Visual analysis and representation of invention to market commercialization factors

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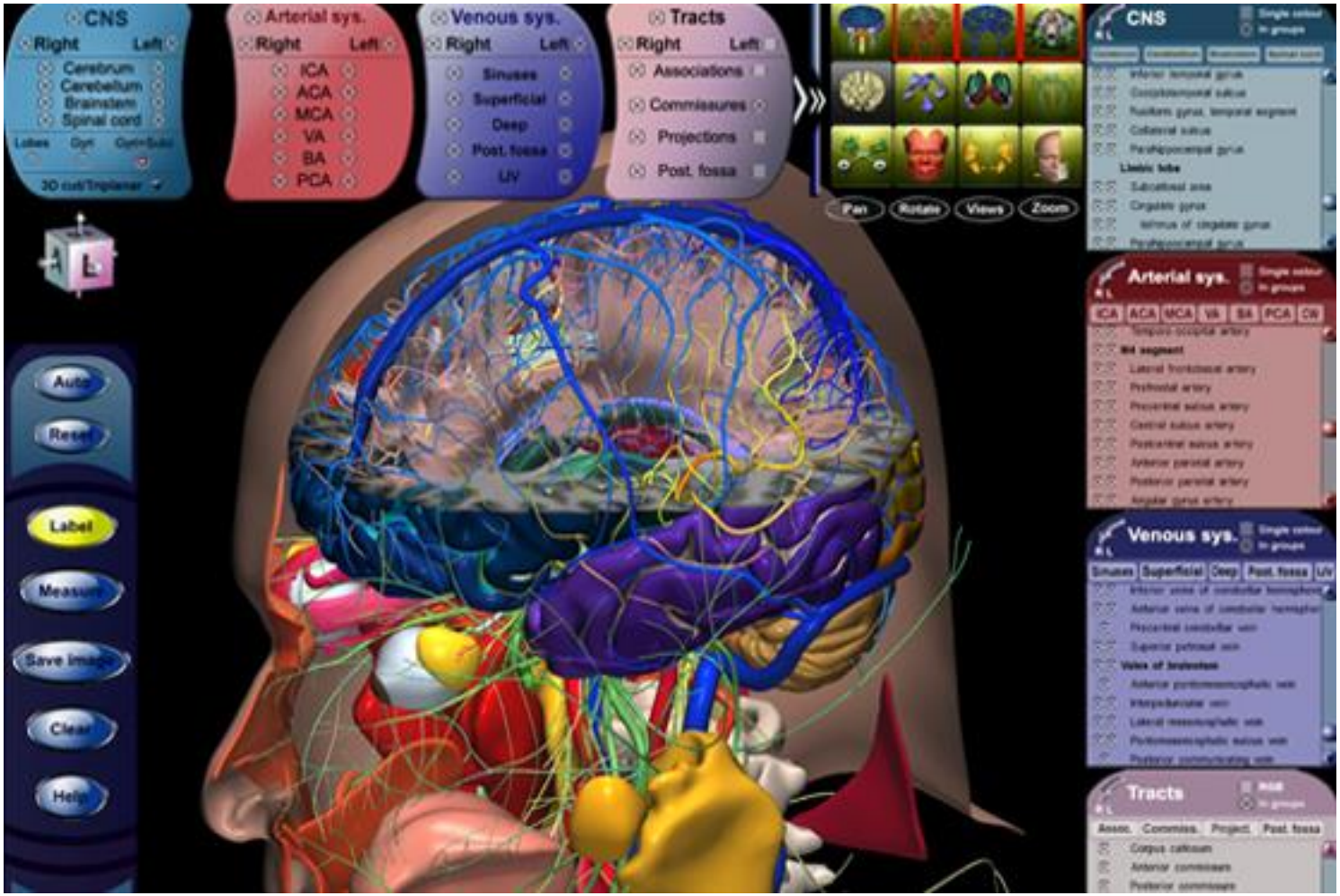
From Invention to the Innovation

- European Inventor Award (2014 finalists)
  - Industry
    - Mobile network communication standard LTE (Long Term Evolution)
    - Self-cleaning concrete
    - Drug against multidrug-resistant tuberculosis
  - Lifetime achievement
    - 3D brain atlases for clinical use
    - …

From Invention to the Innovation

- 3D brain atlases for clinical use

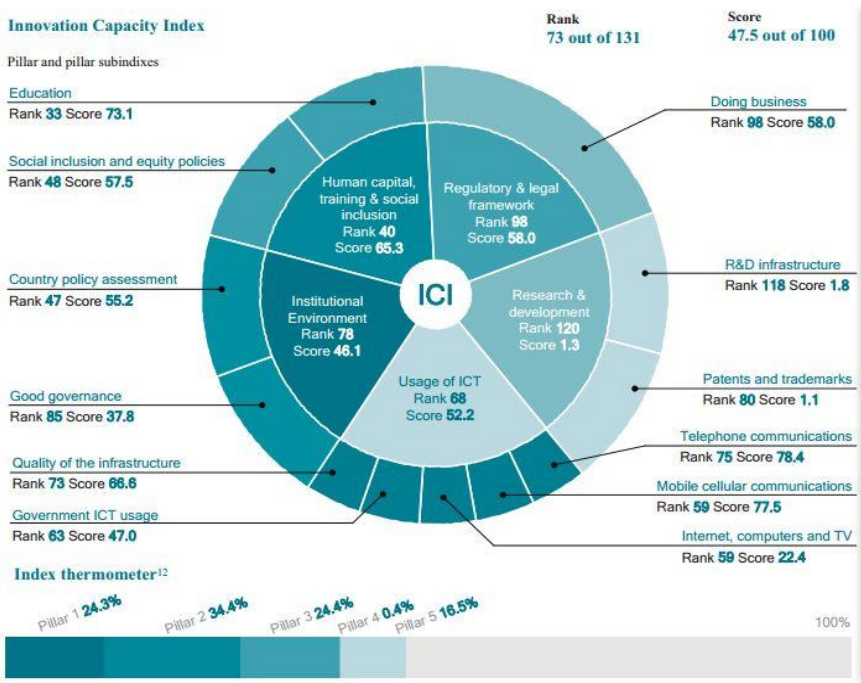


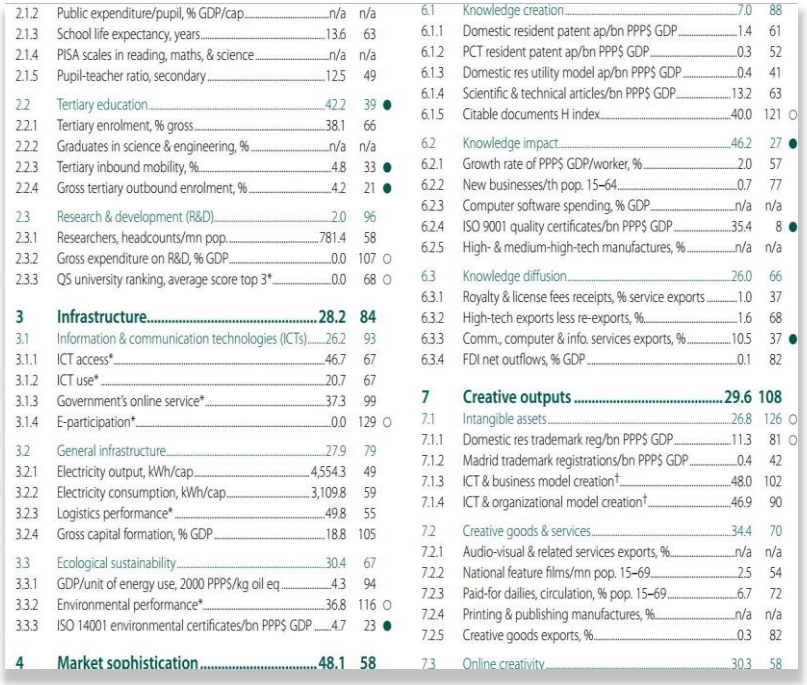
Goal

- Explore and compare a number of important factors that influence innovativeness and competitiveness.
- Expected result: Group of factors that have positive impact on the successful transition from the invention to the innovation

Big Data

- More than 5000 indicators from collections such as Gender Statistics, The World Bank, African Development Indicators, and Education Statistics.





2.1.2	Public expenditure/pupil, % GDP/cap	n/a	n/a
2.1.3	School life expectancy, years	13.6	63
2.1.4	PISA scales in reading, maths, & science	n/a	n/a
2.1.5	Pupil-teacher ratio, secondary	12.5	49
2.2	Tertiary education	42.2	39 ●
2.2.1	Tertiary enrolment, % gross	38.1	66
2.2.2	Graduates in science & engineering, %	n/a	n/a
2.2.3	Tertiary inbound mobility, %	4.8	33 ●
2.2.4	Gross tertiary outbound enrolment, %	4.2	21 ●
2.3	Research & development (R&D)	2.0	96
2.3.1	Researchers, headcounts/mn pop.	781.4	58
2.3.2	Gross expenditure on R&D, % GDP	0.0	107 ○
2.3.3	QS university ranking, average score top 3*	0.0	68 ○
3	**Infrastructure**	**28.2**	**84**
3.1	Information & communication technologies (ICTs)	26.2	93
3.1.1	ICT access*	46.7	67
3.1.2	ICT use*	20.7	67
3.1.3	Government's online service*	37.3	99
3.1.4	E-participation*	0.0	129 ○
3.2	General infrastructure	27.9	79
3.2.1	Electricity output, kWh/cap	4,554.3	49
3.2.2	Electricity consumption, kWh/cap	3,109.8	59
3.2.3	Logistics performance*	49.8	55
3.2.4	Gross capital formation, % GDP	18.8	105
3.3	Ecological sustainability	30.4	67
3.3.1	GDP/unit of energy use, 2000 PPP$/kg oil eq	4.3	94
3.3.2	Environmental performance*	36.8	116 ○
3.3.3	ISO 14001 environmental certificates/bn PPP$ GDP	4.7	23 ●
4	**Market sophistication**	**48.1**	**58**

6.1	Knowledge creation	7.0	88
6.1.1	Domestic resident patent ap/bn PPP$ GDP	1.4	61
6.1.2	PCT resident patent ap/bn PPP$ GDP	0.3	52
6.1.3	Domestic res utility model ap/bn PPP$ GDP	0.4	41
6.1.4	Scientific & technical articles/bn PPP$ GDP	13.2	63
6.1.5	Citable documents H index	40.0	121 ○
6.2	Knowledge impact	46.2	27 ●
6.2.1	Growth rate of PPP$ GDP/worker, %	2.0	57
6.2.2	New businesses/th pop. 15–64	0.7	77
6.2.3	Computer software spending, % GDP	n/a	n/a
6.2.4	ISO 9001 quality certificates/bn PPP$ GDP	35.4	8 ●
6.2.5	High- & medium-high-tech manufactures, %	n/a	n/a
6.3	Knowledge diffusion	26.0	66
6.3.1	Royalty & license fees receipts, % service exports	1.0	37
6.3.2	High-tech exports less re-exports, %	1.6	68
6.3.3	Comm., computer & info. services exports, %	10.5	37 ●
6.3.4	FDI net outflows, % GDP	0.1	82
7	**Creative outputs**	**29.6**	**108**
7.1	Intangible assets	26.8	126 ○
7.1.1	Domestic res trademark reg/bn PPP$ GDP	11.3	81 ○
7.1.2	Madrid trademark registrations/bn PPP$ GDP	0.4	42
7.1.3	ICT & business model creation†	48.0	102
7.1.4	ICT & organizational model creation†	46.9	90
7.2	Creative goods & services	34.4	70
7.2.1	Audio-visual & related services exports, %	n/a	n/a
7.2.2	National feature films/mn pop. 15–69	2.5	54
7.2.3	Paid-for dailies, circulation, % pop. 15–69	6.7	72
7.2.4	Printing & publishing manufactures, %	n/a	n/a
7.2.5	Creative goods exports, %	0.3	82
7.3	Online creativity	30.3	58

Selected Index-Groups

- Basic Country Info
- Political Environment
- Business environment
- Research and Development
- Usage of Information Communication Technology (ICT) and online creativity
- Education
- Patents

Basic Country Info

- Country Name
- Latitude
- Longitude
- Population
- Urban population (% of total)
- GDP per capita (current US$)

Political Environment

- Government effectiveness
- Political stability

Business environment

- Ease of doing business index
- Ease of protecting investors
- Firms using banks to finance investment
- Time required to start a business
- Unemployment

Research and Development

- Researchers in R&D (per million people)
- Research and development expenditure (% of GDP)
- R&D financed by business
- University and Industry research collaboration
- Scientific and technical journal articles

Usage of ICT and creativity

- Online creativity
- Telephone lines
- Mobile cellular subscriptions (per 100 people)
- Internet users (per 100 people)
- ICT goods imports (% total goods imports)
- ICT goods exports (% of total goods exports)
- High-technology exports (current US$)
- Access to electricity (% of population)

Education

- Literacy rate, adult total (% of people ages 15 and above)
- Public spending on education, total (% of GDP)
- Knowledge Intensive employment
- School enrollment, tertiary (% gross)

Patents

- Patent application per capita
- Trademark applications, total
- Charges for the use of intellectual property, payments (BoP, current US$)
- Charges for the use of intellectual property, receipts (BoP, current US$)
- Global Innovation Index (Score)

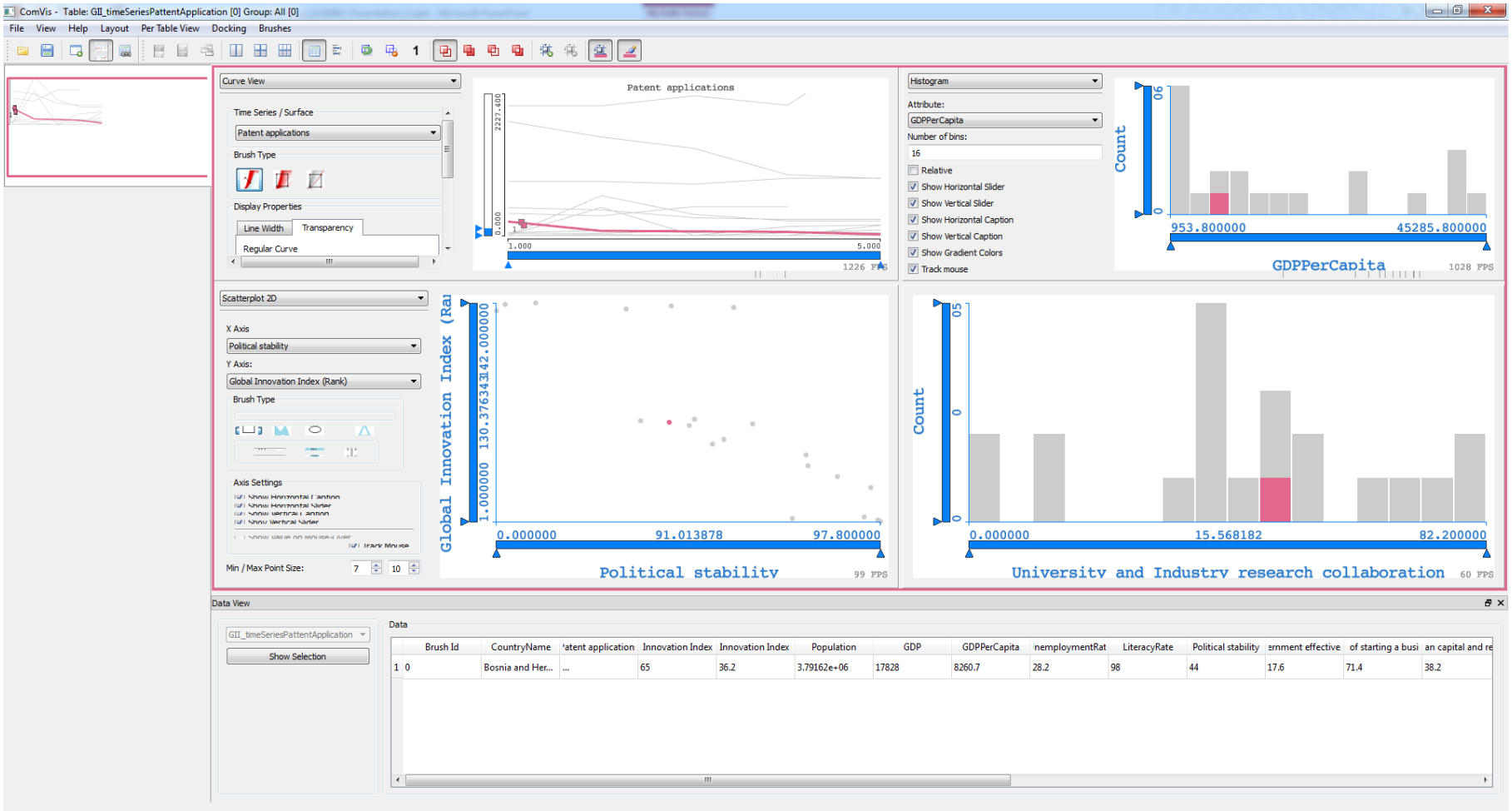
Data Table

- Missing data in the Data Table

AE	AF	AG	AH	AI	AJ
NUM	NUM	NUM	NUM	NUM	NUM
Political stability	Population (Total)	Public spending on education, total (% of GDP)	Researchers in R&D (per million people)	Research and development expenditure (percent of GDP)	R&D financed by business
59.5	3162083	3.26756	0	0.15308	3.3
33	38481705	4.33702	0	0.0666	0
58	20820525	3.47644	0	0	0
71	41086927	6.25856	0	0.61745	22.3
63.8	2969081	3.27778	0	0.26736	0
87.4	22722000	5.58827	0	2.38365	61.9
95.3	8429991	5.915	4397.49599	2.74793	44.6
52.2	9295784	2.43564	0	0.21932	24.8
50.4	1317827	2.57594	0	0	0
29.4	154695368	2.23384	0	0	0
97.9	283221	5.61038	0	0	0
59.1	9464000	5.14991	0	0.75903	28.8
87.7	11128246	6.57661	3679.41801	2.04315	58.6
67.6	324060	6.61337	0	0	0
72.7	10050702	5.34512	0	0	0
53.8	10496285	6.89264	0	0.157	0.5
44	3833916	0	0	0.02171	0
51.6	2003910	9.48738	0	0.51601	0
65.2	198656019	5.82225	0	1.16042	45.4
93.6	412238	3.45082	0	0.03701	1.6
73.6	7305888	4.09688	1623.04677	0.57074	30.5
52.8	16460141	3.42701	0	0.20056	11.9
55.3	14864646	2.60388	0	0	0
51.1	21699631	3.18472	0	0	0
91.6	34754312	5.39627	0	1.74261	46.5
79.8	17464814	4.52154	0	0.41962	35.4
49	1350695000	0	963.20314	1.83704	71.7
35.4	47704427	4.38377	0	0.18195	22.1
80.9	4805295	6.28192	1289.02754	0.47829	28.7
31.5	19839750	4.60299	0	0	0
79.3	4267600	4.30777	1583.5527	0.74929	38.8
79.4	1128994	7.27143	810.5593	0.48531	15.7
93.5	10510785	4.24842	2891.47884	1.84036	46.9
93.3	5591572	8.73995	6722.63798	3.0929	60.2

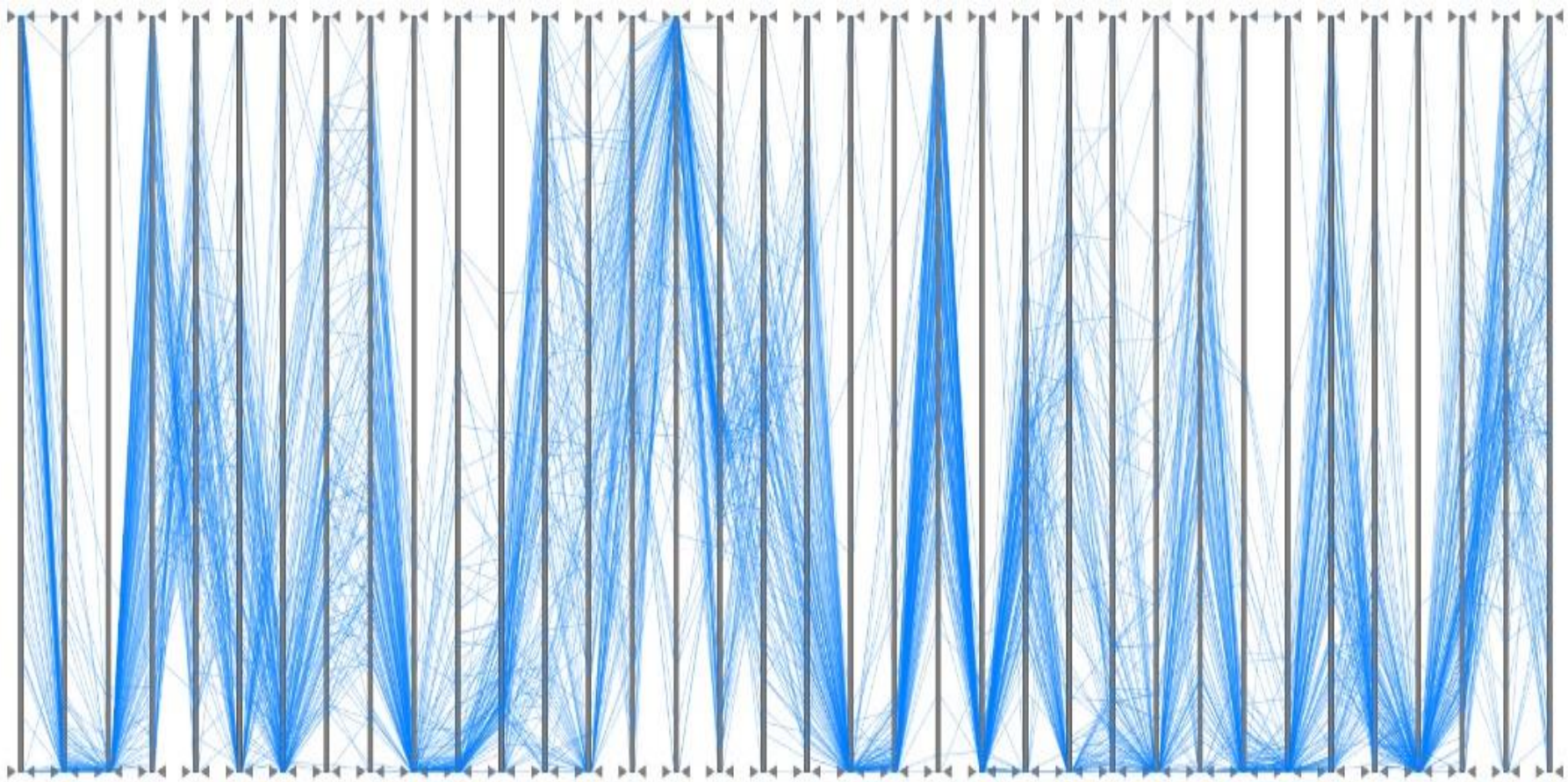
Visualization Tools

- ComVis



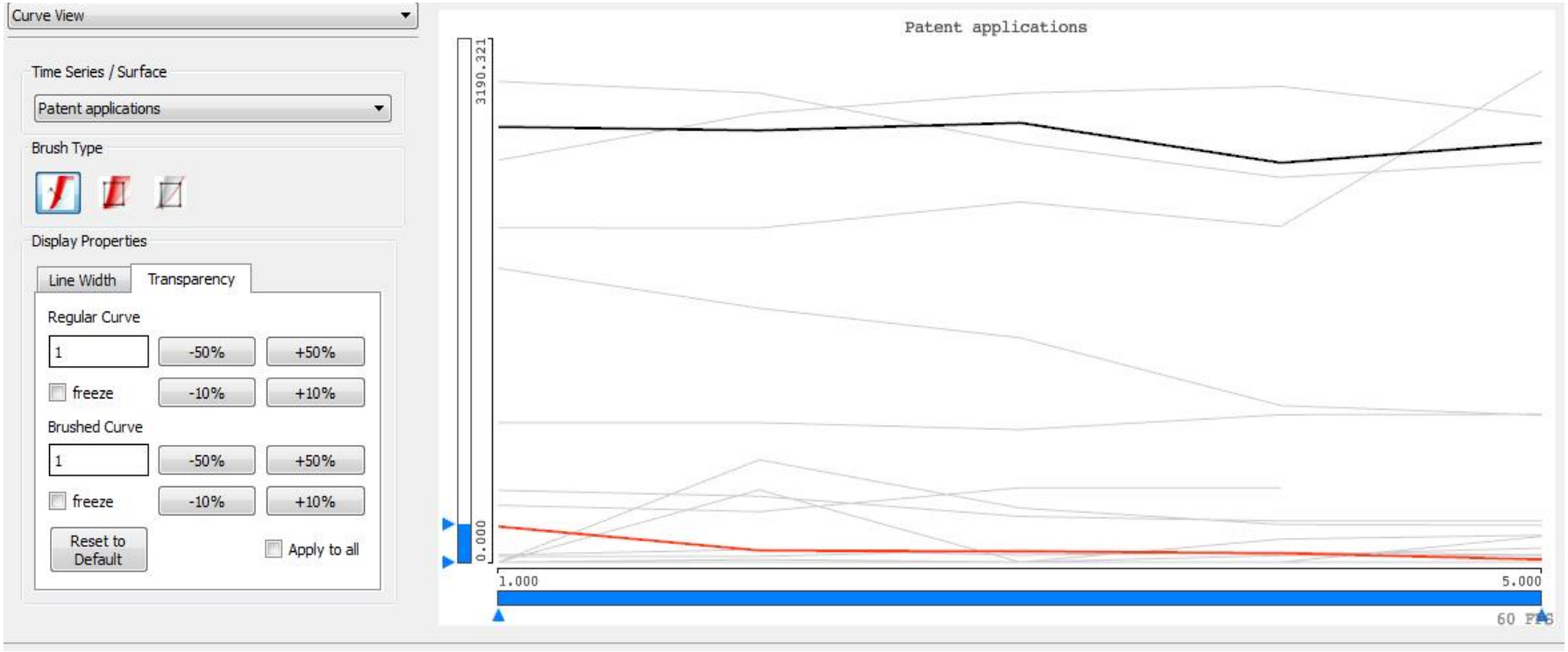
Selected Index-Groups

- Parallel coordinates plot is used to visualize all used indicators.



Indicator – Patent Applications

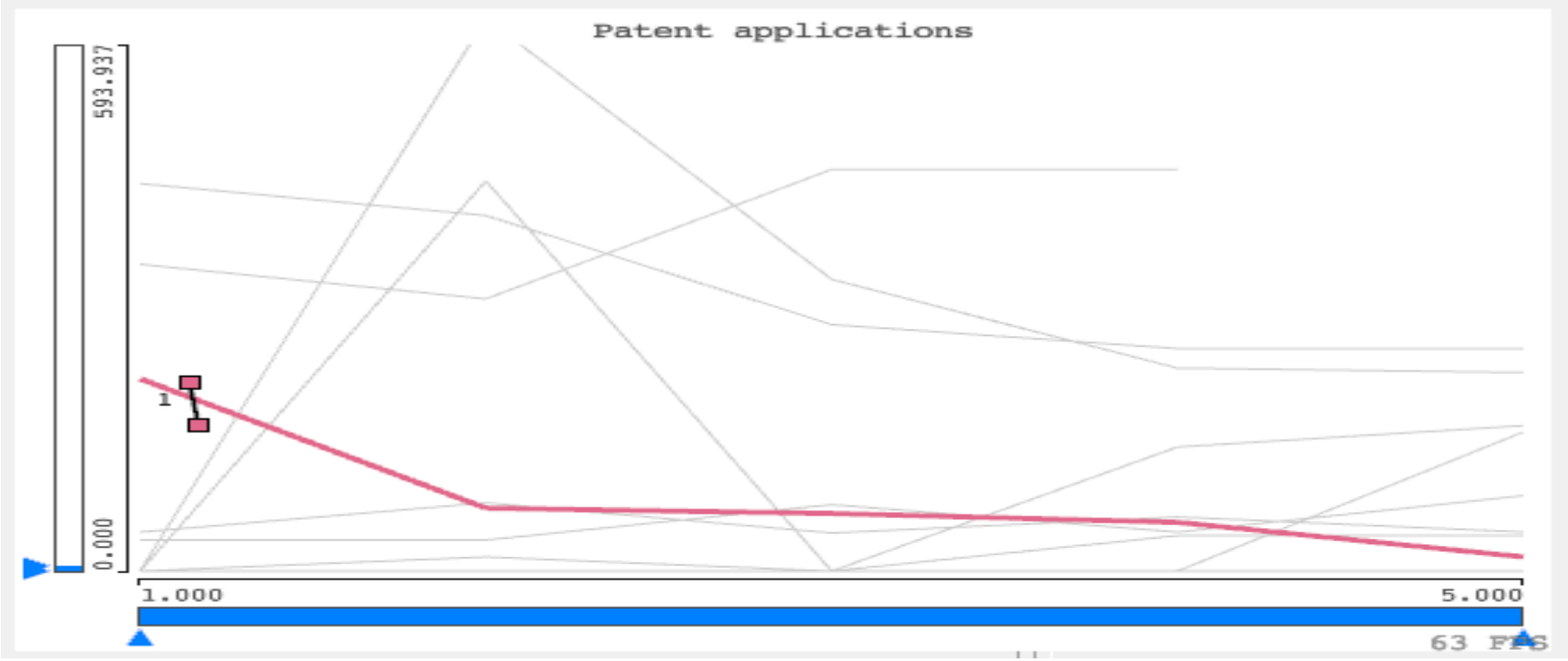
- Evident is the negative trend for the number of patent applications in Bosnia and Herzegovina and Austria



Patent applications over five years period

Indicator – Patent Applications

- Evident is a negative trend for the number of patent applications in Bosnia and Herzegovina

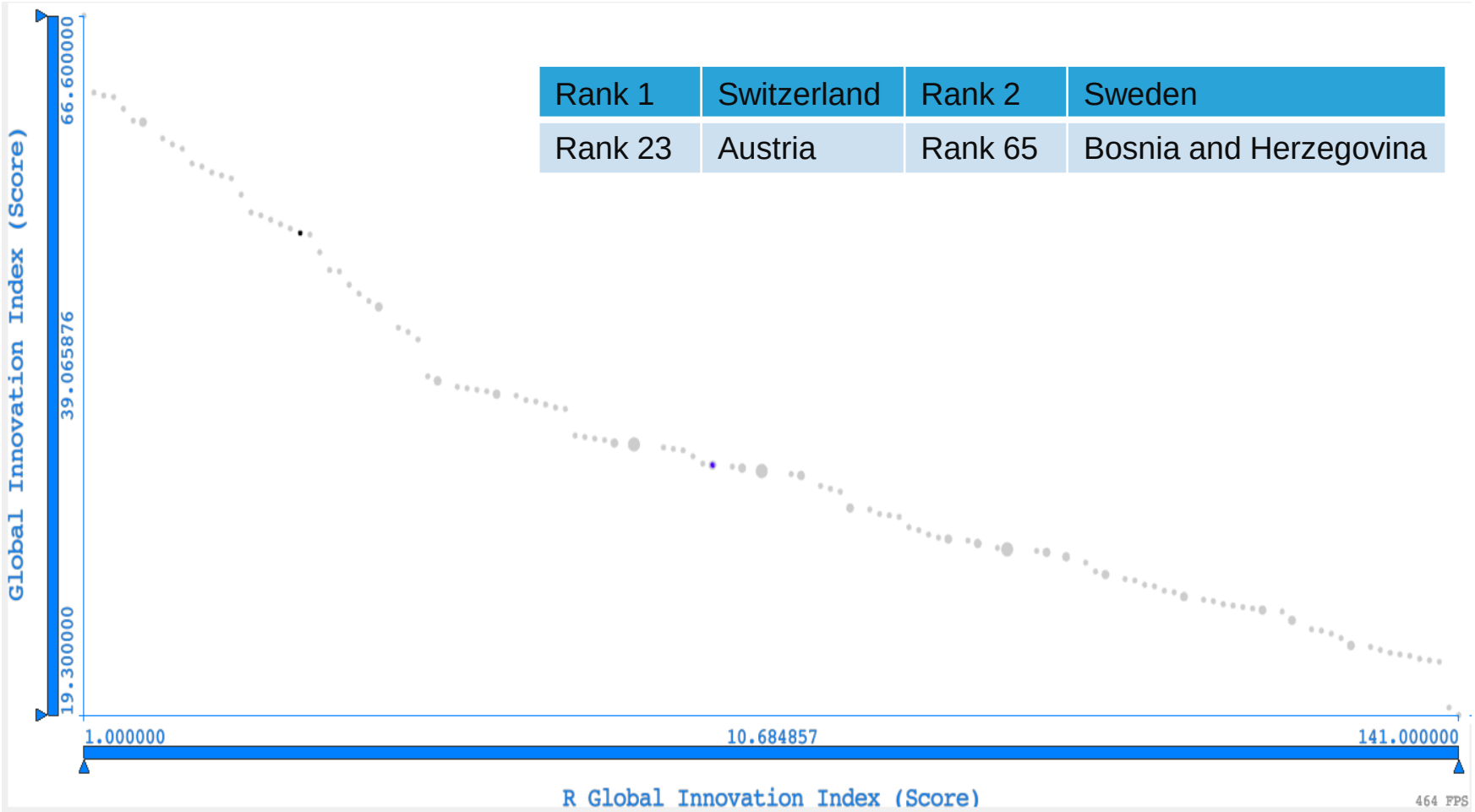


Patent applications over five years period

World rank

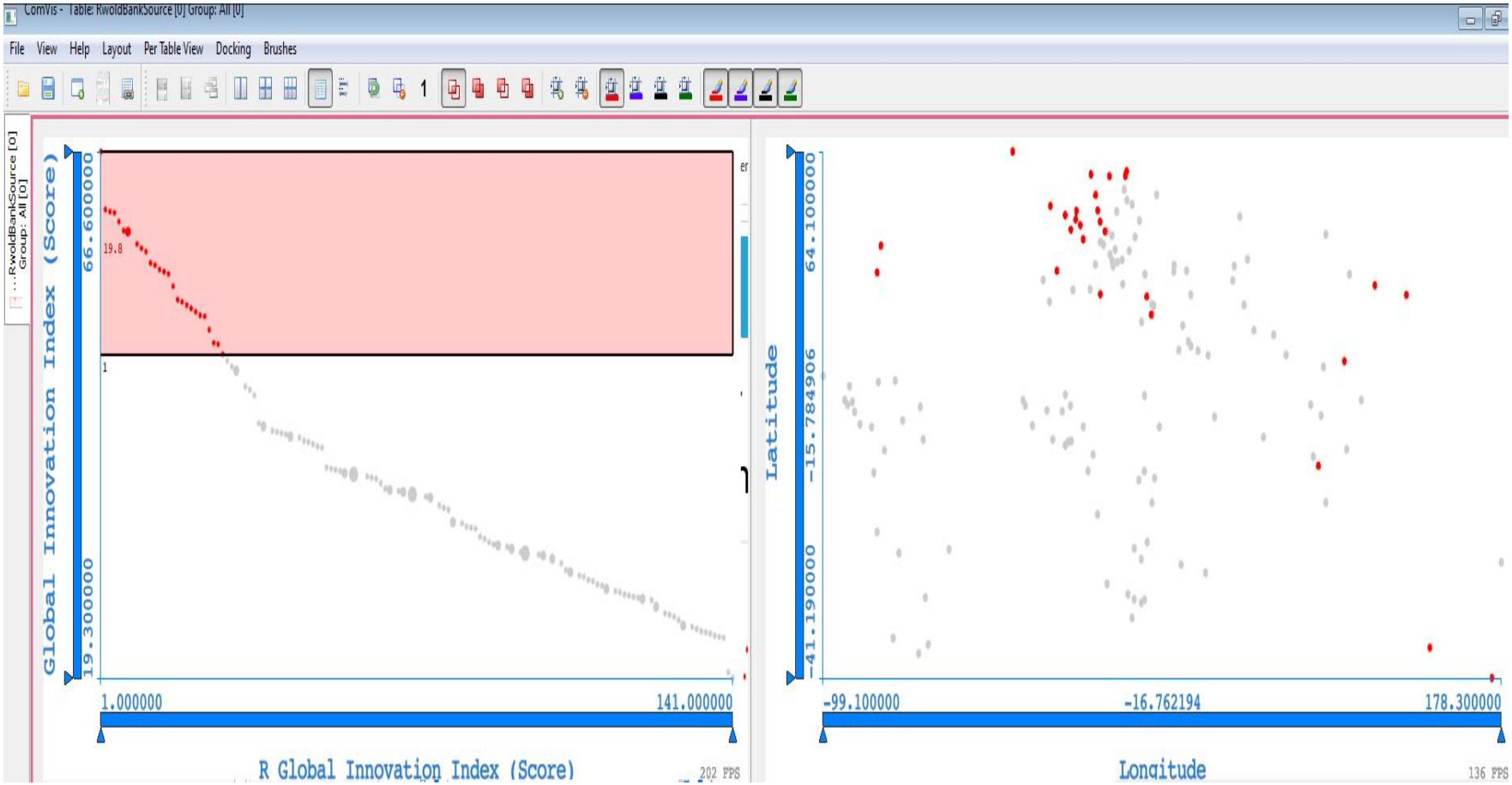
- Global Innovation Index (GII) 2012 (141 Countries)

Rank 1	Switzerland	Rank 2	Sweden
Rank 23	Austria	Rank 65	Bosnia and Herzegovina



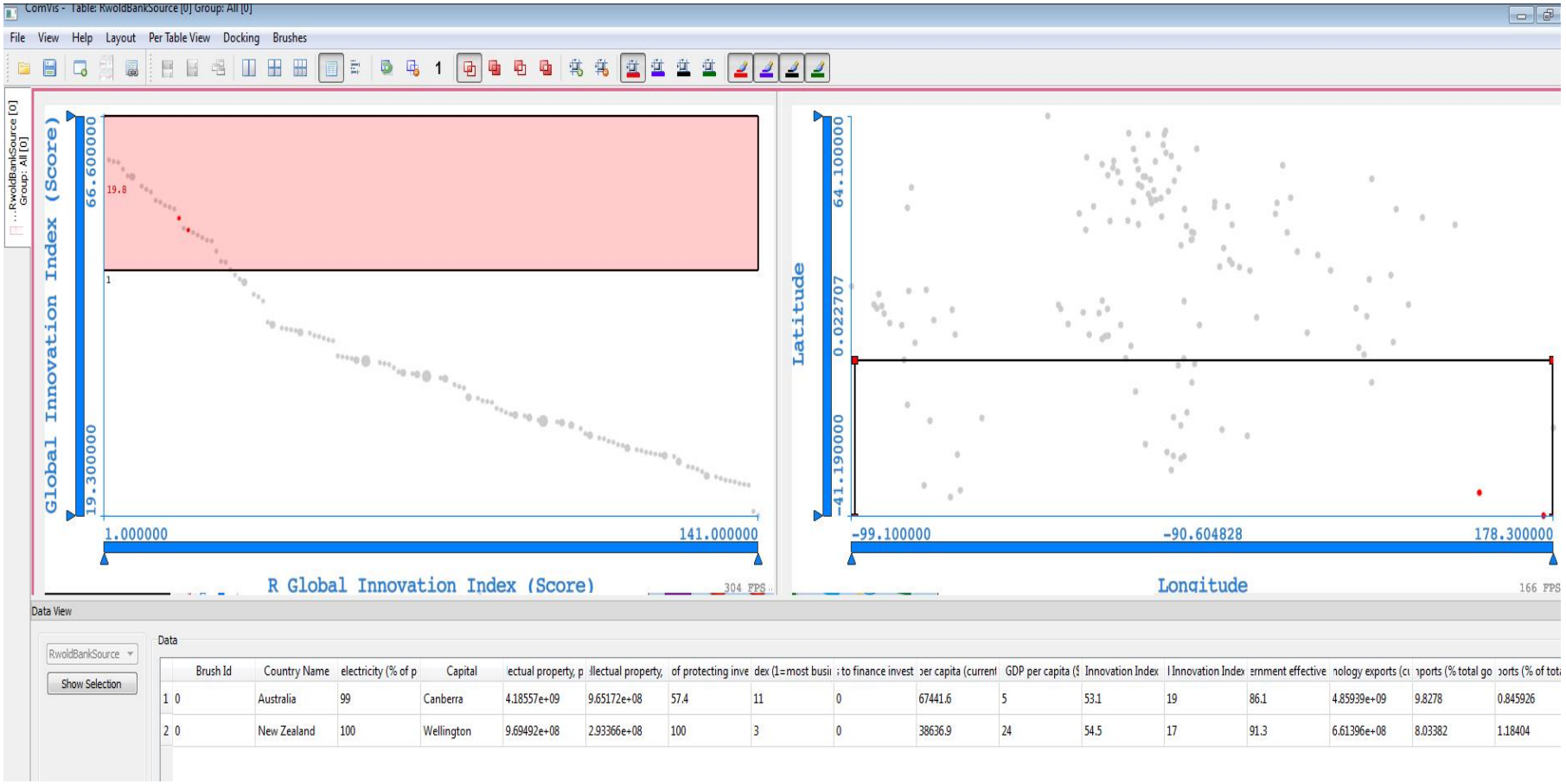
World rank

- Selected best 20% of Gii score values. Mostly located in the northern hemisphere (rich north).



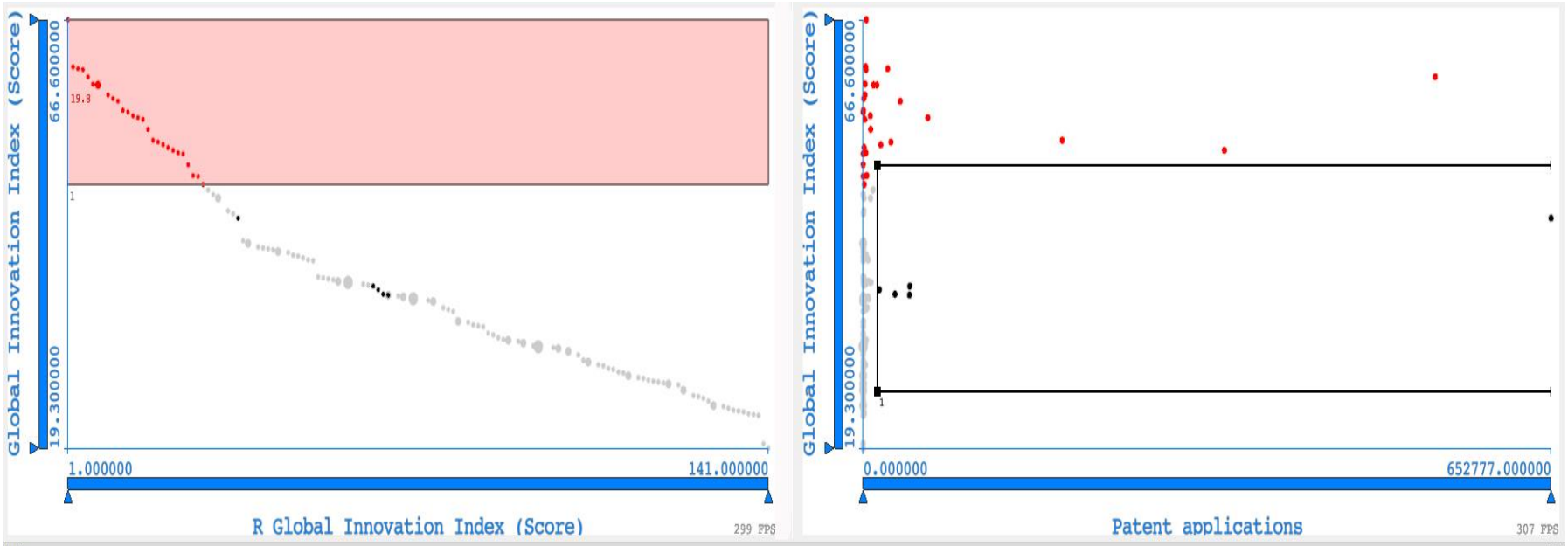
World rank

- Selected best 20% of Gii score values. Only a couple of countries located in the southern hemisphere.



World rank – patent applications

- Countries with average Gii index and high number of patent applications



ta View

RwoldBankSource

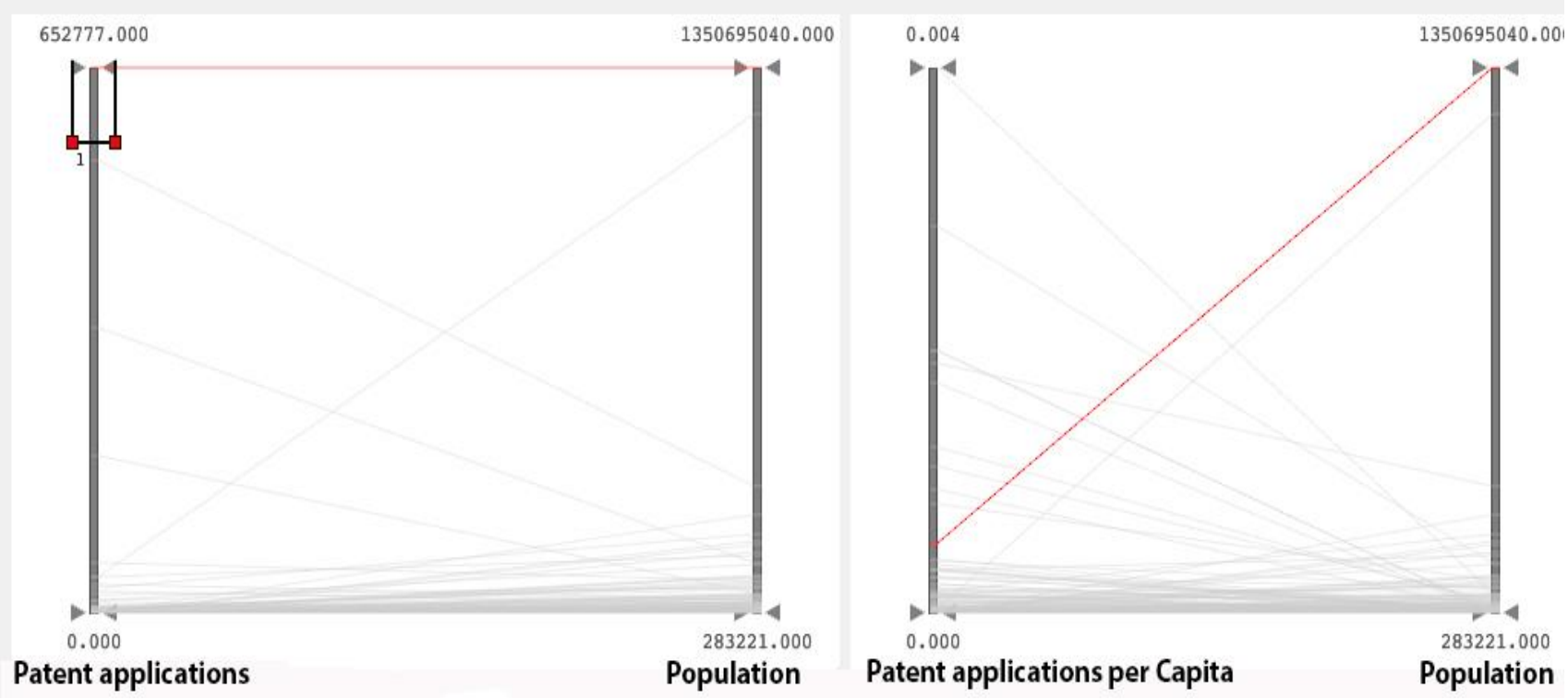
Show Selection

Data

	Brush Id	Country Name	electricity (% of p	Capital	ectual property, p	llectual property,	of protecting inve	dex (1=most busi	; to finance invest	per capita (current	GDP per capita ($	Innovation Index	l Innovation Index	ernment effective	nology exports (cu	nports (% total go	ports (% of to
1	2	Brazil	99.3	Brasilia	3.66648e+09	5.10712e+08	55.9	116	48.4	11339.5	54	36.3	64	38.2	8.41489e+09	8.82804	0.699903
2	2	China	99.8	Beijing	1.7749e+10	1.0441e+09	50.4	96	14.7	6091.01	73	44.7	35	41.7	4.57e+11	17.9992	26.7602
3	2	India	75.3	New Delhi	3.99006e+09	3.21445e+08	61.5	134	46.6	1503	113	36.2	65	37.6	1.28707e+10	5.97356	2.18267
4	2	Mexico	95	Mexico	1.12023e+09	9.56263e+07	61.9	53	16.2	9748.87	58	36.8	63	47.3	4.07954e+10	17.2843	16.9833
5	2	Russian Federation	0	Moskva	7.62928e+09	6.642e+08	47.4	92	11.3	14037	46	37.2	62	27.3	5.44336e+09	7.15668	0.237297

Data Derivation 1

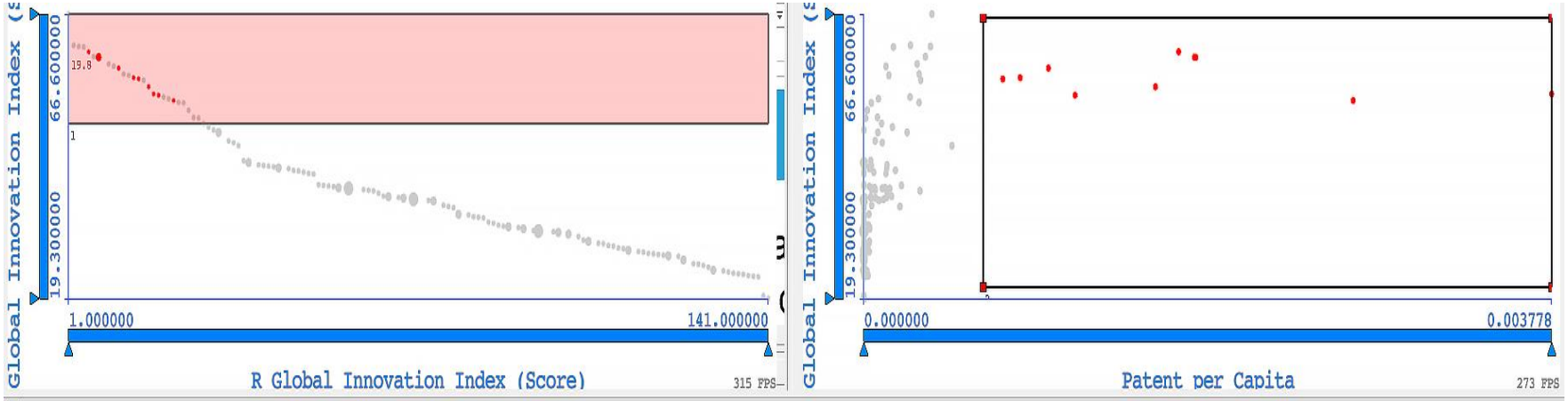
- Data transformation
  - Not all data useful in original form



Brushing ‘Patent vs. Patent per Capita’

World rank – patent per capita

- Only a several countries are above the average regarding the number of patents per capita.



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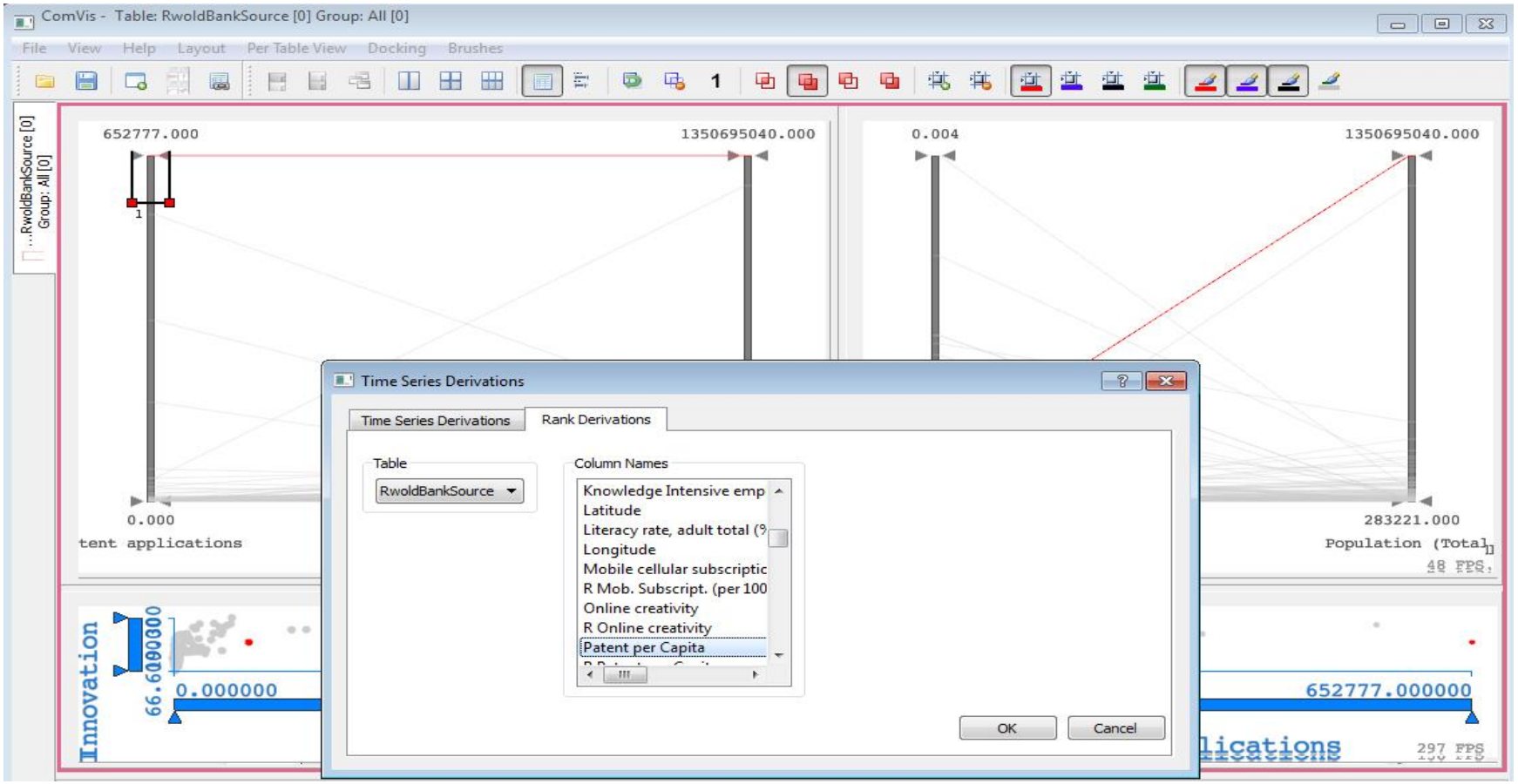
1	0	Australia	99	Canberra	4.18557e+09	9.65172e+08	57.4	11	0	67441.6	5	53.1	19	86.1	4.85939e+09	9.8278	0.845926
2	0	Canada	100	Ottawa	1.0867e+10	3.74496e+09	90	19	0	51206.2	11	57.6	11	89.1	2.5017e+10	7.98598	2.48345
3	0	Germany	100	Berlin	1.22426e+10	1.38704e+10	51.9	21	45	42624.8	18	55.8	15	80.4	1.83e+11	7.94948	4.60253
4	0	Hong Kong SA...	100	Hong Kong	2.00928e+09	4.59271e+08	93	2	0	36795.8	25	59.4	7	85.1	8.05497e+08	40.4118	42.48
5	0	Israel	99.7	Jerusalem	1.0725e+09	1.0565e+09	86.7	35	0	32567.1	27	56	14	71.4	8.82559e+09	8.72505	10.6898
6	0	Japan	100	Tokio	1.98976e+10	3.18923e+10	72.2	27	0	46730.9	13	52.2	22	75.3	1.26e+11	10.1386	9.22833
7	0	Korea, Rep.	100	Seul	8.3869e+09	3.4355e+09	61.5	7	39.9	22590	33	53.3	18	72.2	1.22e+11	10.4279	17.9855
8	0	New Zealand	100	Wellington	9.69492e+08	2.93366e+08	100	3	0	38636.9	24	54.5	17	91.3	6.61396e+08	8.03382	1.18404
9	0	Singapore	100	Singapore	1.6511e+10	1.64899e+09	96.7	1	0	51709.5	10	59.4	7	97.5	1.26e+11	23.5417	28.9108
10	0	United States	100	Washington DC	3.9889e+10	1.24e+11	86.7	4	0	51748.6	9	60.3	5	77	1.45e+11	12.8422	9.49954

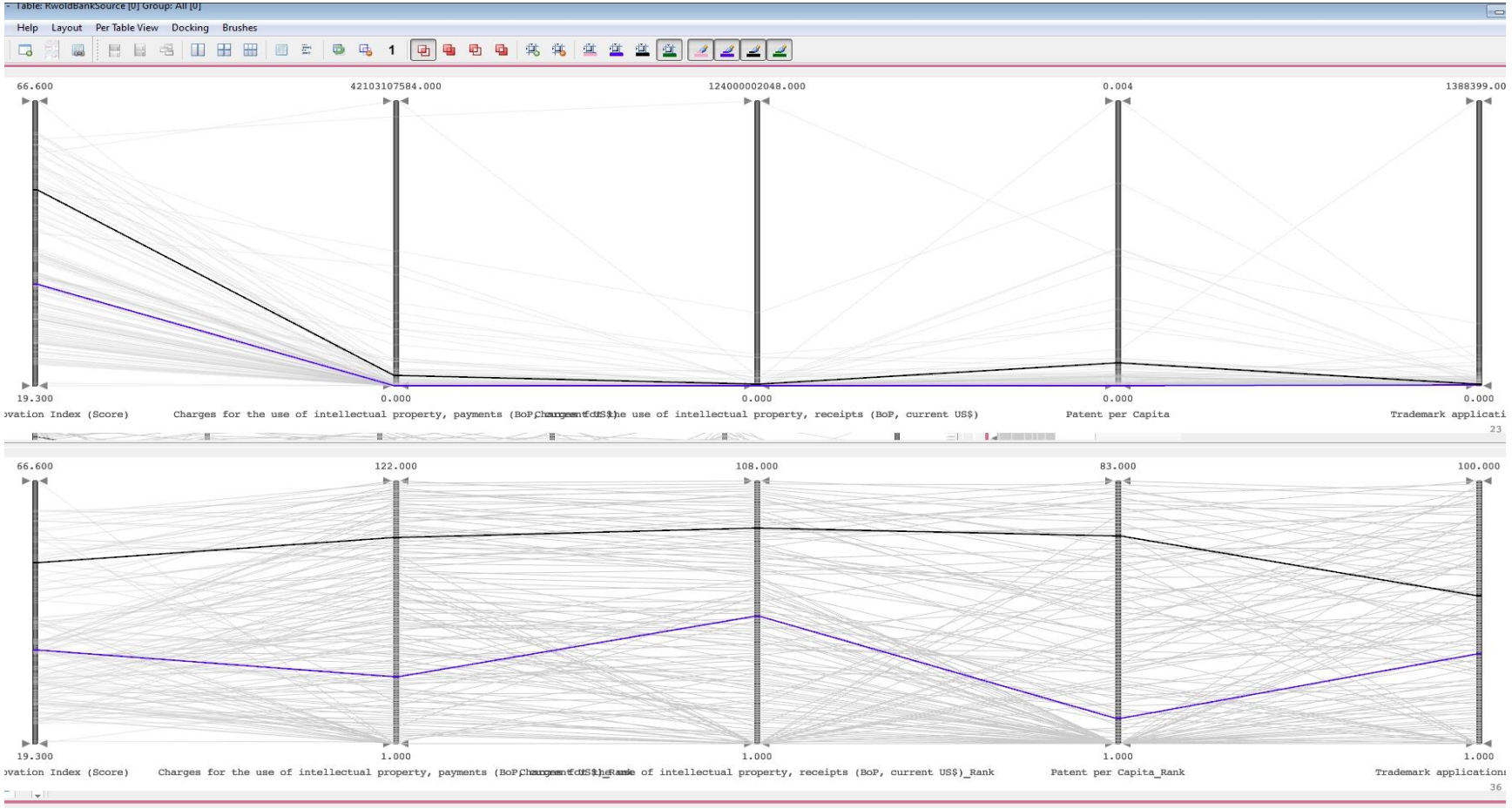
Data Derivation 2

- Rank derivation
  - Useful for the numerical data



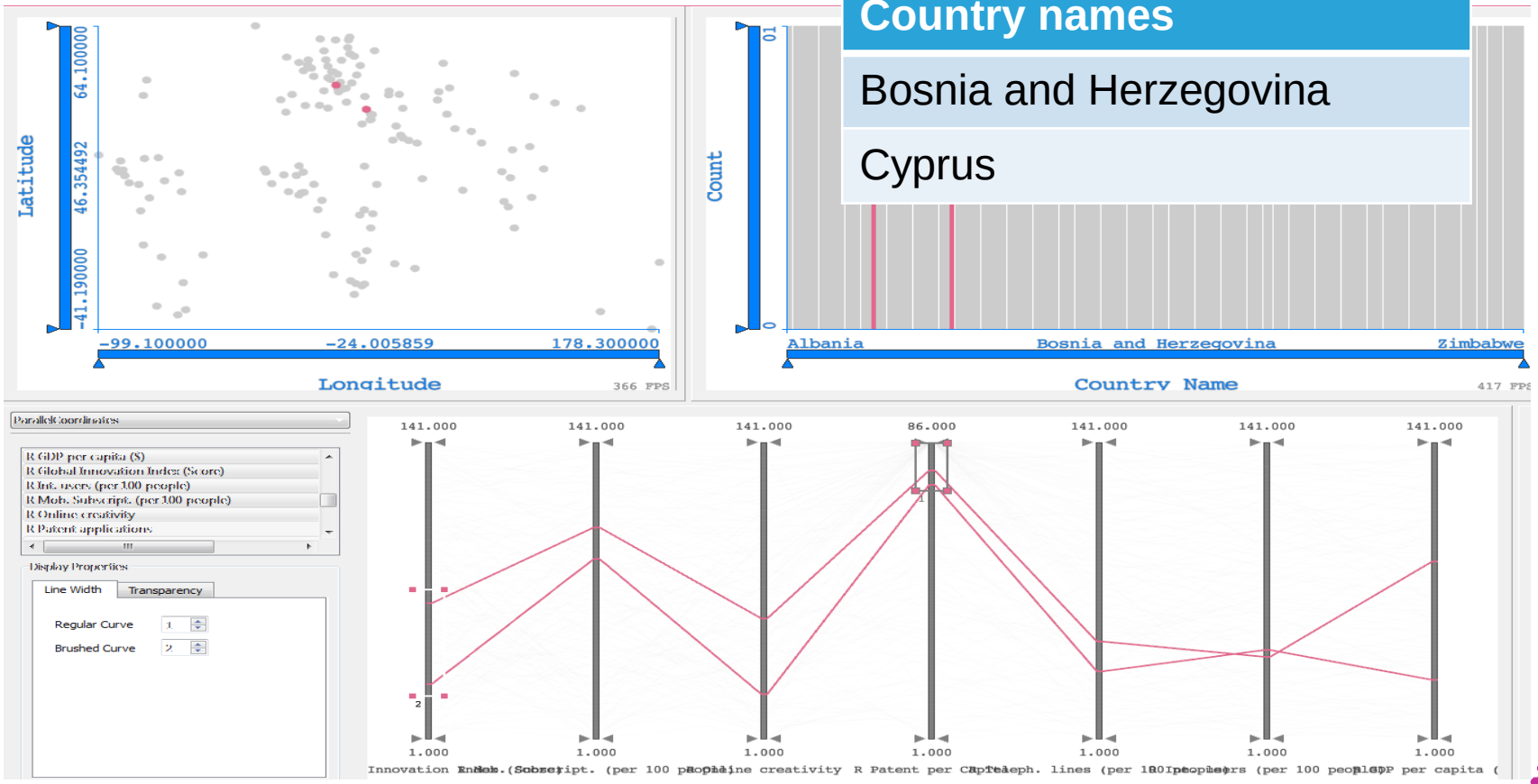
Brushing the Patent Group of Indexes

- Rank information provide better insight into the data relations.



Brushing patent applications

- Countries with a small number of patent applications per capita and a average GII index



Map of Facebook Users

- Bosnia is better than Cyprus only in the single index ‘Internet users (per 100 people)’

  But who uses internet more efficiently?

Facebook statistics

- BiH: Play poker; watch football or read local newspapers
- Cyprus: Use online guide for exploration, it is cheaper that traveling; go to the cheap supermarket to save money, and buy a smartphone at the MTN

Bosnia and Herzegovina Facebook Statistics

TOP 10

Pages | Brands | Media | Entertainment | Sport | Celebrities | Society | Community

#	Page	Local Fans	Fans
1	Texas HoldEm Poker	598 519	70 357 940
2	Edin Džeko	224 945	935 783
3	Dnevni avaz	199 289	304 775

Cyprus Facebook Statistics

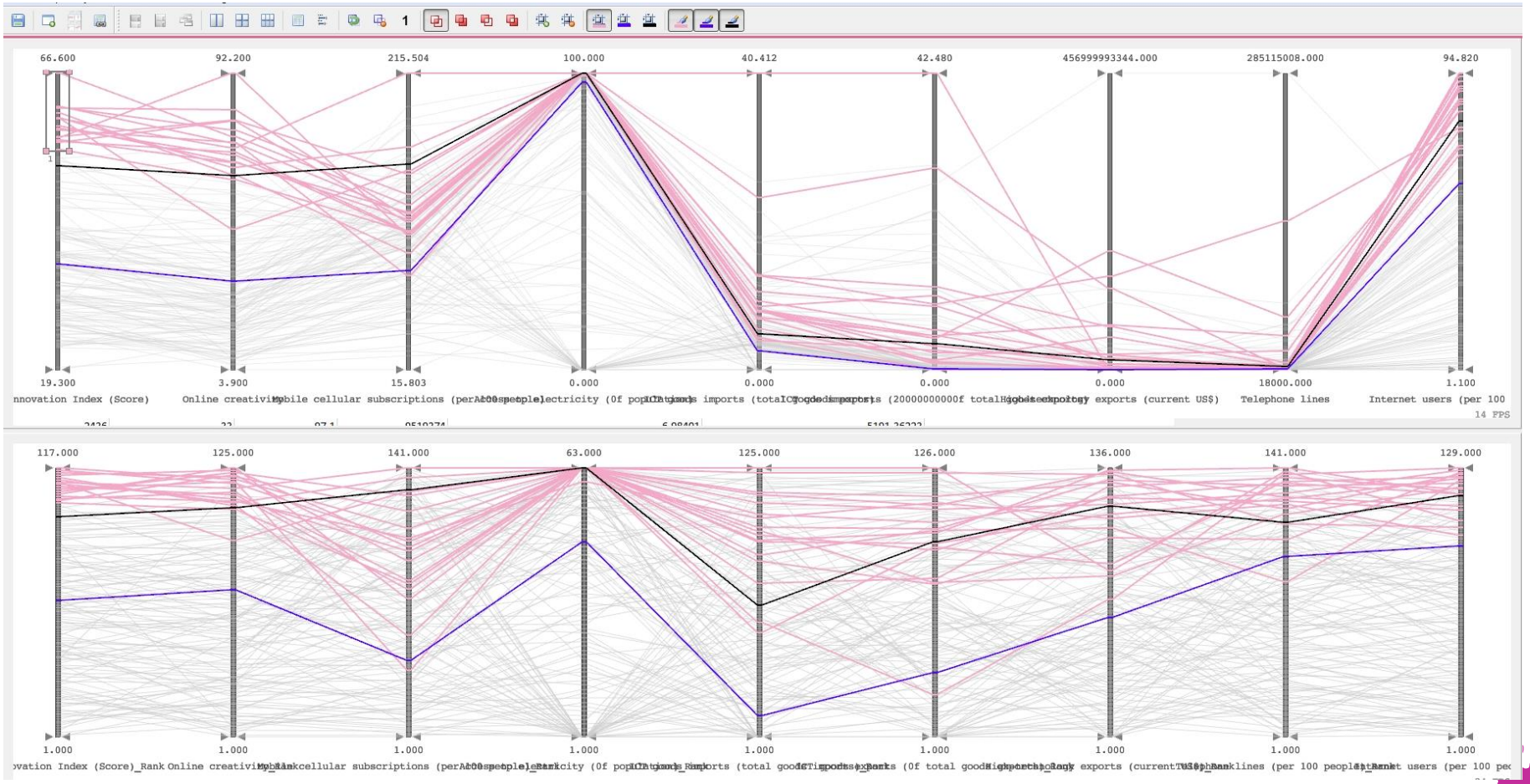
TOP 10

Pages | Brands | Media | Entertainment | Sport | Celebrities | Society | Community

#	Page	Local Fans	Fans
1	Heart Cyprus	68 177	199 931
2	Lidl Cyprus	67 630	78 306
3	MTN Cyprus	58 544	77 436

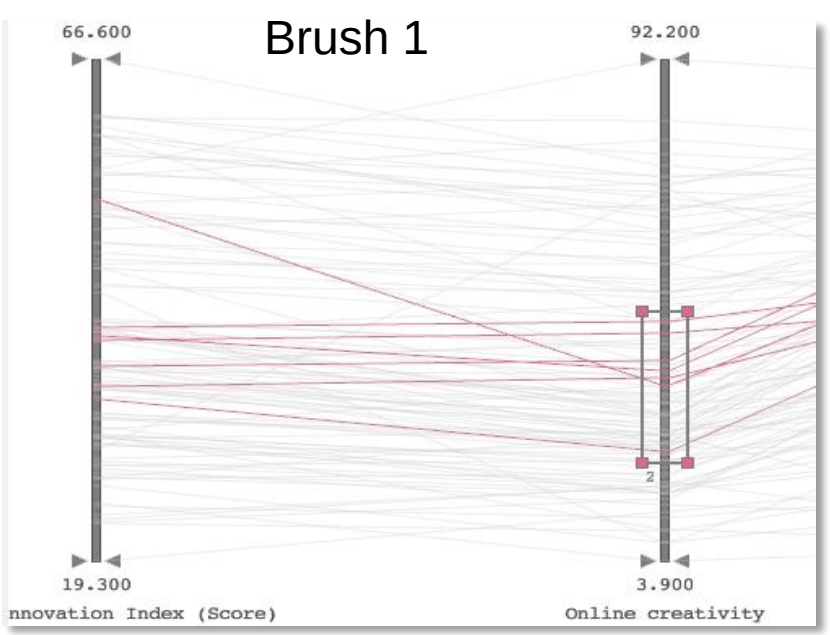
Brushing the Usage of ICT and Creativity

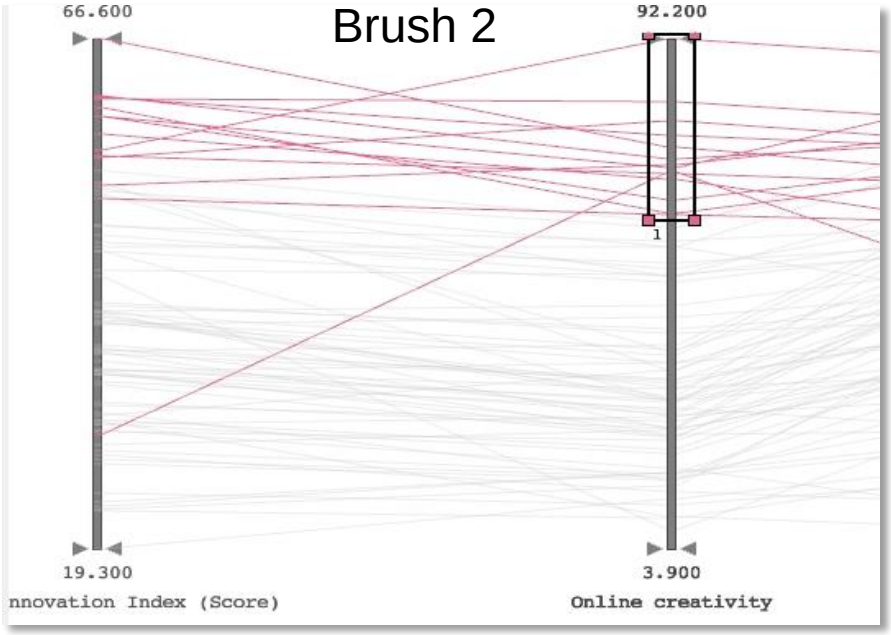
- Online creativity as a strong criterion for the good GII score



Global Innovation Score

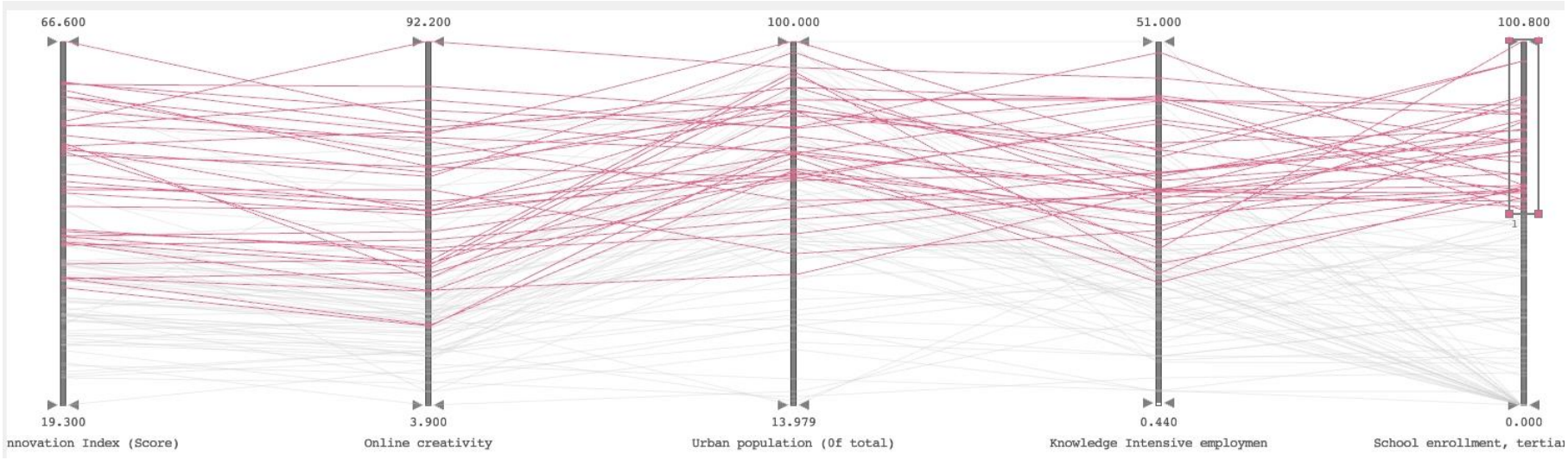
- Global Innovation Score is related to online creativity. Higher online creativity implies higher Global Innovation Index





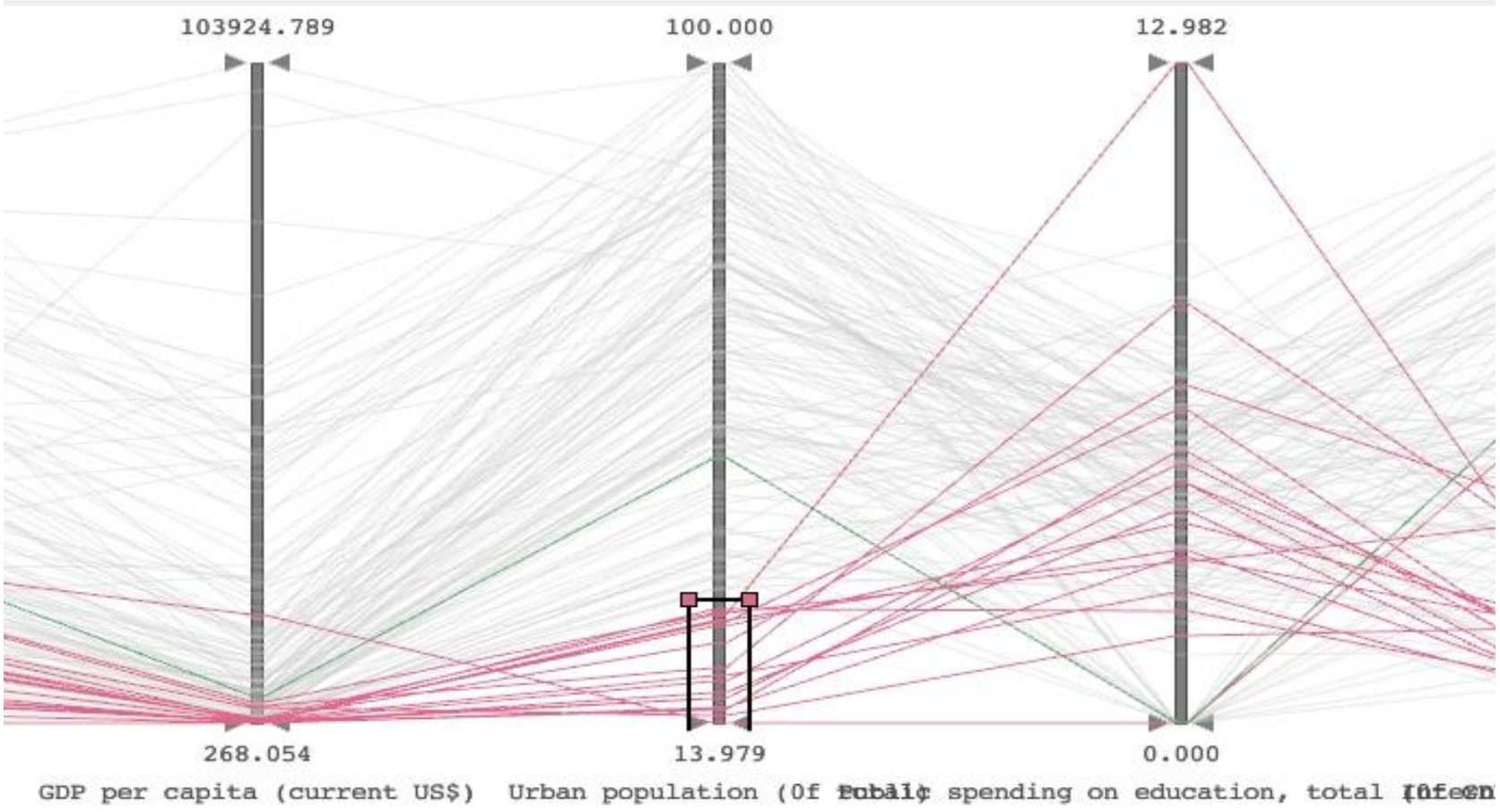
Global Innovation Score

- High Global Innovation Score is related to countries with high tertiary education
- Countries with less urban population still do not have good education



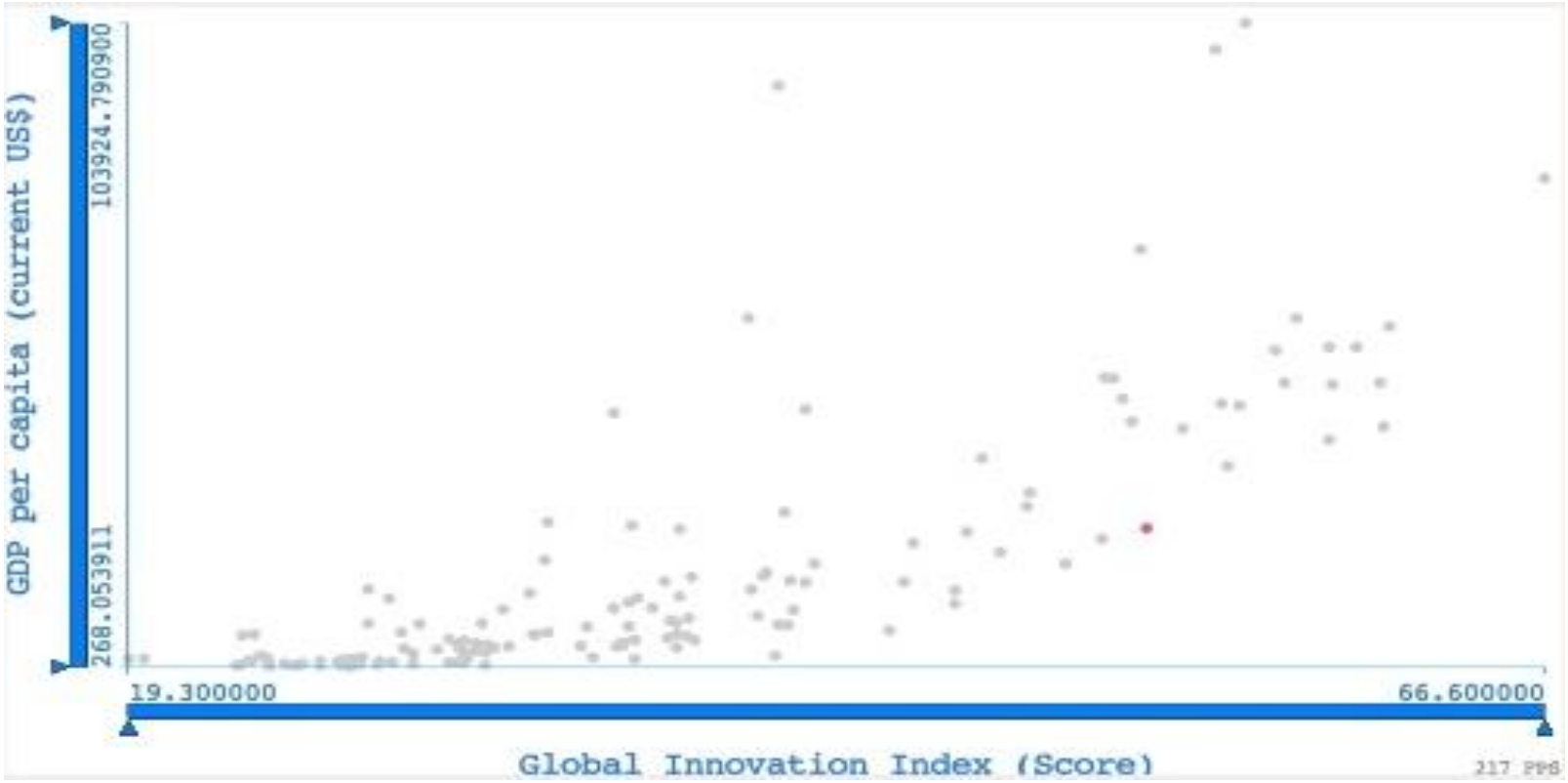
Public Spending on Education

- Countries with less urban population invest higher amount of its GDP on education



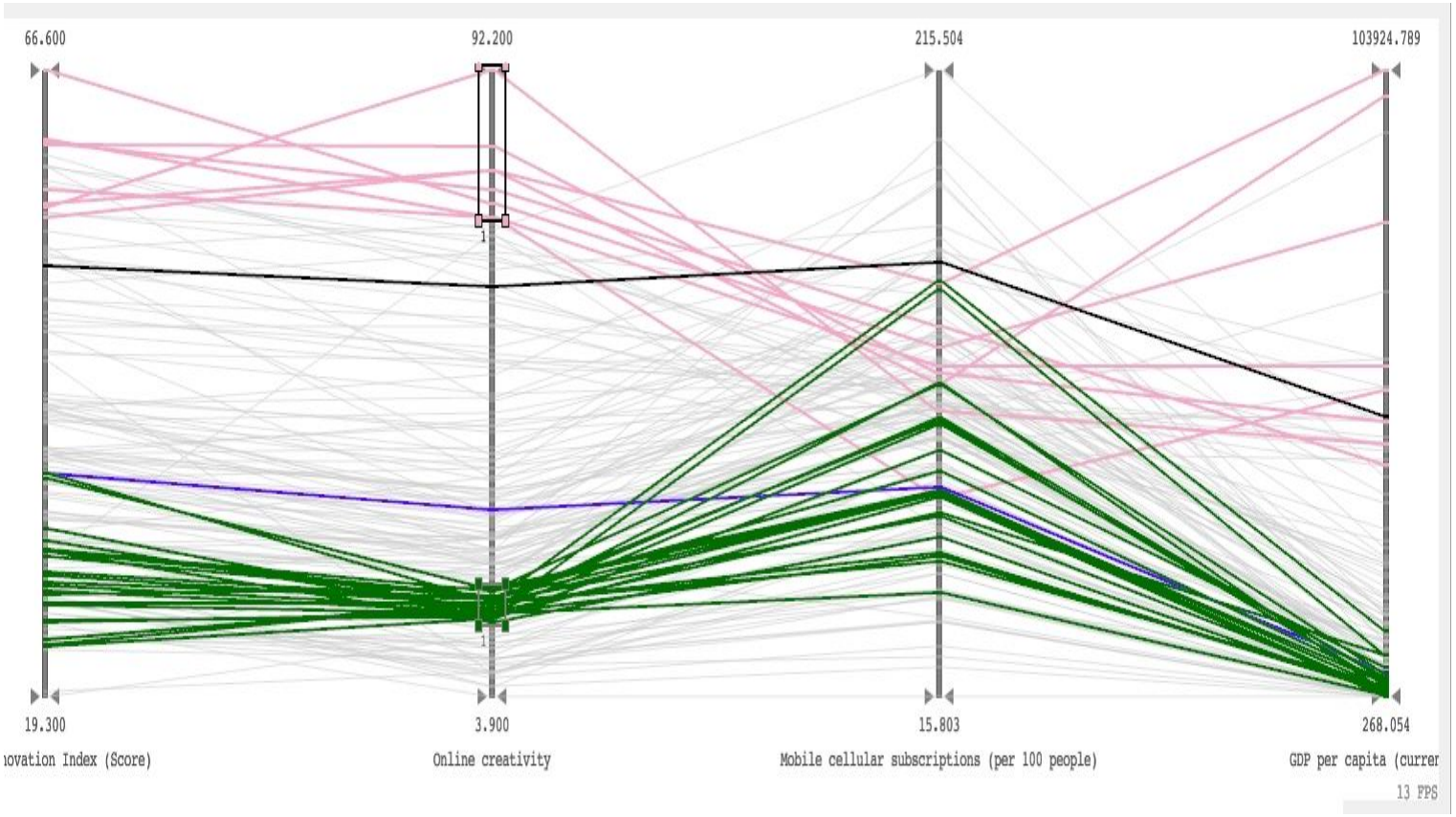
Global Innovation Score

- Global Innovation Index (Score) and GDP per capita are in correlation (as always the money play a important role)

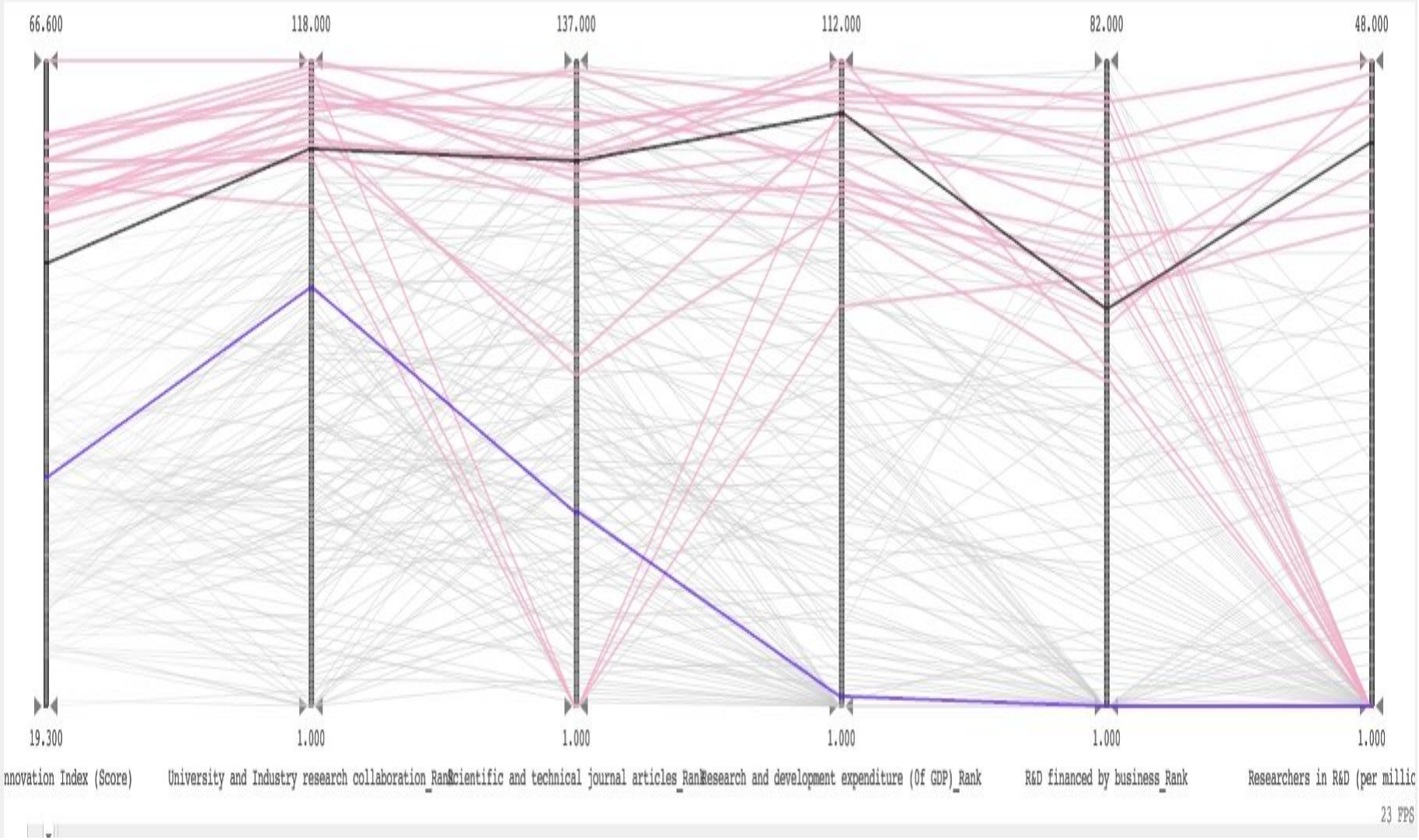


Global Innovation Score

- Global Innovation Index (Score) and GDP per capita

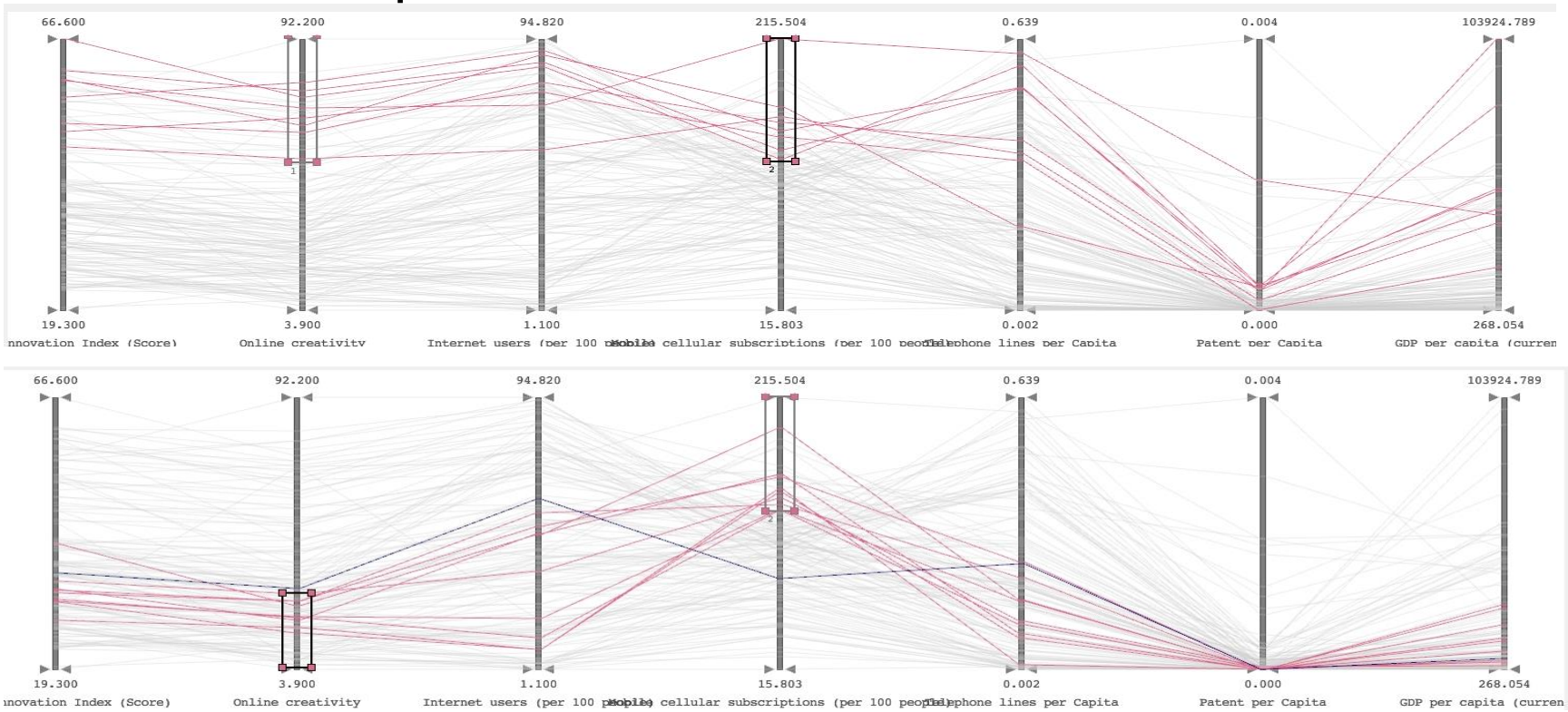


Research and Development

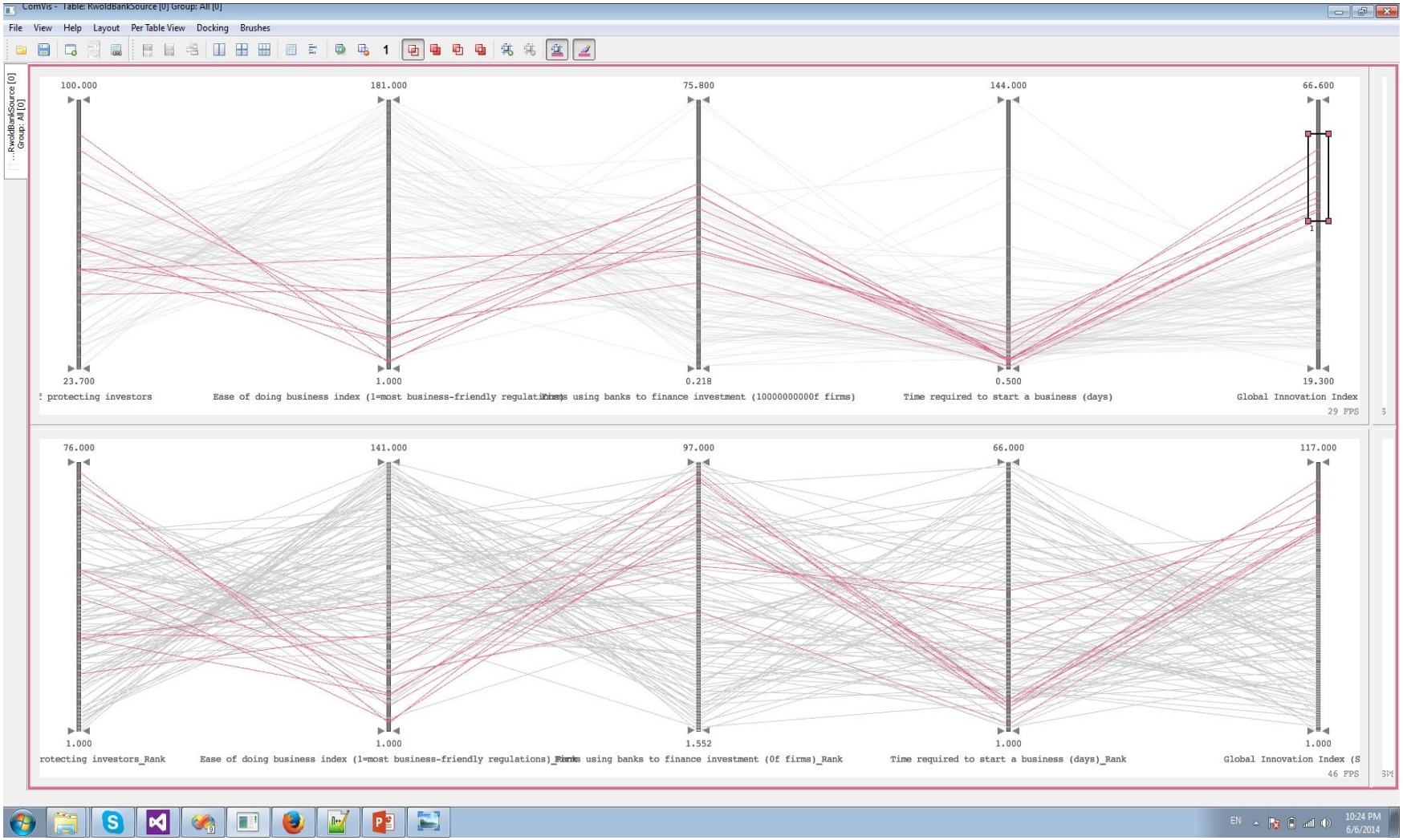


Mobile Devices and Online Creativity

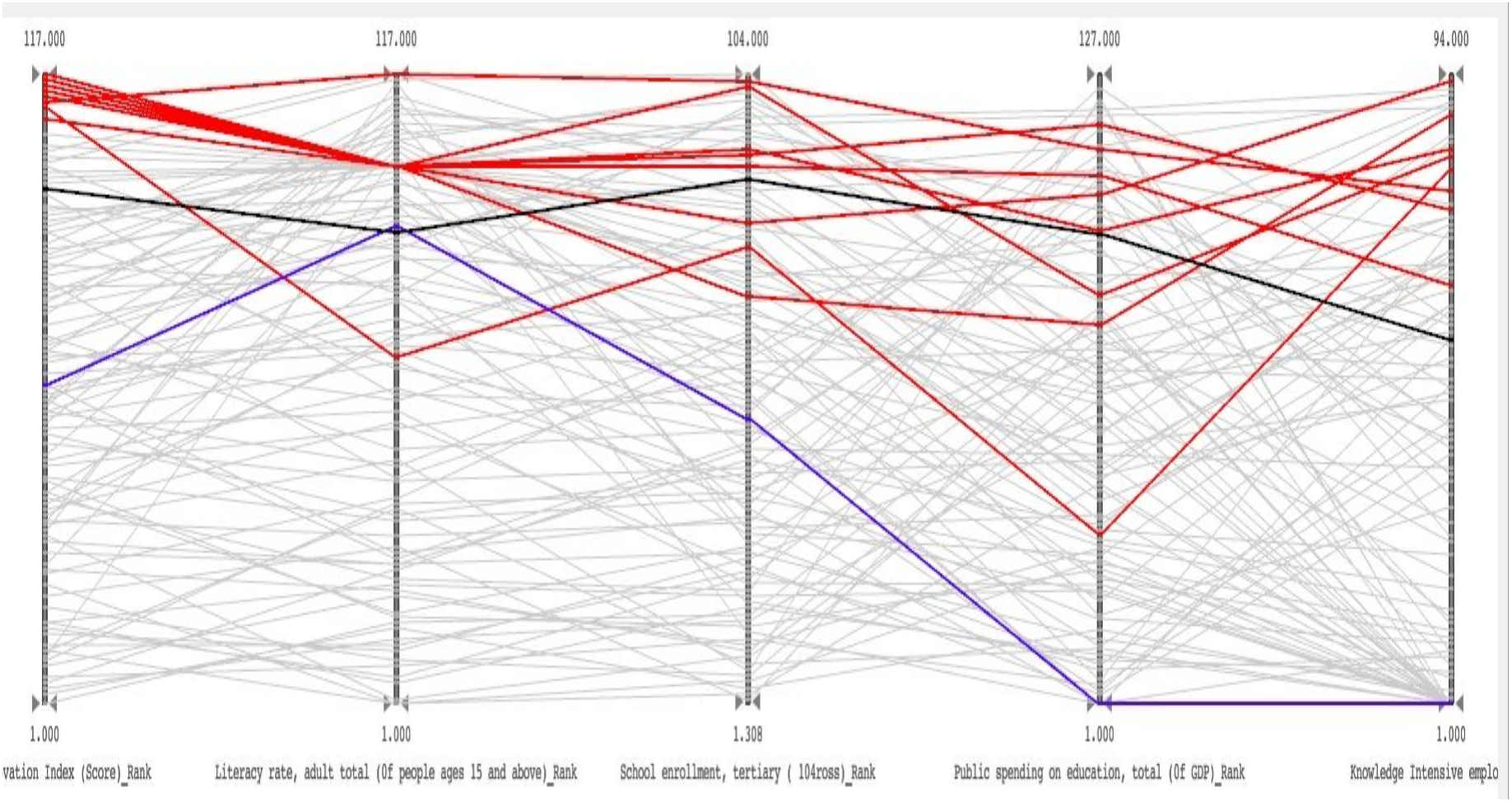
- High usage of mobile devices is connected to the high online creativity. We also see that countries with a low GDP per capita have high number of mobile subscriptions but they are not online creative. Assumption is that there is a very small share of smartphones in such countries.



Business environment



Education as an important factor for innovativeness



Conclusion

- Several factors have positive impact on the successful transition from the invention to the innovation
- For more informative and deeper analysis used data are not sufficient