Competitive Technology Report

Company: Pirelli & C. S.p.A.
Date: September 2023

With this report, Quant IP assesses the competitive position of a company from a technological perspective.

Using forward looking patent data and Machine Learning, Quant IP uncovers strengths and weaknesses in the current technology portfolio, identifies all relevant technological competitors and benchmarks the company's technology portfolio accordingly.

Quant IP also identifies the technology trends with the most potential for disruption and quantifies the company's capabilities to manage them.

Our Solutions

Quant IP makes the untapped treasure trove of patent data available to the financial industry, delivering quantitative innovation insights, at the right speed and format for the use of financial decision-makers.

Fundamental Research

Using proprietary patent metrics, we create reports on every company on the planet with at least one patent, to help investors incorporate innovation into their decision making.

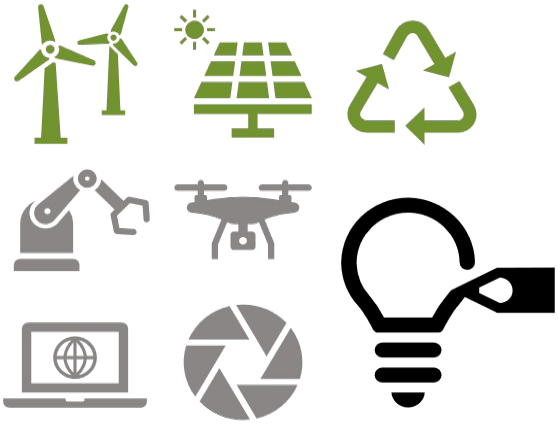
Determine the technological competitive position of companies, analyses of fields in the form of research reports.

More about Technology Reports

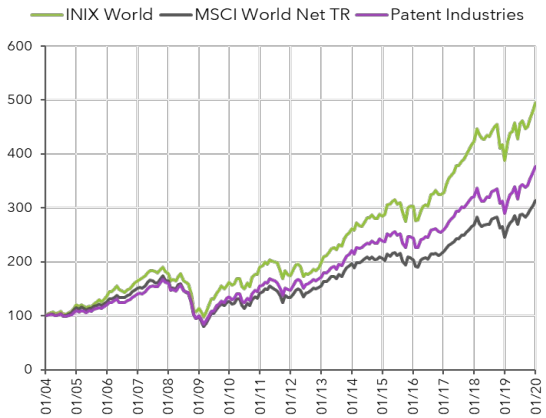
Thematic Investing & ESG

Using themes from our theme catalog or creating custom ones, Quant IP's API solution enables investors to conduct their own thematic research into innovation insights on technologies of interest.

Coupled with our Green Innovation offering, Quant IP helps investors filter for companies with exposure to certain themes or ones with the biggest impact on green innovation.



More about Thematic Investing



Data Feeds

Innovation leaders generate a long-term competitive advantage in both revenue and profit growth out-performance.

Quant IP Patent Data Packages allow investors to find alpha in company-level innovation metrics.

More about Data Feeds

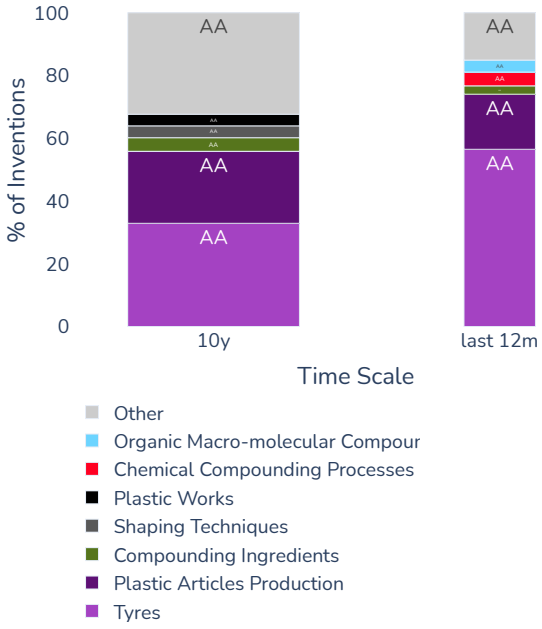
Executive Summary

Pirelli & C. S.p.A. ranks 11 in the Competitive Technology Benchmarking, scoring very well in terms of its patent portfolio size and quality, leading to a very good positioning in terms of technology competitiveness. However, patent filing growth rates are lagging behind and prevent the company from reaching a better positioning within the peer group of technology competitors.

Pirelli & C. S.p.A. is most active in the technological fields “Tyres”, “Plastic Articles Production” and “Compounding Ingredients”. The company’s patent portfolio average quality rating is AA, meaning that, on average, Pirelli & C. S.p.A.‘s patents are better than 78.0% of comparable patents from competitors.

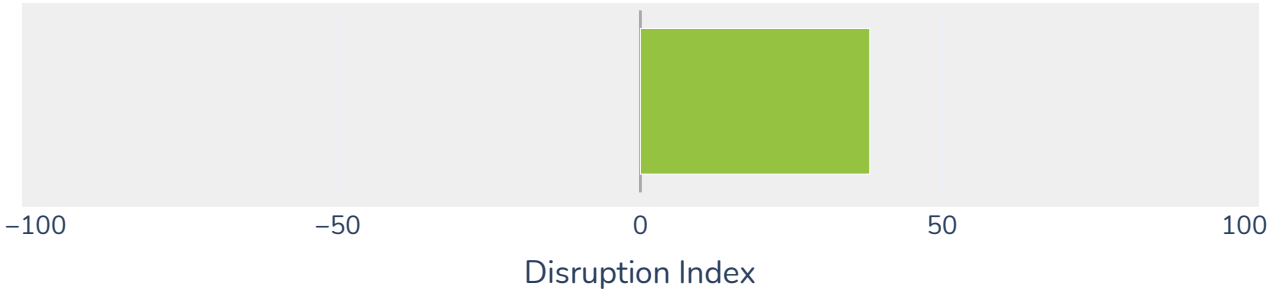
The most important technological fields for the company and its peer group are “Tyres”, “Plastic Articles Production” and “Compounding Ingredients”. A technology disruption index of 38 indicates that Pirelli & C. S.p.A. is well suited to withstand disruptive technology forces. The company is well positioned to disrupt rather than being disrupted in the near future.

Technological Footprint



Average Patent Quality

Technology Disruption Index



Technology Portfolio Evaluation

Innovation Activity
Green Innovation Activity
Top Inventors of the Company

Innovation Activity

Number of inventions
(last 20 years)

1,328

Annualized invention growth rate
(last 12 months)

0.8%

Green invention ratio (last 20 years)

4.4%

Annualized invention growth rate
(last 3 years)

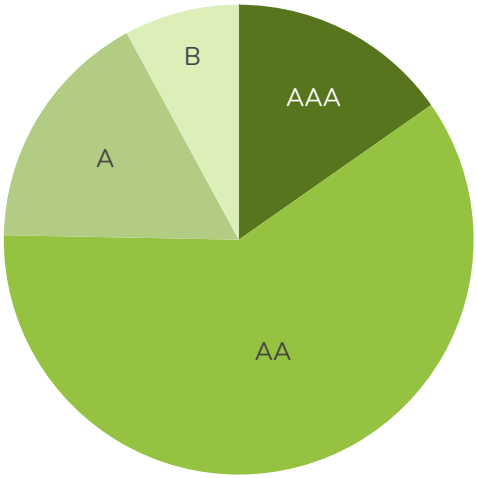
0.9%

Average Patent Rating

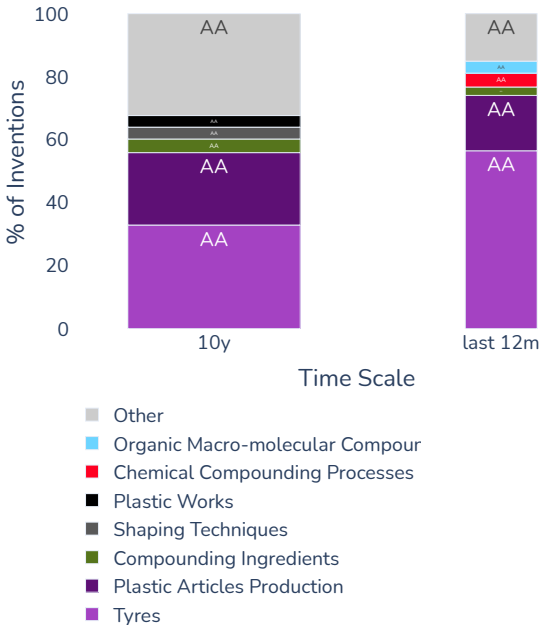
Combining expert domain knowledge with machine learning, Quant IP created Quant IP Patent Rating, the first indicator built on predictions of future patent success and therefore applicable from the first day of publication (see appendix).

Quant IP Patent Rating combines various indicators into one quality assessment quantifying the quality of a company's patents and the whole portfolio.

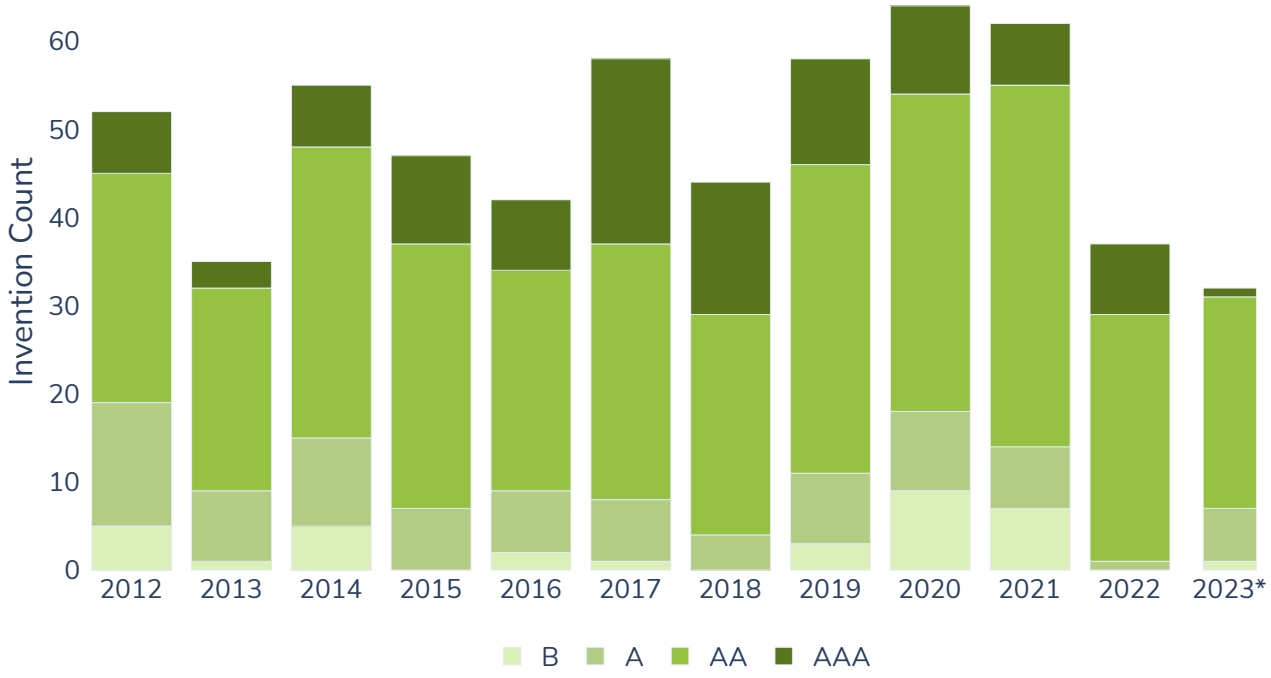
Patent Rating Distribution



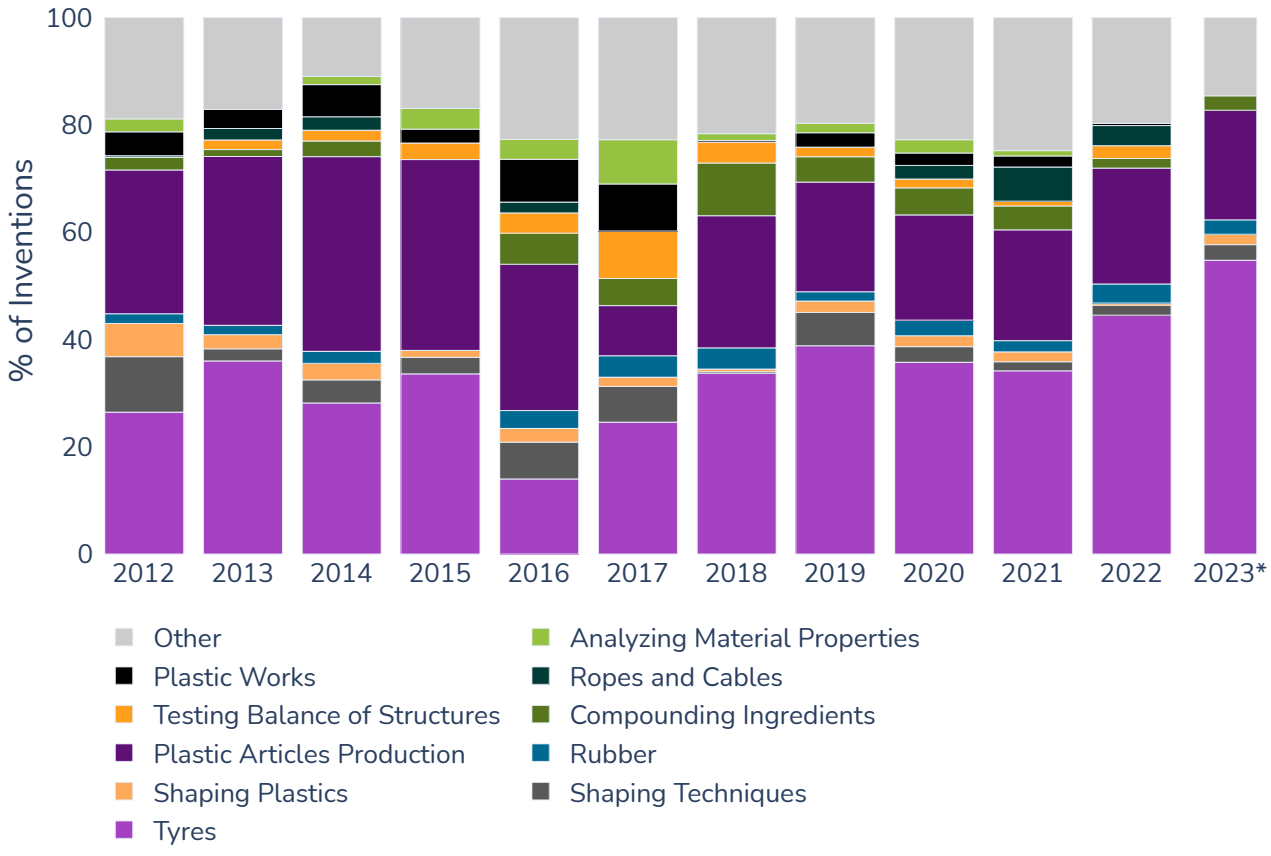
Technological Footprint (10y)



Patent Activity and Quality Over Time



Technology Footprint Over Time



Green Innovation Activity

Quant IP uses the Green Inventory definitions of the World Intellectual Patent Organisation (WIPO) to analyse green innovation activity that is relevant to the UN Sustainability Goals and are among the Environmentally Sound Technologies. Information regarding the green innovation of the company can be found below.

Number of green inventions (last 20 years)

59

Annualized green invention growth rate (last 12 months)

0.0%

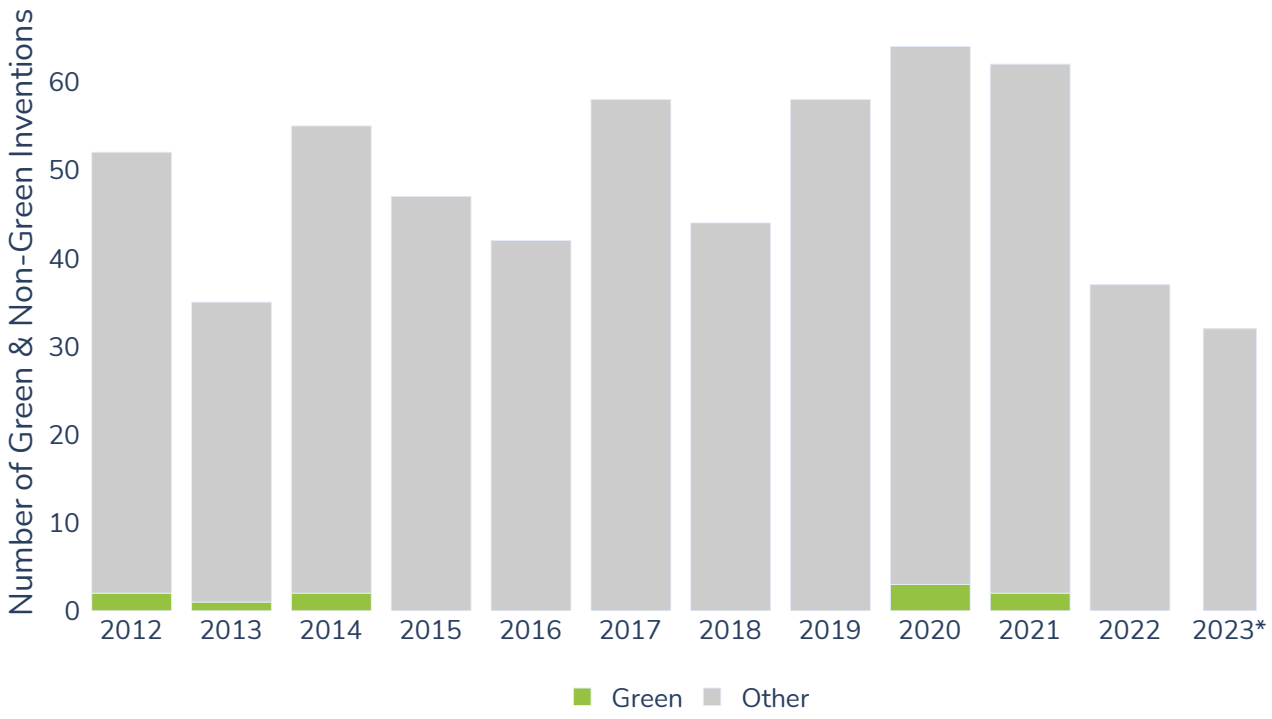
Green invention ratio (last 20 years)

4.4%

Annualized green invention growth rate (last 3 years)

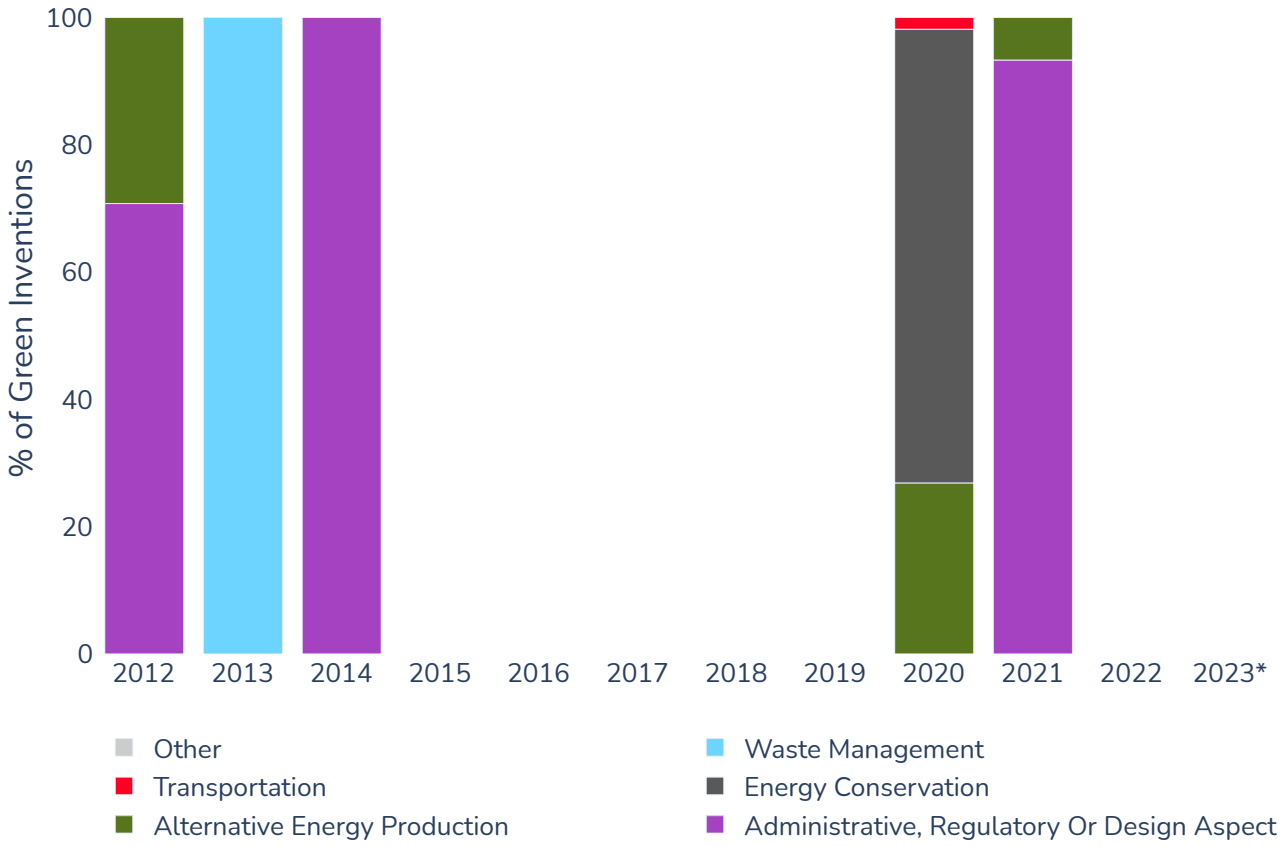
0.7%

Green Invention Ratio Over Time



Green Technology Footprint Over Time

The graph below displays how the green innovation activity of Pirelli & C. S.p.A. has been distributed over green technology areas defined by the WIPO.



Top Inventors of the Company

Inventors are the individuals named on patent documents who made the discovery or took the innovative step, often on behalf of the company. The table of inventors below can be used in order to understand the human resources behind the R&D of a company, as well as the HR risks. If an employee who is responsible for a high fraction of the total innovative output leaves a company, it can lead to a decrease in innovative strength. Looking for existence of inventors with high activity in both 3 year and 10 year time frames, can indicate a strong talent retention strategy.

Inventor Name	Inventions (3y)	Inventions (10y)	Inventions (3y) % of total	Inventions (10y) % of total	Quality Score
DE COL, CHRISTIAN	22	40	16.5	8.5	83
PORTINARI, GIANNI ENRICO	17	18	12.8	3.8	85
GIANNINI, LUCA	16	35	12.0	7.4	85
SPEZIARI, DIEGO ETTORE	15	29	11.3	6.1	76
AGRESTI, SIMONE	12	17	9.0	3.6	82
HANEL, THOMAS	9	33	6.8	7.0	83
TADIELLO, LUCIANO	9	16	6.8	3.4	86
CASAROTTO, GIOVANNI	8	16	6.0	3.4	73
DAGHINI, GUIDO LUIGI	8	13	6.0	2.7	83

Technology Benchmarking

Technology Benchmarking – Overview
Technology Benchmarking – Details
Technology Benchmarking – Market Share
Technology Benchmarking – Evolution over 10 years
Technology Benchmarking - China Share

Technology Benchmarking – Overview

The graph below maps how Pirelli & C. S.p.A. is positioned among its peer group based on Patent Portfolio Quality and the Tech Growth Rate. The bubble size correlates to number of inventions of the company. See appendix for specific definitions of Patent Portfolio Quality Score and Tech Growth Rate.

- 1 - The Yokohama Rubber Co., Ltd.
- 2 - Sailun Group Co., Ltd.
- 3 - Compagnie Générale des Établissements Michelin Société en commandite par actions
- 4 - Toyo Tire Corporation
- 5 - Nexen Tire Corporation
- 6 - The Goodyear Tire & Rubber Company
- 7 - Hankook Tire & Technology Co., Ltd.
- 8 - Kumho Tire Co., Inc.
- 9 - Nuri Holdings (S) Pte. Ltd.
- **11 - Pirelli & C. S.p.A.**

Technology Benchmarking – Details

The table below displays how the company ranks among its technological peer group. This peer group is defined based on the technological footprint of the company, which can lead to a fresh perspective on competitive analyses. A company that is not a direct competitor in the market, can still be a valuable benchmark if the technological footprints are similar.

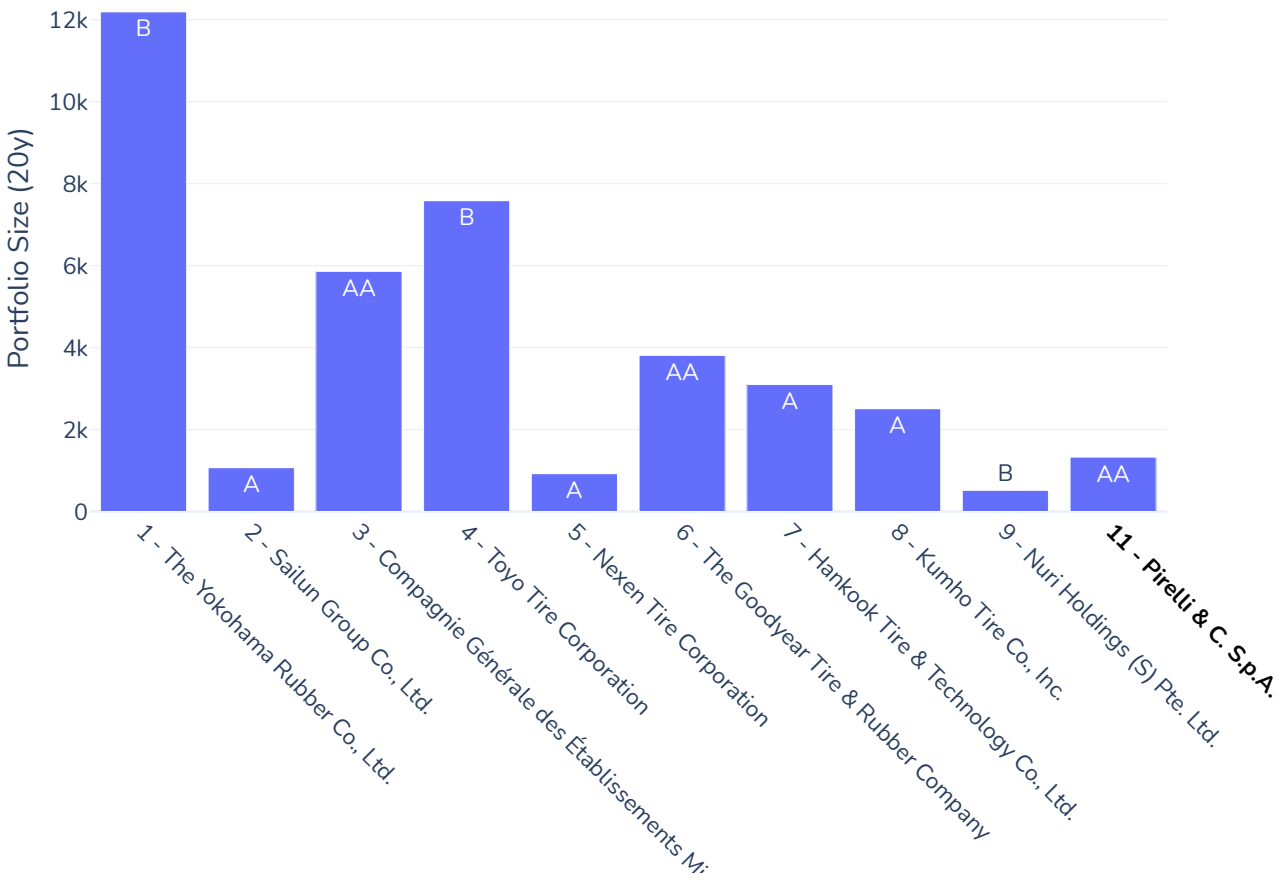
The ranking is an aggregation of how the company performs on size, growth and quality. The rank trend shows whether the company has been stepping up compared to competition or falling even further behind in the recent years, while the color of the company row shows whether the company is performing in the top 10% (green), bottom 20% (red) or in the middle (yellow), when the complete peer group is considered.

Company	Region	Portfolio Size (20y)	Absolute Growth (3y)	Relative Growth (%, 3y)	Quality Score	Rank	Rank Trend
The Yokohama Rubber Co., Ltd.	Asia	12191	1081	5.1	48	1	⇨
Sailun Group Co., Ltd.	Asia	1069	793	74.2	50	2	⇗
Compagnie Générale des Établissements Michelin Soc...	Europe	5860	729	8.2	80	3	⇨
Toyo Tire Corporation	Asia	7582	833	6.8	47	4	⇨
Nexen Tire Corporation	Asia	923	504	54.5	60	5	⇨
The Goodyear Tire & Rubber Company	US / Canada	3811	466	2.6	74	6	⇨
Hankook Tire & Technology Co., Ltd.	Asia	3099	273	6.0	59	7	⇨
Kumho Tire Co., Inc.	Asia	2508	225	7.6	54	8	⇨
Nuri Holdings (S) Pte. Ltd.	Asia	516	203	38.7	44	9	⇨
Qingdao Sentury Tire Co., Ltd.	Asia	228	131	57.5	59	10	⇗
Pirelli & C. S.p.A.	**Europe**	**1328**	**144**	**2.7**	**78**	**11**	**⇨**
Continental Tires (China) Co., Ltd.	Asia	144	75	52.1	38	12	⇨
Nokian Renkaat Oyj	Europe	147	54	28.9	70	13	⇨
Aeolus Tyre Co., Ltd.	Asia	275	42	15.3	51	14	⇨
Shandong Huasheng Rubber Co., Ltd.	Asia	48	35	72.9	51	15	⇗
KraussMaffei Company	Asia	76	27	35.5	43	16	⇨

Limited							
Ningxia Shenzhou Tire Co.,Ltd	Asia	111	21	18.9	51	17	⇘
Shaanxi Yanchang Petroleum Group Rubber Co., Ltd	Asia	22	15	68.2	38	18	⇨
Shandong Taishan Tyre Co., Ltd.	Asia	30	12	40.0	26	19	⇨
Societe De Technologie Michelin	Europe	2237	0	0.0	82	20	⇘
Zhejiang Qingda Rubber Co., Ltd.	Asia	12	6	50.0	38	21	⇗
Dongguan Teamwork Plastics & Metal Products Co., ...	Asia	5	4	80.0	58	22	⇨
Promera Gmbh & Co. Kg	Europe	6	3	50.0	79	23	⇗
Youil Industries Corporation	Asia	7	3	33.3	64	24	⇨
Ralf Bohle Gmbh	Europe	15	3	14.3	67	25	⇨
Revvo Technologies, Inc.	US / Canada	2	1	50.0	77	26	⇨
Lecont S.R.L.	Europe	1	1	100.0	34	27	⇗
Goodtire (Zhangjiagang) Rubber Industrial Co., Ltd...	Asia	10	1	10.0	31	28	⇗
Xiamen Zhengxin Industrial Co., Ltd.	Asia	40	0	0.0	27	29	⇘
Daniel Wolf Gmbh	Europe	5	0	0.0	78	30	⇘

Technology Benchmarking – Market Share

This graph displays how the IP Portfolio Size and the Average Quality Score of the top members of the peer group vary, compared to Pirelli & C. S.p.A., helping spot dominant players and up-and-coming new entrants.

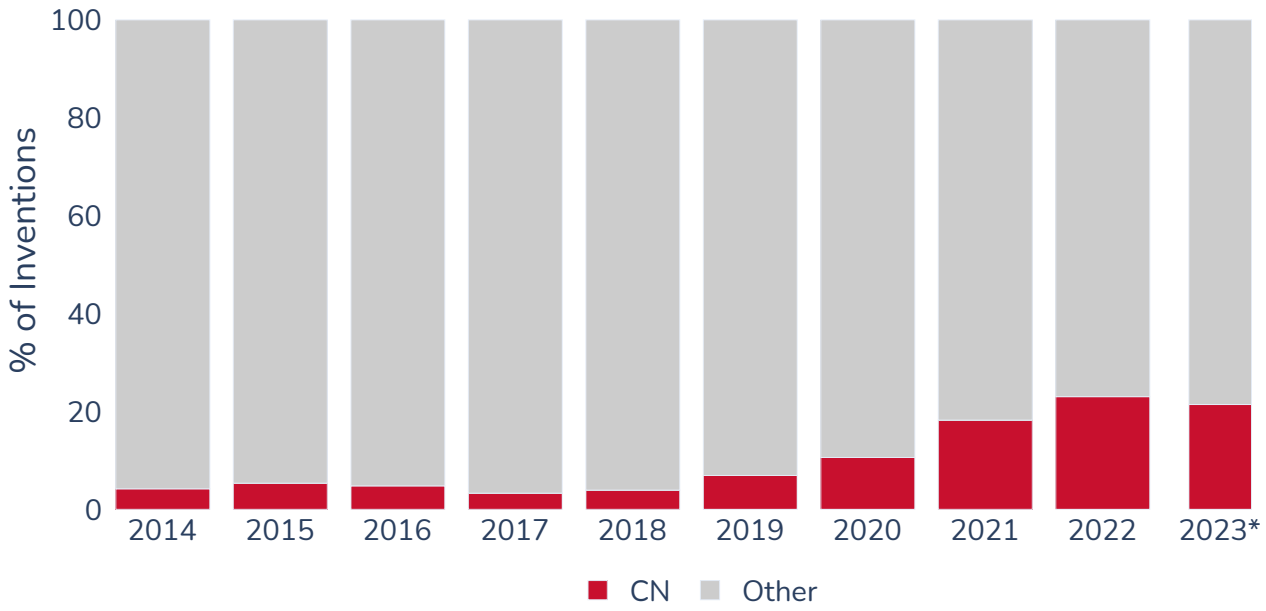


Technology Benchmarking – Evolution over 10 years

The graph below displays how the company was positioned within its peer group over time regarding its innovative output.

Technology Benchmarking - China Share

The graph below displays the fraction of inventions of to the company's peer group which are published by Chinese organisations. A higher ratio means that the Chinese companies have caught up in R&D and have a strong competitive presence in the relevant fields.

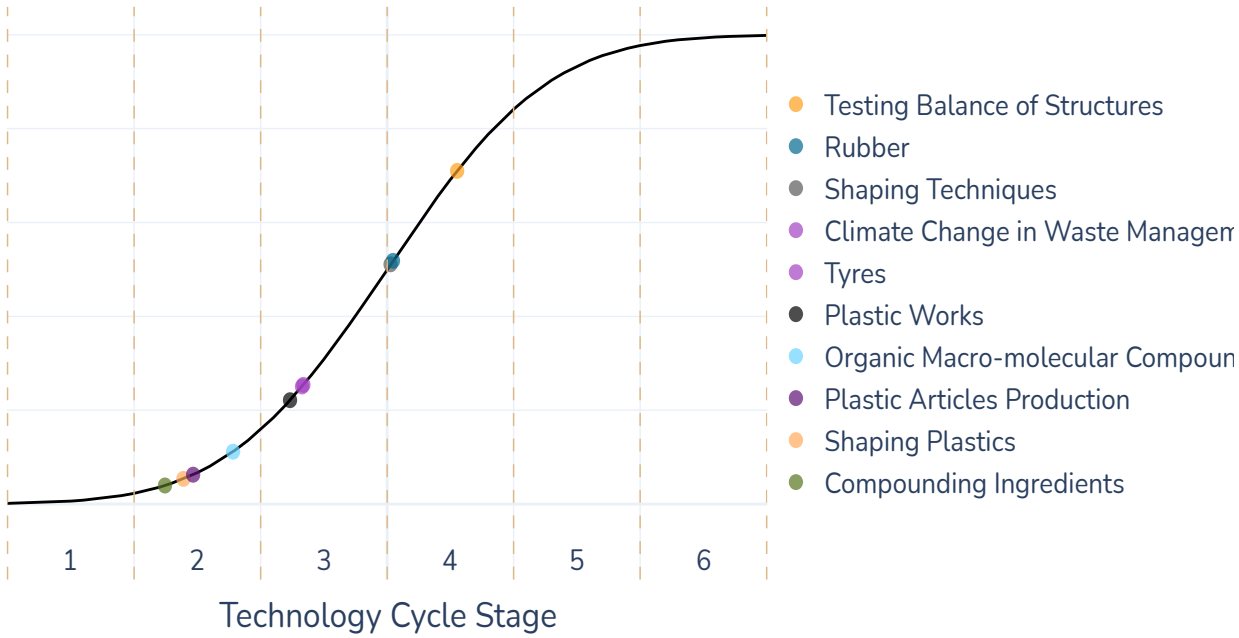


Technology Disruption Index

Technology Life Cycle Analysis
Technology Trend Analysis
Technology Disruption Index

Technology Life Cycle Analysis

The Technology Life Cycle mirrors the Technology Adoption S-Curves from a patent filing perspective with a lead time. Technologies in the earlier stages are novelties that might take a long time before showing significant returns on investments from there patent filing move to a sweet spot where most of the most important inventions in a cycle happen. After stages of decelerating growth the cycle closes when all relevant inventions are filed for A new cycle within one technology fields starts when new breakthrough technologies offer new market opportunities.



Stage 1 In this stage, few companies file for patents and filing growth is still low. Applications for new inventions are still far from certain and the risks of R&D investments are very high. At the same time rewards for companies able to file for key inventions are extremely high.

Stage 2 In this stage, competitors accelerate their filing activity and new competitors feel confident to join as applications for new inventions become more obvious and the risks of R&D investments decrease. For companies with enough confidence in marketable solutions this is the sweet spot for ramping up filing activity as many key patents are filed at this stage.

Stage 3 Here filing growth rates accelerate significantly and are very likely to stay high for some months or even years. At this stage it is the last chance to gain a significant share technology field for new entries as product launches start and the full potential of the market becomes apparent.

Stage 4 While companies coming late still enter the field, filing growth rates are peaking. Almost all important applications are known and product launches become more common.

Stage 5 Here filing growth rates are slowing down considerably and some competitors leave the field because they cannot compete for the most prominent spots in the technology market. In the application market, first signs of consolidation appear as well.

Stage 6 Almost all companies slowed down filing activity as the new technology has been filed for in every aspect. New technical approaches are needed to start a new cycle. Consolidation in the market for applications starts to accelerate even as revenues overall are still growing.

Technology Field Identification

The Technology Disruption Index is an objective assessment of the company's ability to withstand or actively manage disruptive technology trends. The first step is to identifying the tech fields that grow the fastest in both relative and absolute terms.

The graph below shows the trending fields relevant to the peer group. The graph highlights the importance of the technology field with the Impact Index and the expected future growth in the field over the next 12 months.

The **Impact Index** (x-axis), quantifies the impact of a technology by measuring the received citations of the technology's inventions. The index is normalized to a range of 0 to 100, with the leading technology having a normalized impact of 100. A high impact index indicates that the technology is highly relevant for future developments.

The **Tech Growth Rate** (y-axis) quantifies a technology's relative growth in the last 12 months, by looking at the number of newly published inventions.

The **bubble size** reflects the number of inventions in the last 20 years, and thus the investments in that fields as of now.

Technology Trend Analysis

The table below provides the overview on important technology fields for the peer group of Pirelli & C. S.p.A. Size and Growth metrics are based on invention counts. It is important to note that all metrics take into account patents that are relevant to the target company.

Technology Field	Absolute Growth (12m)	Relative Growth (%, 12m)	Impact	Disruptive Rank
Tyres	903	3.1	100	1
Plastic Articles Production	225	2.1	53	2
Compounding Ingredients	226	2.3	44	3
Organic Macro-molecular Compounds	149	1.9	52	4
Rubber	232	2.6	40	5
Shaping Techniques	72	1.4	39	6
Climate Change in Waste Management	89	26.2	2	7
Plastic Works	51	1.5	30	8
Shaping Plastics	92	2.0	23	9
Testing Balance of Structures	78	4.0	13	10
Chemical Compounding Processes	39	1.3	25	11
Recognition and Presentation of Data	28	9.2	4	12
Analyzing Material Properties	59	4.6	8	13
Copolymers	32	3.8	8	14
Digital Data Processing	25	5.7	5	15
Layered Products	24	1.2	19	16
Rubbers	33	2.9	9	17
Measuring Linear Dimensions	38	4.4	6	18
Wheels	41	2.5	9	19
Adhesives	24	2.2	9	20

The 3 highlighted above are the fields with the highest growth and the most impactful. They are therefore selected for further analysis for impact. In the following pages, each field is examined in more detail.

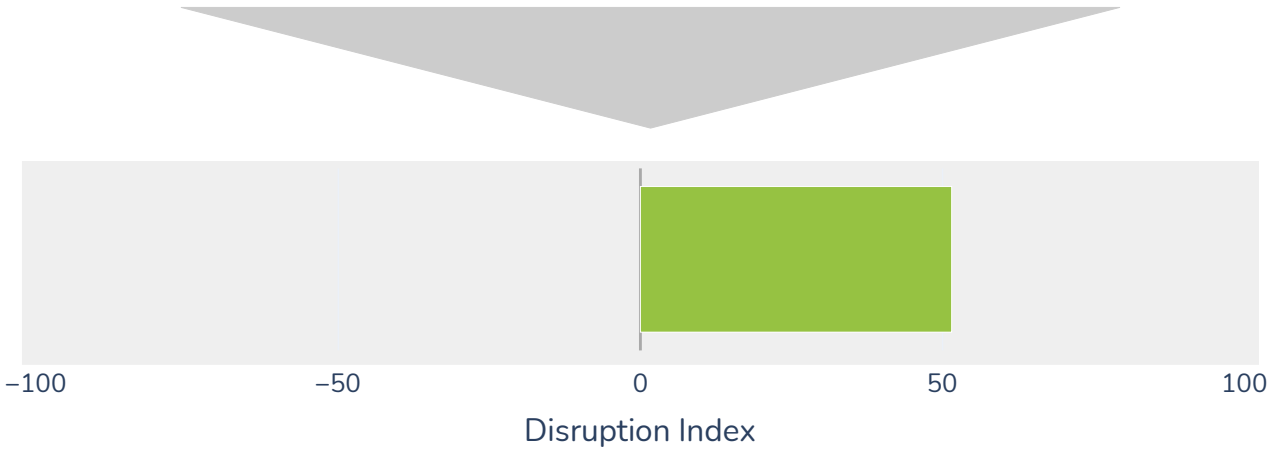
Technology Field Benchmarking: "Tyres"

The most common keywords among patents relevant to this technology field are: **pneumatic tire, rubber composition, tire tread**

Size:

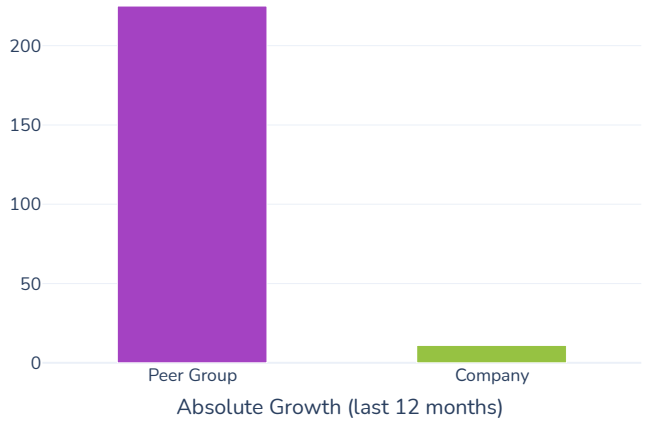
501
Inventions in the last 20 years
(4.5% of the patents in this field among the peer group)

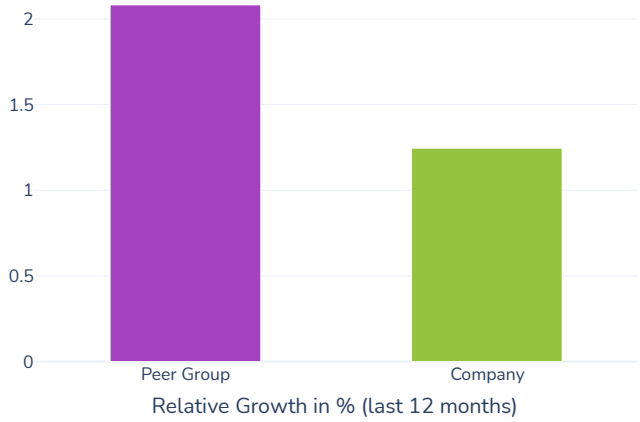
Quality:



Technology Field Benchmarking: “Plastic Articles Production”

The most common keywords among patents relevant to this technology field are: **pneumatic tire, tire manufacturing, tire vulcanization**



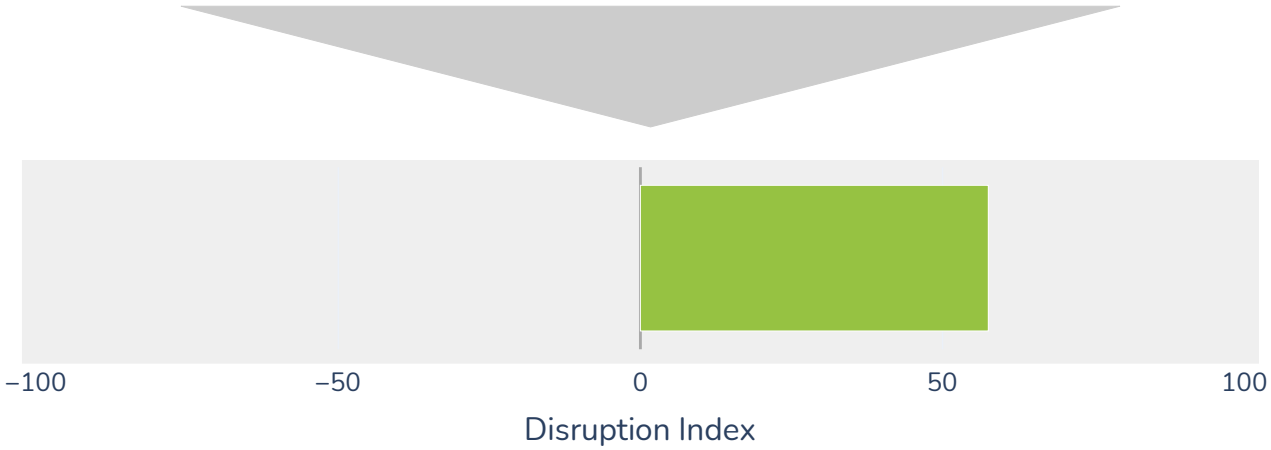


Size:

445

Inventions in the last 20 years (14.5% of the patents in this field among the peer group)

Quality:



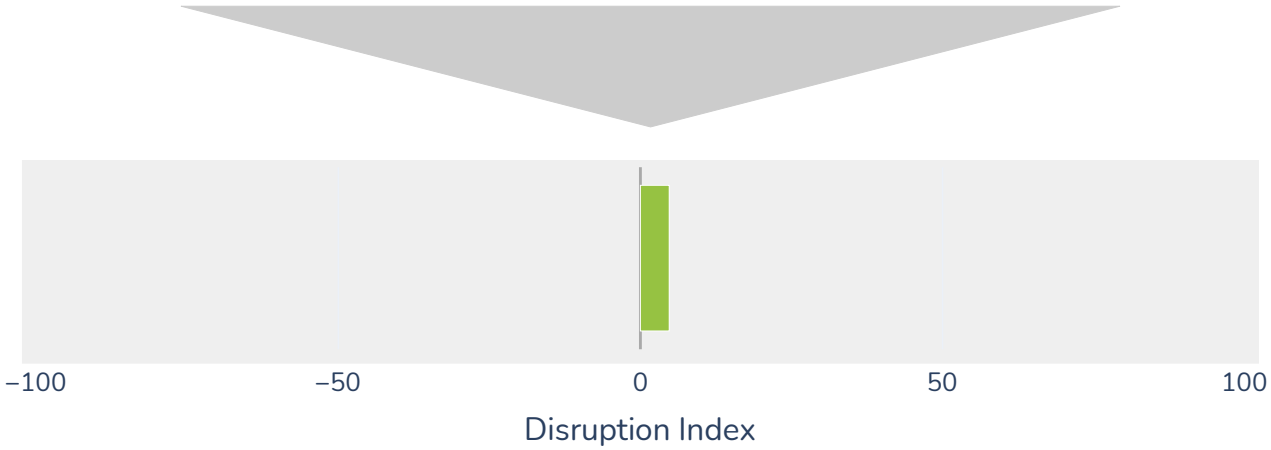
Technology Field Benchmarking: “Compounding Ingredients”

The most common keywords among patents relevant to this technology field are:
rubber composition, pneumatic tire, tire tread

Size:

109
Inventions in the last 20 years
(3.4% of the patents in this field
among the peer group)

Quality:



Technology Disruption Index

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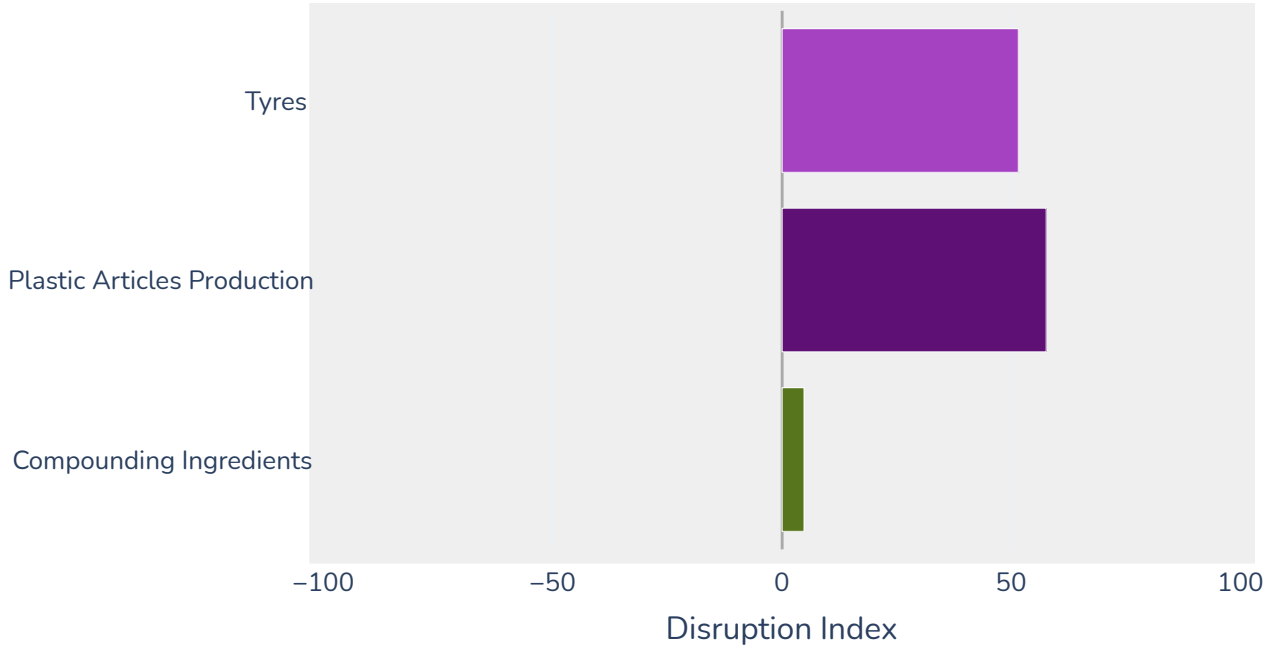
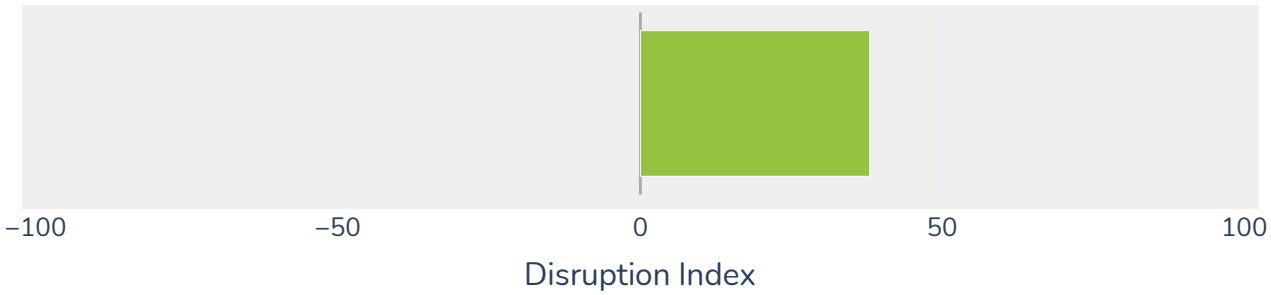




Appendix

Glossary
Patent Processes in a Nutshell: Introduction
Quant IP Patent Rating
Quant IP Benchmarking

Glossary

Invention - New product, process or apparatus or any new use thereof. To be patentable, an invention must be novel, involve an inventive step and be susceptible of industrial application.

Patent Application - Request for patent protection for an invention filed with a patent office. Aimed at legal protection for the invention in the patent offices' jurisdiction.

Pending Patent - Patent application that is filed and in process to receive a grant from the patent office.

Granted Patent - Patent application that is filed and has received a grant from the patent office.

Active Patent - Granted patent that is not expired or otherwise discontinued.

Patent Family - Set of interrelated patent applications filed in one or more countries to protect the same or a similar invention by a common inventor and linked by a common priority.

Priority - A priority is a right to file applications for the same invention at other offices within 12 months of the first application and yet claim the filing date of the first application.

Priority Date – Filing date of the earliest patent application of an invention.

Filing Date - The date when a patent application is first filed at a patent office.

Publication Date - The date on which a patent document is published. Most patents are published 18 months after filing.

Publication Number - The publication number is the number assigned to a patent application on publication.

Applicant - A person or an organization that has filed a patent application. There may be more than one applicant per application.

IPC – International Patent Classification, currently divides all technologies into approximately 70 000 areas.

Citations - A list of references containing cited and citing documents. As in academia, citations are used as an indicator for the quality of the invention.

Cited Document - Documents that are cited by a specific patent document by a patent authority or by the applicant. Also known as backward citations.

Citing Documents - Patent documents that cite a specific patent. Also known as forward citations.

Technology Field – A subset of IPC classifications or a number of patents which define a specific technology.

Technology Life Cycle – The time period in between two minima of patent filing activity related to a specific technology. A global maximum is present within the life cycle. Quant IP defines 6 phases within a cycle.

Technology Footprint – All technology fields of a collection of patent families displayed in percentage and weighted by size.

Disruptive Technology – Innovations/technology fields that significantly alter the way that consumers, industries, or businesses operate. Disruptive technologies show above average growth rates and higher than average impact.

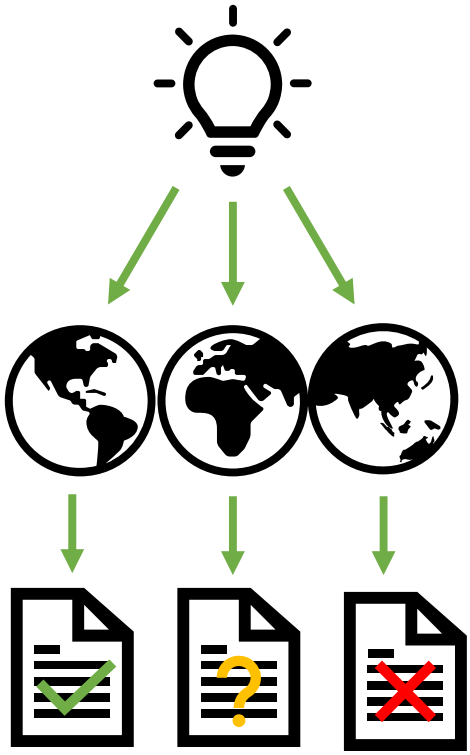
Patent Quality Score – Quant IP proprietary scoring algorithm predicting the success of a patent family, compared with similar patents.

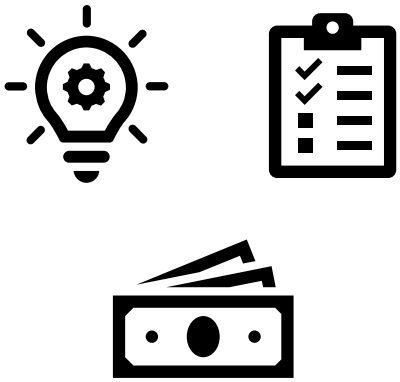
Patent Rating – Quant IP proprietary patent rating with 4 categories AAA (top 10%), AA (top 30%), A (top 50%) and B (bottom 50%), derived from the Patent Quality Score.

Patent Processes in a Nutshell: Introduction

The intellectual property domain can be complicated for professionals not involved in it at a daily basis. Here is a basic summary to explain the terms and include all you might need to know to understand this report.

- When a new discovery is made you can apply for a patent. This discovery is called an **invention**.
  - Each incremental discovery is an invention on it is own. Often, a single product consists of many inventions.
- You need to file for a patent in each country separately and creating **many patent filings** for **one invention**.
  - Each application comes with its own filing costs, results and upkeep costs, making it a strategic decision to internationalize.





- These patent documents are all linked to one invention. They are also called a **patent family**.
- Patent filings that are not yet granted are referred to as pending or as a **patent application**.
- If the patent offices grant the right, the patent becomes a **granted** or **active patent** until it expires.

Quant IP Patent Rating

Quant IP Patent Rating takes a purely quantitative approach and is based on proprietary algorithms to predict patent success in three critical areas. It is based on benchmarking inventions relative to similar ones and thus makes it possible to compare the quality of patents in all technical fields.

Quant IP Patent Rating is based on three Quality Scores defined as:

Grant Robustness: The average probability for a patent to be granted in 4 major jurisdictions (USA, EU, China, Japan), evaluated at the time of publication of the patent application.

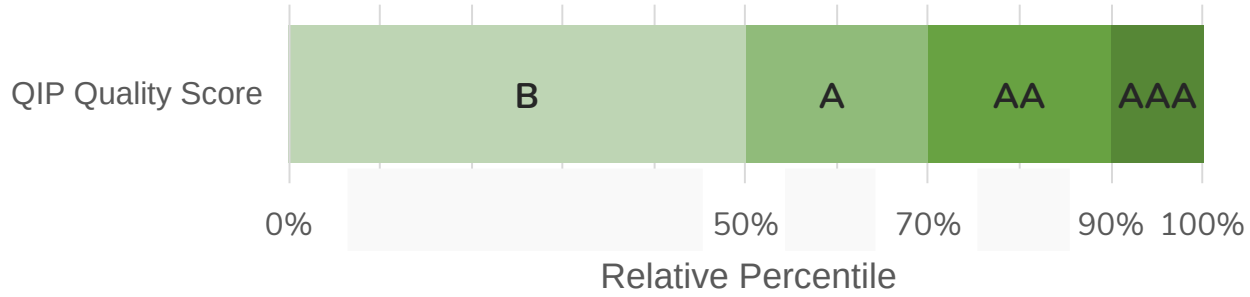
Market Potential: The predicted number of markets the rights for the innovation is secured within 2 years after publication date.

Citation Potential: The predicted number of forward citations an invention receives 5 years after filing.

Quant IP Quality Score is an aggregated score of the three scores above. Quant IP Quality Score is translated into Quant IP Patent Rating.

Quant IP Patent Rating percentiles based on the Quant IP Quality Scores for similar patents are defined as follows:

> **AAA** – Top 10%, **AA** – Top 30%, **A** – Top 50%, **B** – Bottom 50%
> Similar patents are determined using IPC classification codes, a standard developed by the European Patent Office to classify and categorize patent documents



Quant IP Benchmarking

Reference Applicant - The applicant of interest.

Quant IP Peer Group - All applicants that are active in the same technological fields as the reference applicant including the reference applicant. Quant IP uses several similarity metrics on patent level and company level (tech footprint) to derive a peer group of the technological competitors.

Competitor - An applicant in the peer group excluding the reference applicant.

Patent Portfolio – All patent documents assigned to an applicant.

Patent Portfolio Quality Score – Average Quant IP Quality Score for a portfolio of inventions .

Technology Growth Rate – Ratio of inventions published in the last 12 months over the relevant applicant portfolio.

Technology Benchmark – Ranked list of applicants inside the peer group based on technology competitiveness (innovation strength). The Benchmarking is based on the size of the relevant patent portfolio, the technology growth rate and the patent portfolio quality score.

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