	1681,8	25	14,5	9	362,7	28	9,0
Switzerland	3	1126,6	2	50,0	2	783,1	1	45,1
Germany	4	971,2	11	30,8	4	555,8	9	27,2
USA	5	816,9	5	39,4	8	402,3	8	29,5
Sweden	6	801,5	8	35,6	5	535,5	7	29,8
Denmark	7	698,1	7	38,3	10	341,5	5	30,6
Australia	8	669,5	9	31,9	3	556,7	13	22,5
Finland	9	654,8	15	29,6	6	425,6	16	21,7
United Kingdom	10	584,7	22	23,4	7	408,3	20	17,9
Israel	11	580,0	18	28,3	11	341,5	19	19,5
Luxemburg	12	570,0	1	60,0	27	105,0	2	40,0
Holland	13	500,4	16	29,1	18	238,6	14	22,5
EU 15	**14**	**460,6**	**19**	**26,3**	**14**	**305,6**	**17**	**21,6**
Norway	15	434,1	3	44,9	17	263,2	4	32,7
Austria	16	409,5	10	31,1	12	324,8	10	25,9
France	17	365,6	13	29,9	16	268,1	11	24,9
Ireland	18	342,1	14	29,7	19	202,1	22	14,6
New Zeeland	19	287,5	21	23,8	13	322,5	21	17,5
Canada	20	230,4	12	30,3	23	128,8	15	22,0
Island	21	213,0	6	39,1	24	121,7	6	30,4
Belgium	22	189,6	17	29,0	25	115,9	12	24,1
Slovenia	23	172,0	28	11,5	29	94,0	29	8,5
Russia	24	170,4	41	3,1	15	269,0	36	3,6
Ukraine	25	139,1	54	0,9	42	5,9	48	1,6
Moldavia	26	101,6	60	0,5	60	0,0	55	0,7
Hungary	**27**	**99,9**	**34**	**5,5**	**22**	**147,6**	**34**	**4,2**
Spain	28	96,3	23	18,1	32	57,2	23	14,0
Croatia	29	95,0	36	4,8	28	99,8	35	3,8
Kazakhstan	30	94,7	48	1,6	36	25,5	47	1,7
Byelorussia	31	94,5	46	2,0	54	0,0	45	1,9
Italy	32	67,7	20	24,5	21	162,3	18	21,0
Malta	33	65,0	30	10,0	40	7,5	60	n.d.
Czech Rep.	34	59,9	32	6,0	50	0,0	31	5,0
Poland	35	57,5	37	4,6	30	75,0	38	3,0
Latvia	36	53,9	43	3,0	26	109,1	42	2,6
Brasilia	37	51,6	31	6,6	37	16,3	30	5,0
Romania	38	51,0	50	1,5	31	64,8	49	1,3
Slovakia	39	48,1	38	4,4	51	0,0	39	3,0
Armenia	40	47,0	59	0,6	59	0,0	59	0,3
Georgia	41	46,7	57	0,7	58	0,0	54	0,7
Serbia	42	44,8	51	1,3	55	0,0	46	1,7
Uzbekistan	43	40,2	56	0,8	57	0,0	53	0,8
Macedonia	44	33,0	45	2,5	53	0,0	43	2,5
Bulgaria	45	32,7	52	1,2	34	37,1	51	1,2
China	46	29,9	53	1,2	38	9,9	57	0,5
Lithuania	47	20,0	44	2,9	33	38,3	40	2,9
Kyrgyzstan	48	19,5	61	0,5	61	0,0	56	0,7
Portugal	49	18,2	26	12,5	41	6,9	25	9,8
Estonia	50	17,9	39	4,3	52	0,0	41	2,9
Iran	51	12,6	47	1,8	44	4,1	50	1,3
Bosnia-Herzego.	52	11,8	55	0,9	56	0,0	61	n.d.
Turkey	53	9,0	40	4,0	45	4,0	37	3,3
Egypt	54	8,4	49	1,6	43	5,5	52	1,0
Mexico	55	8,1	33	5,6	39	7,7	32	4,3
Greece	56	7,1	27	12,2	35	35,2	26	9,6
South Africa	57	5,8	35	5,4	20	183,3	33	4,3
Cyprus	58	5,7	24	15,7	49	0,0	24	11,4
Saudi Arabia	59	2,8	29	10,5	48	1,3	27	9,4
Columbia	60	1,9	42	3,1	46	3,6	44	2,5
India	61	0,3	58	0,7	47	1,7	58	0,4

Let's consider first the top 20 countries by the number of patent applications for one million inhabitants. In this list all countries are above the ten thousand US dollars per capita GDP level. In fact, all but one are above the twenty thousand level. Korea's GDP per capita is 14 500 USD, while the average of the other nineteen countries in the top 20 is 34 400.

We also see examples when relatively richer countries are placed lower in terms of inventions. Five countries with a higher GDP per capita (10 to 20 thousand USD) are placed between the 20th and the 40th places (Iceland, Belgium, Slovenia, Spain, and Italy). Four countries with this GDP level are placed even lower, between the 40th and 60th places (Portugal, Greece, Cyprus, and Saudi Arabia).

Of the poorest countries (where the GDP per capita is lower than one thousand USD) two were placed relatively high on the list: Ukraine, and Moldavia, on the 25th and 26th places.

It is difficult to define one metric for innovation potential. The two measures that we use here are a better approximation. Inventions and material resources are co-determinants of innovation potential. To visualize this idea, we created a two dimensional chart, that plots countries along GDP per capita as the horizontal dimension and inventions per million inhabitants as the vertical dimension. Since the distributions of both measures are very uneven, we use the logarithm for both. *Figure 4* uses data from 2001. We divided the figure into sectors that represent typical combinations of economic development and inventiveness.

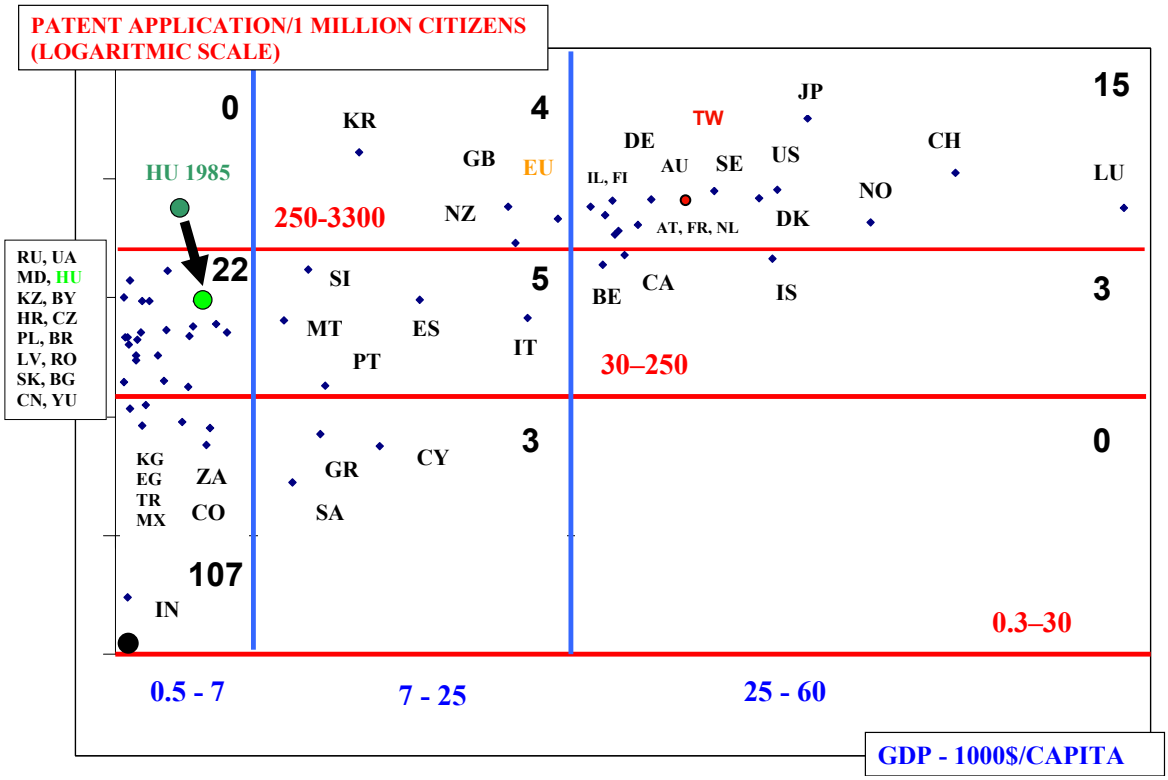

Figure 4 – Innovation potential by countries

This figure is the innovation space of the world. Hungary, for example has a medium innovation potential now. Its place was higher in the years of 1980; Hungary was on the top ten list in 1985.
Figure 5 adds data from 1992, to illustrate trends in the movement of countries.

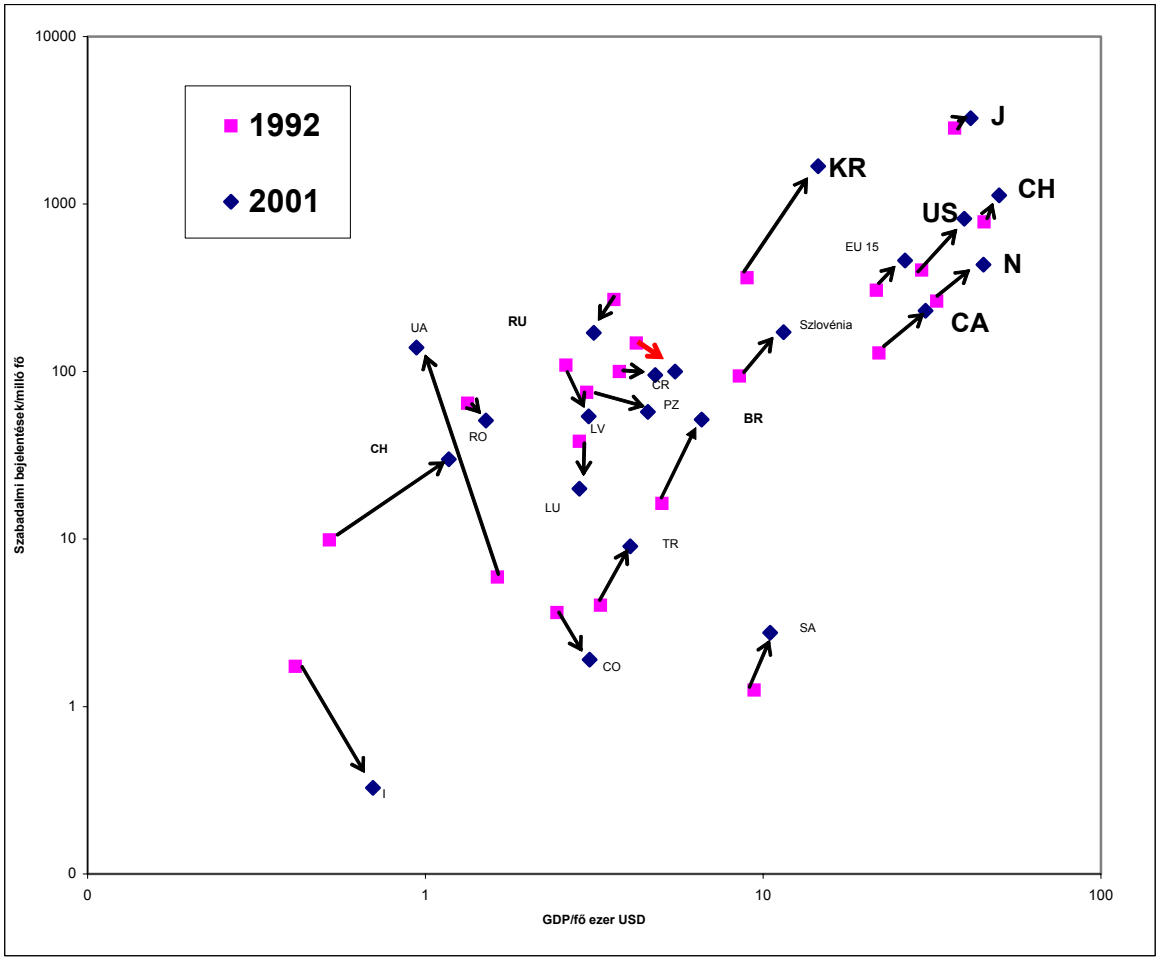

Figure 5 – Innovation developing

This figure shows the countries that are on a developmental path, from bottom left to top right. The length of the arrows indicates the amount of development. Hungary for example has declined.

Let us turn to the other form of intellectual property.
Utility model - that is often referred to as a small patent - is a form of protection for technical creations, that have a specific structure and shape. The application that grants priority, is basically the same as a patent application. The patent authority only assesses the formal requirements of application. There is no novelty search; the certificate of protection is issued within six months of application.
This form of protection is tailored to small enterprises. Especially because the protected intellectual property can be mobilized fast; with a patent, one often needs to wait five years for the final protection.
In 2001 there were 162 315 utility models created in the world. This is 17% of patents. 98 percent of these creations came from ten countries, displayed in the following *figure 6*.

This chart has an important message: it shows the countries that are on the way up in innovation.

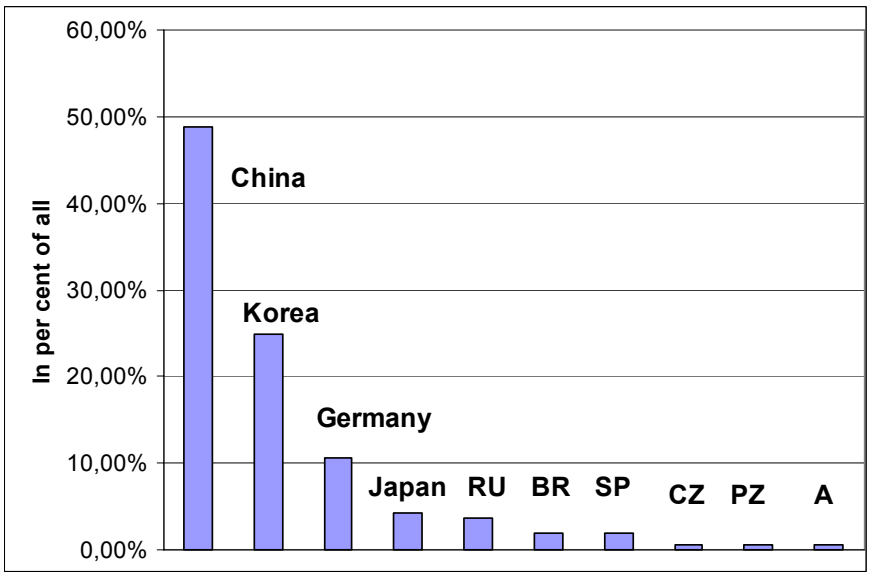

Figure 6 – Utility model; Top ten countries (2001)

China is the best example, where millions of small enterprises started to produce with low costs, and started to innovate in response to economic difficulties. These creations then became utility models, and thus small monopolies that lead to higher profits. To achieve this, it is entirely sufficient to use the "softer" and cheaper form of protection offered by the utility model.
We see Russia, Brazil, Spain, Czech Republic, Poland and Austria also among the countries where entrepreneurs started to step on this path.

The plants which made by people are inventions too. The appropriate protection form is the **plant variety protection**. This ensures the legal protection of improved plant varieties (hybrids, lines, clones etc.). Plant variety protection may be granted for varieties of all botanical genera and species.
Figure 7 shows the countries which make the most new plants in 2001. Japan, Russia, US and Netherlands are the most important new plant producers.

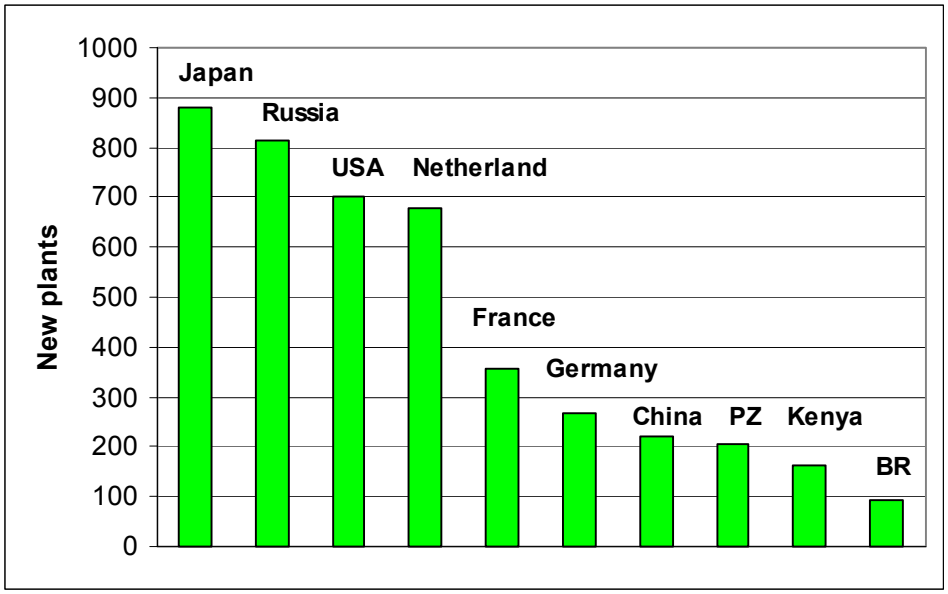

Figure 7 – Plant variety protection; Top ten countries

Industrial design is a further part of the intellectual property. It grants legal protection for the appearance of a product. By means of this protection, the right holder can create or strengthen his position on the market. The industrial design is one of the most important condition for the innovation of light industry. Let us see the most active countries in this field (*Figure 8*).

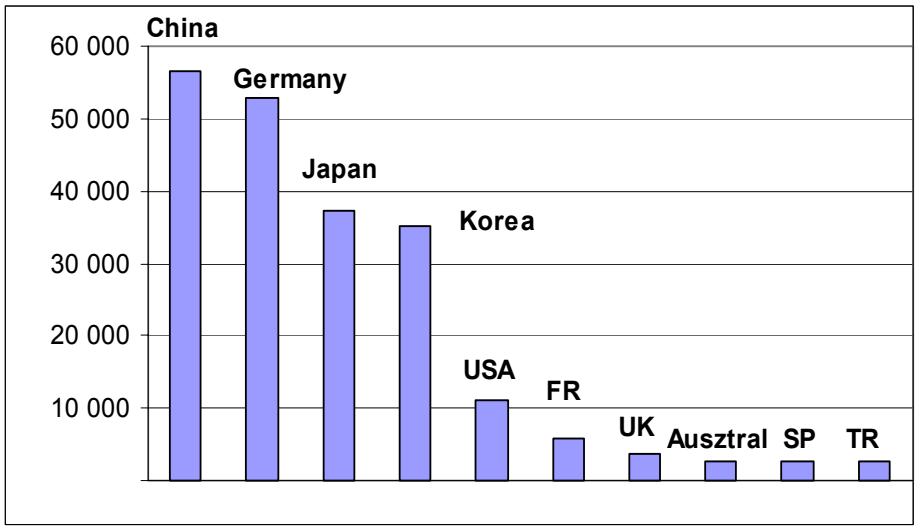

Figure 8- Industrial design; Top ten countries (2001)

The first place of China is no wonder. China is the most productive country in the light industry (textile, shoes, household, etc industry).

This study would be no complete without the analyses of the **trademark**. A trade mark is any sign which is capable of being represented graphically and which can in the course of trade, distinguish the goods or services from those of other undertakings. Such signs may include words, including personal names, designs, letters, and the shape of goods and their packaging. It is a basic tool of the economic competition and plays very important role in marketing and advertisement. The number of the new trademark applications shows the business ambitions of small and medium size enterprises mainly. We receive very important information about the innovation potential from *figure 9* which shows the number of new trademark applications per1 million inhabitants.

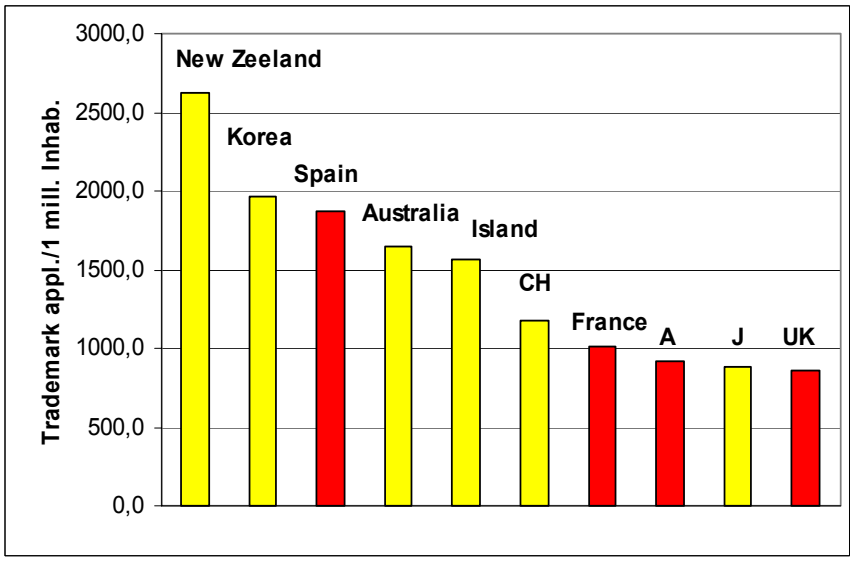

Figure 9 – Trademark; Specific trademark application of top ten countries (2001)

The findings are: New Zeeland and Australia are on the top; Activity of European small and medium size enterprises (Spain, Island, Switzerland, France, Austria and UK) are high. Here is no dominancy of Japan.

Summary

This was the presentation of innovation potential of countries. Finally let us give a summary and let us predict the future.

- Japan has the highest innovation potential. No country which can reach the Japan level until 2020.
- The speed of US innovation is no sufficient to reach Japan. Asia became the most innovative continent.
- The fall of Europe will increase; because of the EU innovation remains a fiction while the innovation in Europe based on national systems.
- The innovation in South America will develop slowly; the backwardness of African continent will not decrease.
- The importance of Austral continent innovation will be higher in the future.
- The innovation potential of Russia will more quickly increase if the role of its army will grow or Russia will approach to Asia and will move away from Europe.