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Uncovering most Sustainable Sectors and hidden ESG Champions analysing their patents

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Sustainability – aims and problems

Sustainability has become the driving factor in analyzing and evaluating companies.
Sustainability is now the most important factor for all stakeholders, be it: customers, employees, business partners and investors.
The establishment of the 17 Sustainability Goals from the UN and the Foundation of the UN Global Compact and the UN Principles for Responsible Investments provide an excellent framework and while initially the response was: what is the cost? It has been proven over years that a focus on sustainability is an important value driver.
The UN Principles for Responsible Investing have now 2.500 signatories with 90 trillion USD assets which is enormous but the impact is still limited. One has to a knowledge that significant issues remain.
The assessment from companies is mainly based on self-reporting and objective measures exist only in part thus greenwashing[1] is to a large extent possible.
Sustainability Ratings focus on historical data provided by the companies and forward-looking trends are mostly not tangible.
Terms like Fair, Clean, Sustainable, are often used but are lacking a clear definition and confuse customers and even investors struggle.

Thus, approaches which are transparent, forward looking and objective not relying solely on companies self-reporting are highly desired.
In the most recent "Report on Benchmarks", the EU Technical Expert Group on sustainable finance (TEG) proposes, greater disclosure of the methods and benchmarks used to prevent greenwashing[2]. However, this approach is also criticised, among other things because the proposed benchmarks (the reference values against which a measured sustainability value can be compared and put into relation) would tend to encourage greenwashing due to their lack of variability. The proposals would primarily help ESG data providers, but less so investors and thus decision-makers. [3]
Accordingly, approaches are desirable that allow a sustainability analysis without relying on any "self-assessment" of the company concerned and where benchmarks and methodology are transparent.

Patents –deep insights behind the scenes

In a sense, patents are the blueprint for the R&D activities of a (technically or scientifically oriented) company. They document the results of successful investments in tomorrow's innovations. These inventions describe in detail the (innovative) approaches to solving problems that one would like to address with new products

[1] Companies give themselves an environmentally friendly and responsible image in the public eye without there being a sufficient basis for this

[2] EU Technical Expert Group on Sustainable Finance: TEG FINAL REPORTON CLIMATE BENCHMARKS AND BENCHMARKS' ESG DISCLOSURES, November 2019, https://ec.europa.eu/info/sites/info/files/business_economy_euro/banking_and_finance/documents/190930-sustainable-finance-teg-final-report-climate-benchmarks-and-disclosures_en.pdf

[3] ScientificBeta, Feb 2020 https://ml-eu.globenewswire.com/Resource/Download/ce6a5722-511b-4fc4-8d0b-db0ae42326da

in the future. With a patent, one creates a temporary, regionally limited, legitimate monopoly on the invented problem solution, for which a company is only willing to spend money for patent attorneys and fees if a certain seriousness is expected, i.e. a return on investment behind a patent application. This seriousness is ultimately reflected in the value of a patent. So, the value of a patent of course reflects the value of an invention, but also the value from the viewpoint of the applicant/owner, who decides in which countries a patent should be valid and how much budget is allocated accordingly.
Accordingly, the value distribution of a patent portfolio is also the reflection of innovative ability and willingness. Thus, a look at the patent portfolio - and its value distribution - allows a deep insight into R&D activities and a presumed product pipeline.

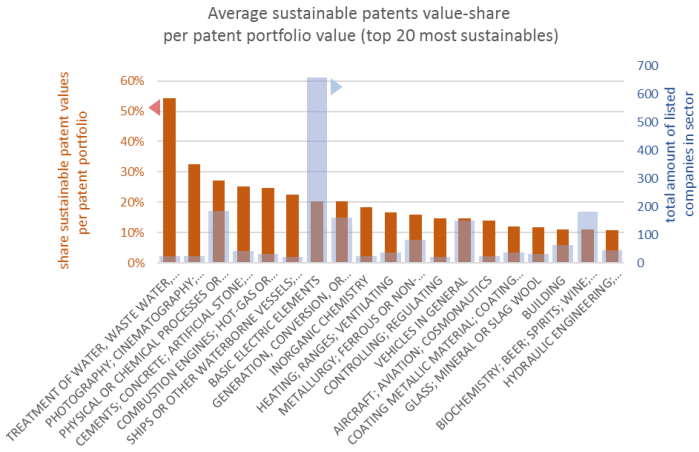
A new, uncorrelated and temper-proof way to determine sustainable actions using patents - description of the idea

If patents reflect R&D results, then the value analysis of patents should also provide a good, thematic insight behind the scenes of a company. If you now identify those patents that aim at sustainability, e.g. in the form of active or passive reduction of greenhouse gases, and put the value of these patents in relation to the total patent portfolio value, you get a very detailed picture of the actual sustainability activities of a company - without any greenwashing. The only requirement is that the company applies for patents at all.
A study published by the Canadian company Corporate Knights[4] presents a list of 7500 companies with an annual turnover of at least USD 1 billion, from which those that are supposedly the most sustainable are selected. The ranking of these companies will be compared with the results of the patent analysis.

Results

The most sustainable-innovative sectors in general

Initially, all living listed or delisted companies with at least 20 living patent families and a patent portfolio value of at least 2 million € were filtered out and then grouped into sectors. Also, only sectors, with at least 20 companies were considered. The sectors were also determined here from the patents that a company filed. For each company, the patent portfolio value of the "sustainable investments" was set in relation to the total patent portfolio value, resulting in the ratio of the "sustainable patents" as the "patent ESG score". This was used to calculate average values within the sectors. The averaged patent ESG scores per industry were ranked.



Graph 1: Only listed companies with a total patent portfolio of more than 2 m€ and at least 20 alive patent families were considered. Only sectors, with at least 20 companies were considered. The left axis represents the patent-ESG share linking to the orange bars, the right axis represents the considered total amount of companies per sector and refers to the blue bars.

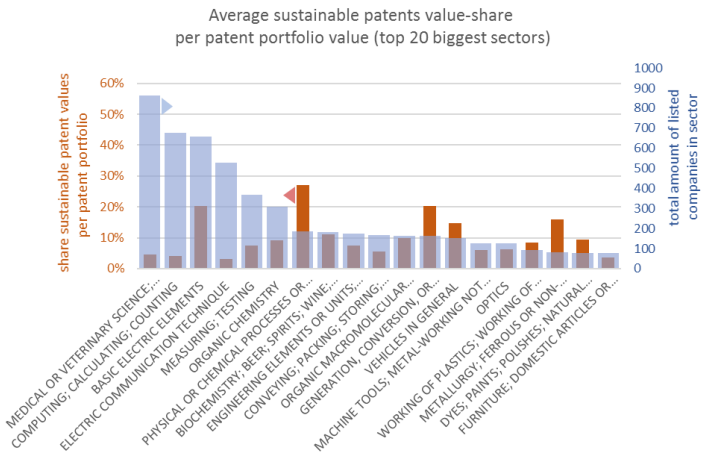
Surprisingly the biggest sector among those 20 most sustainable ones (BASIC ELECTRIC ELEMENTS) only shows a moderate sustainability activity at 20% - whereas the total average patent-ESG score is at 12%. Companies in the sector "Treatment of Water, waste water sewage or sludge" are filing most valuable sustainable

[4] Knights, Corporate. "The 2019 Global 100: Overview of Corporate Knights Rating Methodology." (2019).

patents in relation to their patent portfolio value- this means here are the most likely sustainable innovations. At the same time this sector is a very small one with only 25 (patent filing) listed or delisted companies in it. That is why it is not seen anymore in the following Graph 2.

Biggest sectors and their average sustainable ratio

A sector size here is determined by the total amount of (patent filing) companies in it. The basic population used here is the same as in Graph 1 but using a different ranking: here the sectors were sorted by size descending. The biggest sector, containing most patent filing companies is the pharmaceutical sector: "Medical or veterinary science; hygiene". In this sector comparably few sustainable patent values were generated in relation to their total patent portfolio values: the average sustainability score is only 5%. The most sustainable sector is not even among those 20 biggest sectors. It is ranked on no 43.

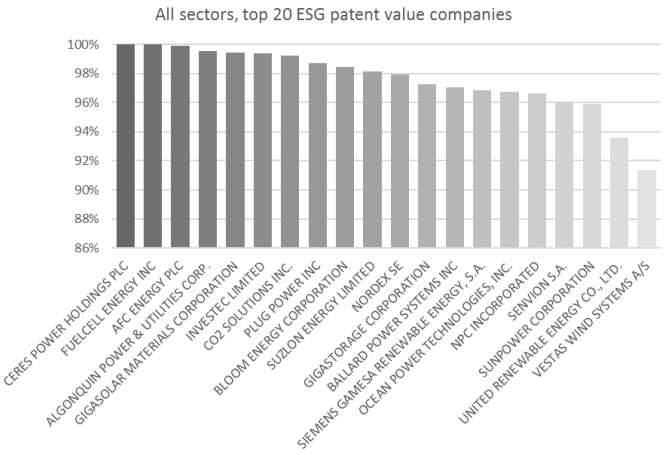


Graph 2: average Patent-ESG score of the top 20 biggest sectors. Axis and population are equal to graph 1, only the ranking method was modified.

According to the strong variation in the average sector-related patent ESG scores and sector sizes, it is making sense to have a deeper look into the different sectors and to verify if here also strong variations are visible.

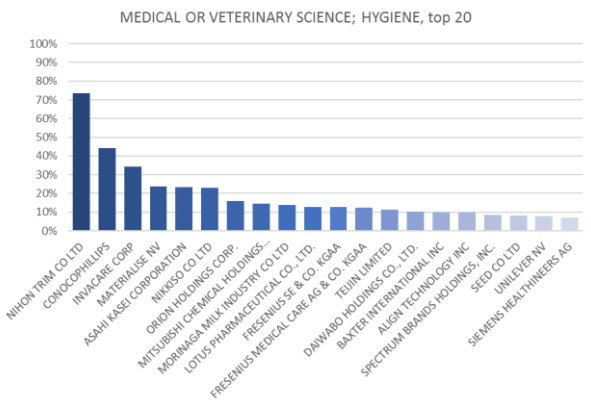
Most active ESG patent filing companies

In the following graph the sectors having companies with the most valuable patent portfolios (means the most innovative companies derived from their patent portfolio values) were investigated. The thesis was that most innovative companies are also those who are generating the highest patent values in the sustainable field, so are the most innovative sustainability drivers. Here a threshold of at least 20 sustainable patents was set in order to find those assignees who are really innovation drivers rather than just holder of few patents.

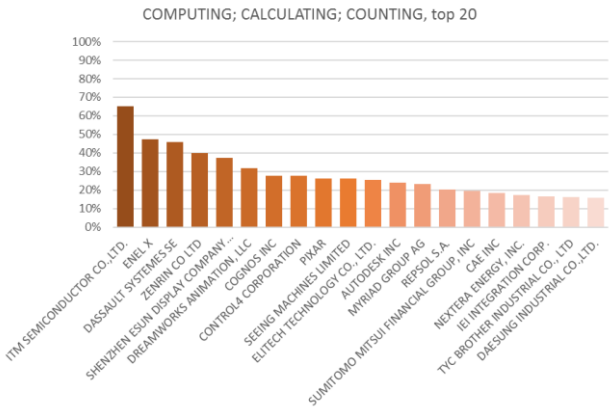


Graph 3: when looking at all sectors it becomes obvious that energy providers are in the focus. Here most obviously the highest density of sustainability-innovations can be expected according to their huge density of sustainability-addressing patents.

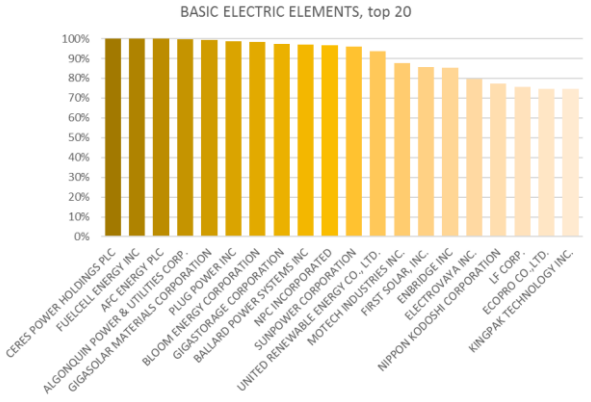
Graph 3 gives a good first impression, where most sustainable patents are filed. The focus are manufacturers of power providing and power plant companies. The strong dominance makes it useful to have a closer look at the different sectors and to identify the most active ESG innovators (derived from patents) here.
Graphs 4-8 show the biggest 5 sectors and the most active sustainable innovators herein, derived from their patent-ESG scores (patent-ESG champions).
Graphs 9-13 shows the patent-ESG champions among the 5 sectors herein with the biggest ESG shares in general.



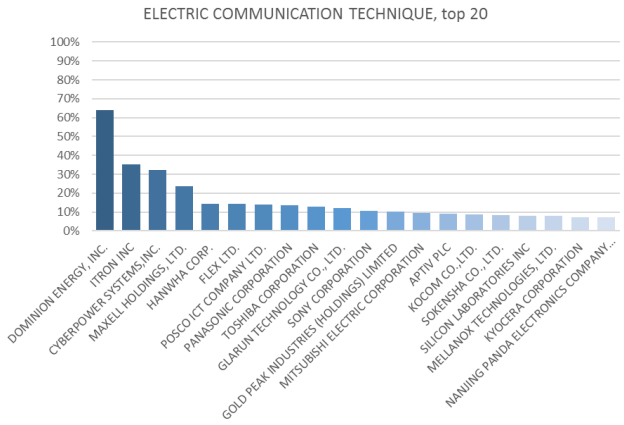
Graph4: the most sustainable companies as a result from their patenting outcome in the Life-Science sector.



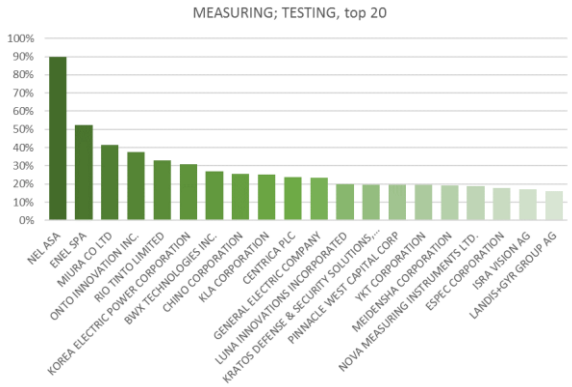
Graph 5: the scheme can be observed in the computing sector



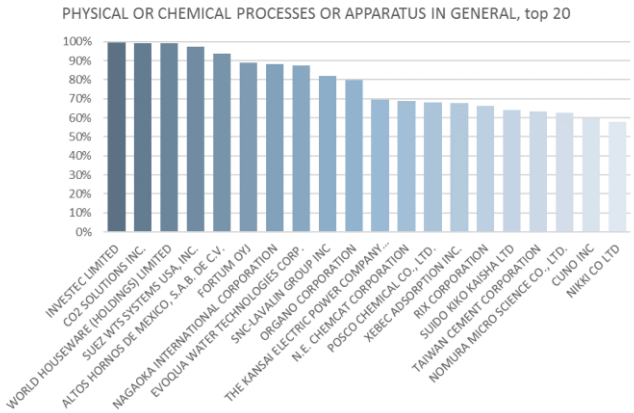
Graph 6: Since the power plant and power providing companies are mostly found in this sector from a patent point of view, this leads to a very similar picture as the total analysis shown in Graph 3



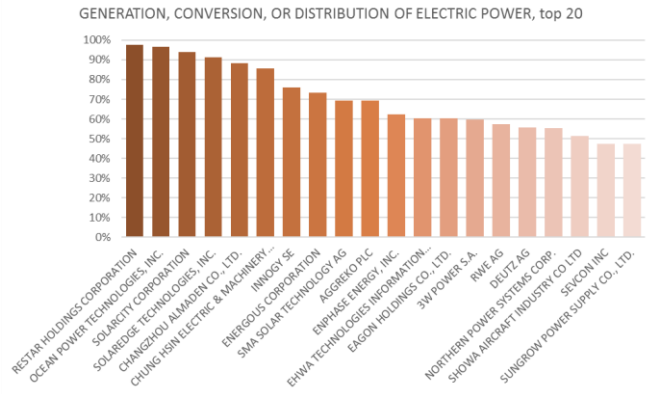
Graph 7: The ranking of the top 20 in the Electric Communication field.



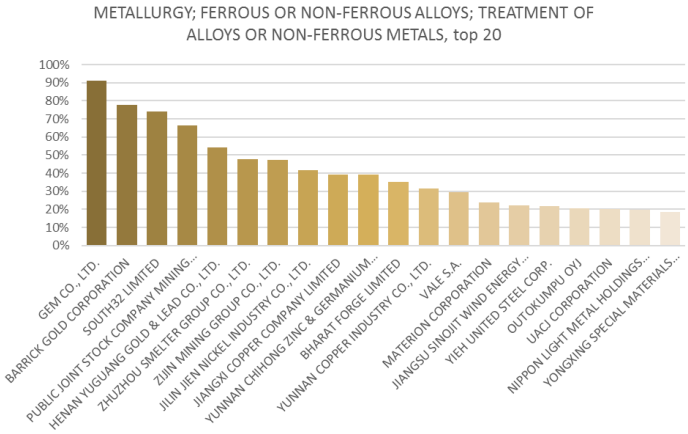
Graph 8: The same ranking in the field of Measuring, testing. The 5th biggest sector according to filed patents and the total number of patent filing companies.



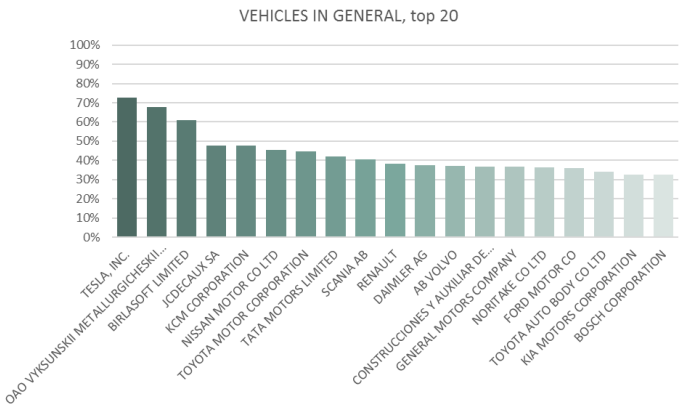
Graph 9: Patent-ESG-score Champions in the sector "physical or chemical processes or apparatus in general" – their scores are very high, all above the average



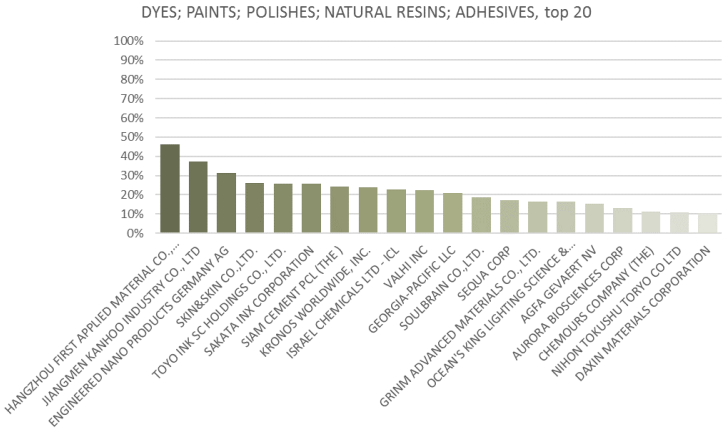
Graph 10: Most sustainable companies as seen from their patenting activities in sector "generation, conversion, or distribution of electric power" the top 20 are all on a very high patent-ESG-level



Graph 11: In sector "metallurgy; ferrous or non-ferrous alloys; treatment of alloys or non-ferrous metals" the top 20 patent-ESG champions have a huge variation in their individual patent-ESG scores



Graph 12: the expected ESG-Champion in this sector is Tesla. Surprisingly not all companies in this list are known car manufacturers. But heir patent filing activities are mainly in this field.



Graph 13: The last sector in this comparison is "dyes; paints; polishes; natural resins; adhesives". Even though here a big sustainable potential would be expected, their average patent-ESG scores are comparably small

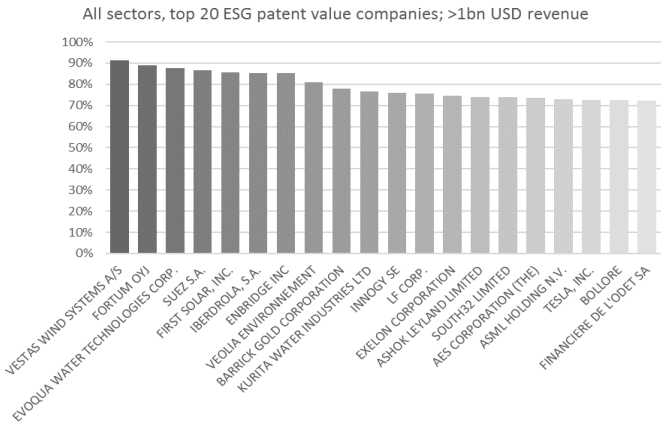
Almost all sectors except the sector BASIC ELECTRIC INSTRUMENTS show a similar pattern with one clear benchmark, having a significantly higher patent-ESG score than all others.

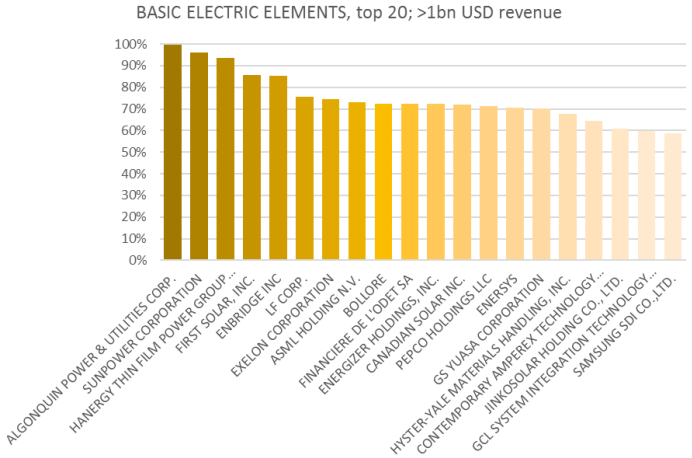
The study "The Most Sustainable Companies In 2019"[5] does not only focus on sustainability, it also considers gender topics and focuses on revenues that are done with sustainable products, as companies claim it. Thus, the results of the study are not directly comparable. Also, it takes only those companies into account whose revenue is of at least 1 bn USD.
Thus, in order to be able to compare values, the same filter was applied for the data set above.

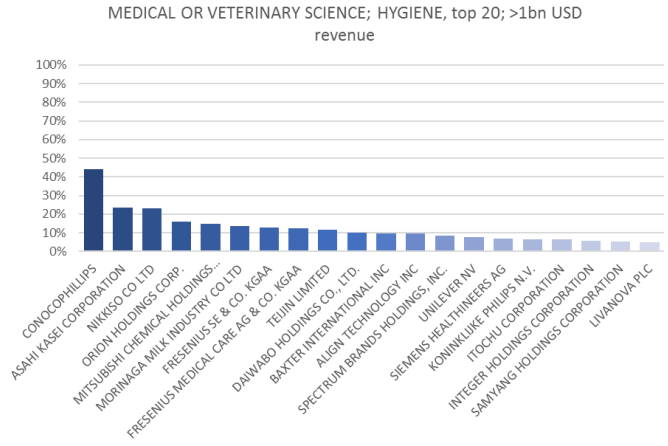
Surprisingly, for all it was leading to a change in the top position. That means that the most sustainability focusing companies were never playing in the 1bn USD revenue leagues. The following charts show the same patent-ESG scores in comparison as seen in Graphs 4-13 but applying the 1bn USD revenue filter.

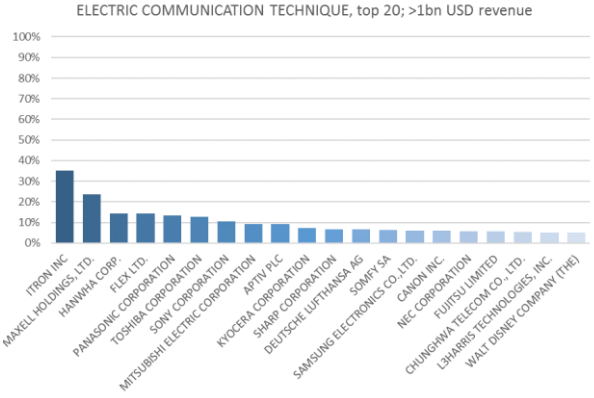
[5] The Global 100 ranks large corporations across the world on their performance reducing carbon and waste, their gender diversity among leadership, revenues derived from clean products, and overall sustainability.

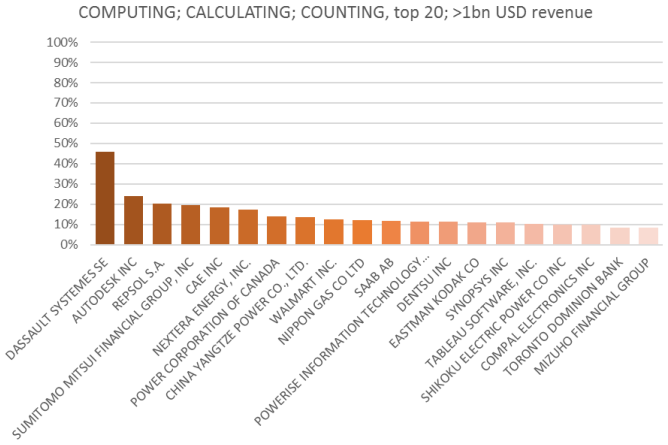
Corporate Knights, based on a list of about 7,500 companies, all of which generate more than $1 billion in annual revenue. https://www.corporateknights.com/reports/2019-global-100/

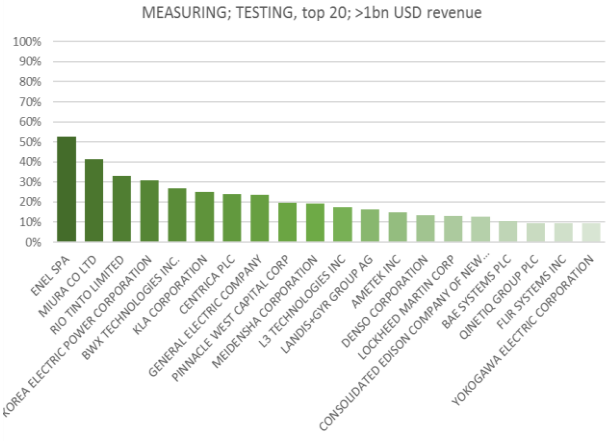




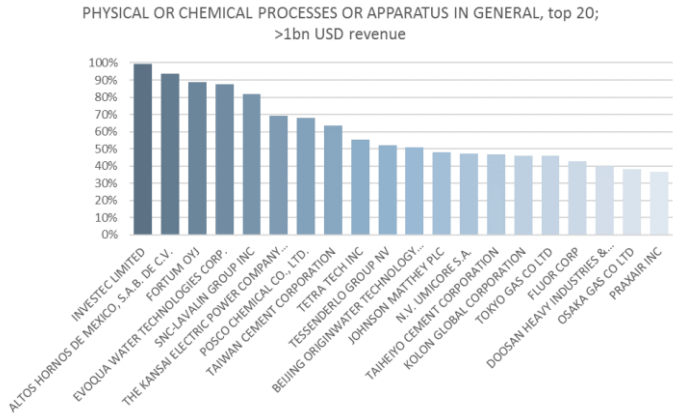


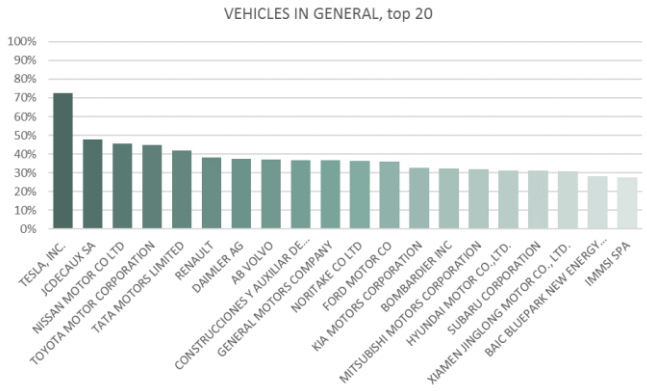


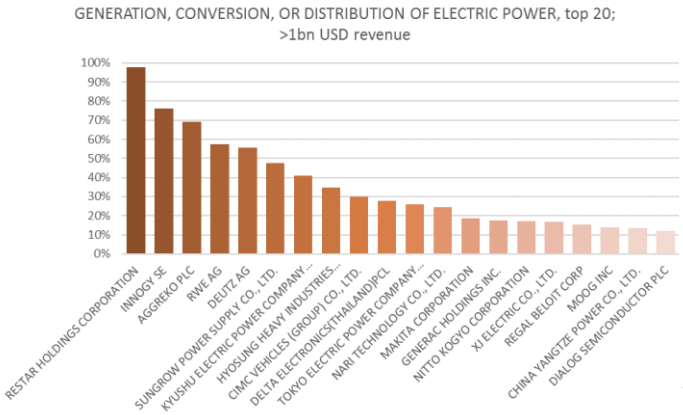


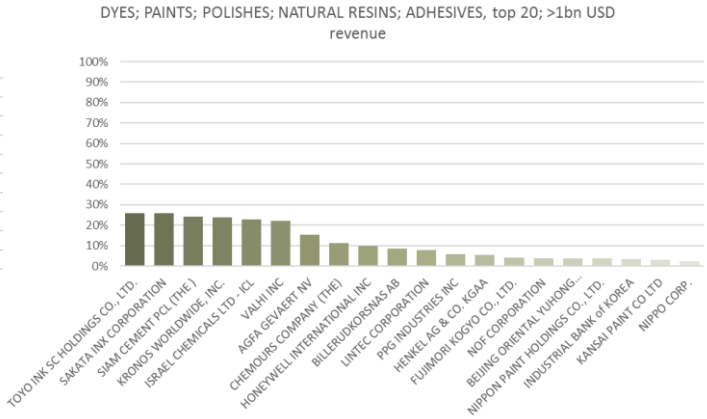


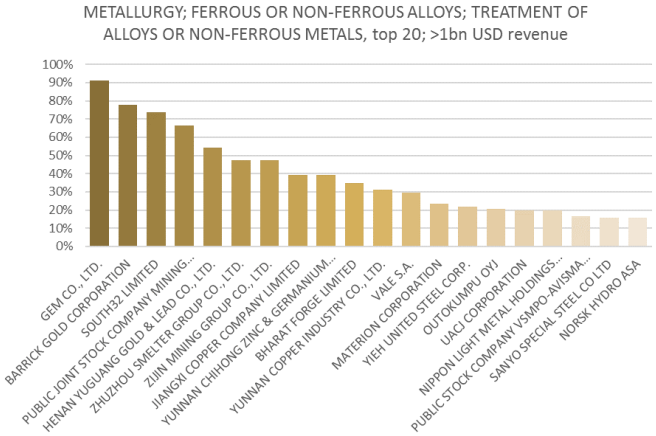
Graph 14: Ranking of the most sustainable Companies in total (upper left) and in the top 5 biggest sectors as a result of their generated patent values in the field of sustainability.











Graph 15: Ranking of the most sustainable Companies per sector in analogy to Graph 9-14. Also, here a strong differentiation between the best (being the sector benchmark) and the rest is visible. For the sectors "vehicles in general" the difference from the benchmark to the rest is very obvious. Also, in sector "generation, conversion or distribution or electric power" a big difference is visible, but the champion here is holding way less patents than the second best (10%).

Sustainability comparison

The analysis of the companies' patent portfolios is primarily intended to take a look behind the scenes. Accordingly, the analysis of the patents with regard to sustainable technologies should help to find out which companies have invested particularly in sustainability-R&D (technologies and procedures). Here, a comparison is to be made between a particularly sustainable perception as well as presentation of a company and the sustainability derived from patenting behaviour. The above-mentioned study "The Most Sustainable Companies In 2019" will again be used for this purpose, in order to compare values. In presenting the results, it is again pointed out that the above-mentioned study takes all ESG (Environment, Social and Governance) factors into account. In contrast, the patent analysis presented here focuses mainly on technology aspects of the "E" of ESG.
For the top 100 most sustainable companies according to the above-mentioned study, the respective value share of ESG patents compared to the total patent portfolio value (relative ESG share) was determined using the same method as in the previous analyses. As a guideline, the respective industry average was calculated from this ratio in order to assess whether the respective company is an above-average (marked with "YES") or below-average ("NO") "sustainable innovator" from the patent portfolio perspective. Also, the trend is shown in the table, it is calculated by the difference between the patent ESG score of the analysed year and the former year. The Corporate Knights study took several factors into account, but in the table below only the "Carbon Productivity Score", "Clean Revenues" and the "Overall Score" are shown, as these are most comparable with the ESG Patent value score.
Nevertheless, the result is very surprising:

Source: Corporate Knights study					Source: Patent value analysis				
Rank	Name	Carbon Productivity Score	% Clean Revenues	Overall Score	ESG patent rank in list	ESG patent value share	sector average ESG patent value share	Over average	trend
1	Chr. Hansen Holding A/S	81%	81%	83,0%	66	**0,2%**	11,0%	NO	→
3	Neste Corporation	85%	25%	80,9%	5	**59,3%**	17,8%	YES	↘
4	Orsted	56%	58%	80,1%	7	**57,9%**	11,0%	YES	↘
5	GlaxoSmith Kline plc	19%	60%	79,4%	61	**0,4%**	4,5%	NO	↘
7	Umicore	93%	81%	79,1%	9	**47,4%**	27,1%	YES	↘
9	Shinhan Financial Group Co.	77%	3%	77,8%	59	**0,7%**	4,1%	NO	↘
10	Taiwan Semi-conductor	29%	63%	77,7%	25	**13,2%**	20,4%	NO	↓
11	Pearson PLC	100%	27%	76,9%	52	**1,3%**	4,9%	NO	↑
12	Outotec Oyj	85%	88%	76,5%	14	**27,9%**	27,1%	YES	↗
14	Cisco Systems, Inc.	12%	55%	76,1%	53	**1,2%**	3,2%	NO	↗
15	Natura Cosmeticos S.A.	94%	70%	75,6%	68	**0,1%**	4,5%	NO	↗
17	Analog Devices, Inc.	69%	50%	75,3%	34	**7,0%**	4,9%	YES	↘
18	Novartis AG	32%	57%	75,2%	49	**1,7%**	4,5%	NO	↘
20	Sanofi	50%	29%	75,2%	60	**0,7%**	4,5%	NO	↘
21	Ericsson	60%	75%	74,9%	58	**0,8%**	3,2%	NO	↗
22	Bombardier Inc.	56%	52%	74,8%	13	**32,2%**	14,6%	YES	↓
23	UPM-Kymmene Oyj	41%	85%	74,4%	19	**20,4%**	9,6%	YES	↑
26	bioMerieux SA	0%	56%	72,2%	56	**1,1%**	11,0%	NO	↓
27	Royal KPN NV	29%	100%	71,8%	57	**0,9%**	3,2%	NO	↗
28	Siemens AG	89%	47%	71,4%	22	**18,2%**	20,4%	NO	↑
29	Valeo SA	42%	40%	71,2%	26	**12,8%**	14,6%	NO	↓
30	LG Electronics Inc.	39%	27%	71,0%	38	**4,2%**	3,2%	YES	↗
32	Ecolab Inc.	59%	38%	70,7%	17	**23,9%**	27,1%	NO	↗
34	Vestas Wind Systems A/S	93%	100%	69,5%	1	**91,4%**	67,0%	YES	↗
36	Electrolux AB	88%	28%	69,2%	44	**2,7%**	3,5%	NO	↑
38	Dassault Systemes SA	55%	100%	69,1%	10	**45,9%**	4,1%	YES	↗
39	HP Inc.	72%	45%	68,3%	43	**2,7%**	4,1%	NO	↗

Source: Corporate Knights study					Source: Patent value analysis				
Rank	Name	Carbon Productivity Score	% Clean Revenues	Overall Score	ESG patent rank in list	ESG patent value share	sector average ESG patent value share	Over average	trend
43	Kone Oyj	75%	53%	67,2%	54	**1,2%**	4,3%	NO	↗
45	ABB Ltd.	59%	56%	67,0%	35	**6,9%**	20,4%	NO	↑
46	Eli Lilly and Company	6%	14%	66,9%	65	**0,2%**	9,1%	NO	↗
48	Autodesk, Inc.	0%	100%	66,4%	16	**24,1%**	4,1%	YES	↑
49	Metso Oyj	23%	32%	66,2%	48	**1,7%**	11,7%	NO	↗
50	AstraZeneca PLC	33%	20%	65,8%	50	**1,4%**	9,1%	NO	↘
52	Alphabet Inc.	0%	99%	65,6%	40	**3,7%**	4,1%	NO	↗
55	Danaher Corporation	0%	22%	64,9%	36	**5,4%**	7,3%	NO	↘
56	Halma plc	82%	24%	64,7%	46	**2,4%**	5,8%	NO	↓
57	Total SA	97%	1%	64,5%	8	**48,2%**	20,4%	YES	↑
58	Novo Nordisk A/S	81%	25%	64,4%	63	**0,3%**	4,5%	NO	↗
60	Schneider Electric SE	79%	45%	63,6%	28	**12,1%**	20,4%	NO	↓
61	Iberdrola SA	59%	48%	62,9%	2	**85,4%**	22,6%	YES	↗
62	Alstom SA	75%	100%	62,5%	21	**18,5%**	7,8%	YES	↑
63	Bank of America Corp	12%	1%	62,4%	64	**0,2%**	4,1%	NO	↗
64	Nokia Oyj	0%	20%	62,2%	51	**1,4%**	3,2%	NO	↗
65	Unilever PLC	34%	28%	61,9%	27	**12,2%**	3,5%	YES	↑
66	Ingersoll-Rand Plc	21%	26%	61,7%	32	**9,0%**	8,6%	YES	↓
68	Acciona SA	16%	34%	61,3%	4	**72,2%**	10,8%	YES	↓
69	Tesla Inc	0%	100%	61,3%	3	**72,7%**	14,6%	YES	↓
70	Itron, Inc.	83%	50%	61,2%	12	**35,1%**	3,2%	YES	↓
73	Eisai Co., Ltd.	41%	20%	60,0%	37	**5,4%**	9,1%	NO	↗
77	OSRAM Licht AG	37%	66%	58,6%	18	**22,7%**	20,4%	YES	↗
78	Takeda Pharma-ceutical Co.	42%	10%	58,1%	47	**2,2%**	4,5%	NO	↑
79	UCB S.A.	97%	8%	58,0%	42	**2,9%**	9,1%	NO	↗
80	Intesa Sanpaolo SpA	29%	1%	57,9%	23	**16,5%**	9,1%	YES	↓
82	Yokogawa Electric Corp.	0%	50%	56,6%	31	**9,3%**	7,3%	YES	↗
83	Samsung SDI Co., Ltd	3%	68%	54,2%	6	**58,8%**	20,4%	YES	↓
84	adidas AG	89%	34%	54,2%	55	**1,1%**	2,1%	NO	↑
87	ANSYS, Inc.	0%	17%	51,3%	30	**11,3%**	4,5%	YES	↓
89	Sekisui Chemical Co., Ltd.	88%	13%	50,7%	29	**11,3%**	11,8%	NO	↘
90	VMware, Inc.	0%	50%	48,8%	67	**0,2%**	4,1%	NO	↗
92	Kao Corp.	17%	15%	45,8%	45	**2,5%**	4,5%	NO	↗
93	Accenture Plc	53%	4%	45,1%	33	**7,7%**	4,1%	YES	↑
95	Toyota Motor Corp.	54%	14%	43,6%	11	**44,7%**	14,6%	YES	↗
96	Konica Minolta, Inc.	14%	16%	43,1%	39	**4,2%**	6,4%	NO	↓
97	Spectris plc	41%	20%	41,6%	41	**3,0%**	7,3%	NO	↓
98	L'Oreal SA	100%	0%	40,5%	62	**0,3%**	4,5%	NO	↗
99	Bayerische Motoren Werke	65%	3%	40,0%	15	**26,8%**	14,6%	YES	↓
100	Panasonic Corporation	39%	10%	38,5%	24	**13,5%**	3,2%	YES	↘

Table 1: overview of the top 100 most sustainable companies according to the *Corporate Knights* study. Those who had less than 20 still alive patents filed or where patents were filed under the corporates' owner company are not shown in the table. The sector-independent overall average of ESG-patent value share was 11%. The trend indicates how the ESG-patent value share has changed qualitatively compared to the former year.

Conclusion

The results of the study show that it is worth taking a look behind the scenes. Only 43% of the companies in the top 100 list in the Corporate Knights study had an above-average sustainability patent portfolio at all - i.e. from the point of view of the R&D results, the sustainable presentation and perception could at least not be confirmed in most cases (57%). However, the analysis of the patent portfolios primarily has a sustainability focus and it can reflect only technologies that are inventive; the Corporate Knights study also takes other factors into

account, such as gender or salary payment issues. Nevertheless, the patent value analyses are very helpful, especially if you look at them in relation to the respective industry average. Nevertheless, these results show that the sustainability analysis of companies should not only rely on "self-assessment" of the companies, their own publications or the presentation from sustainability reports. Patents leave a clear footprint on the activities of a company and it is worth taking a closer look at them, especially since the data availability is high and the available data is of high quality and highly structured. Finally, patents and their values are a well-suited instrument to enrich an ESG profile of a corporation in a sense to make hidden information visible and to make use of high quality, temper proof data. However, patents enlighten only one specific aspect: The R&D activities and their outcome but his is an important, easy to gather and the missing link within an ESG assessment so far.

In the shown analysis, for example, existing, commercially available patent value data sets and ESG patent datasets were used from the biggest and most comprehensive information provider in this field, where patent value data are even broken down to the 17 UN SDG as well as historical data from present back to the year 2007.

For requesting more information or data samples of the basic data that were used for the study, please contact the author directly:
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