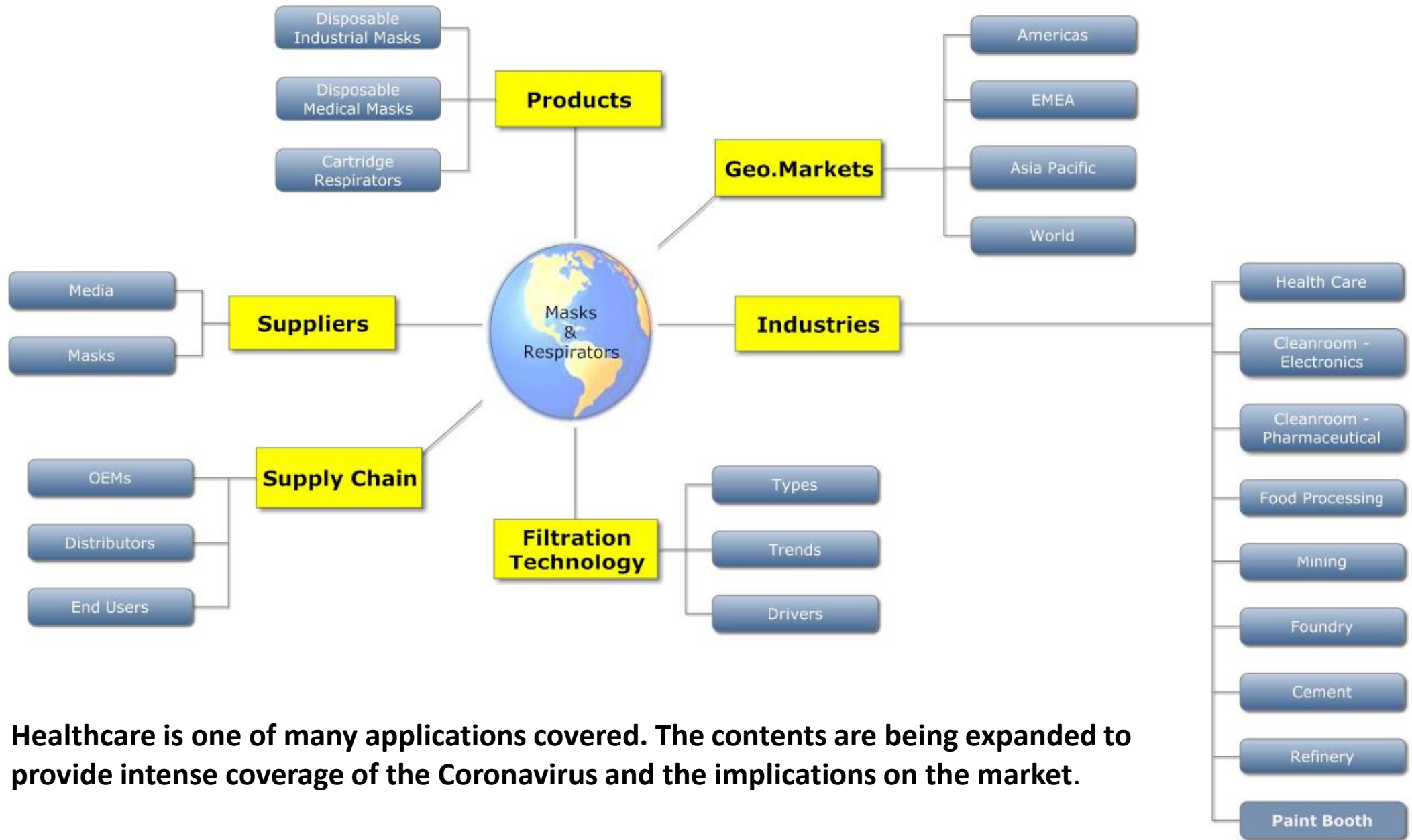


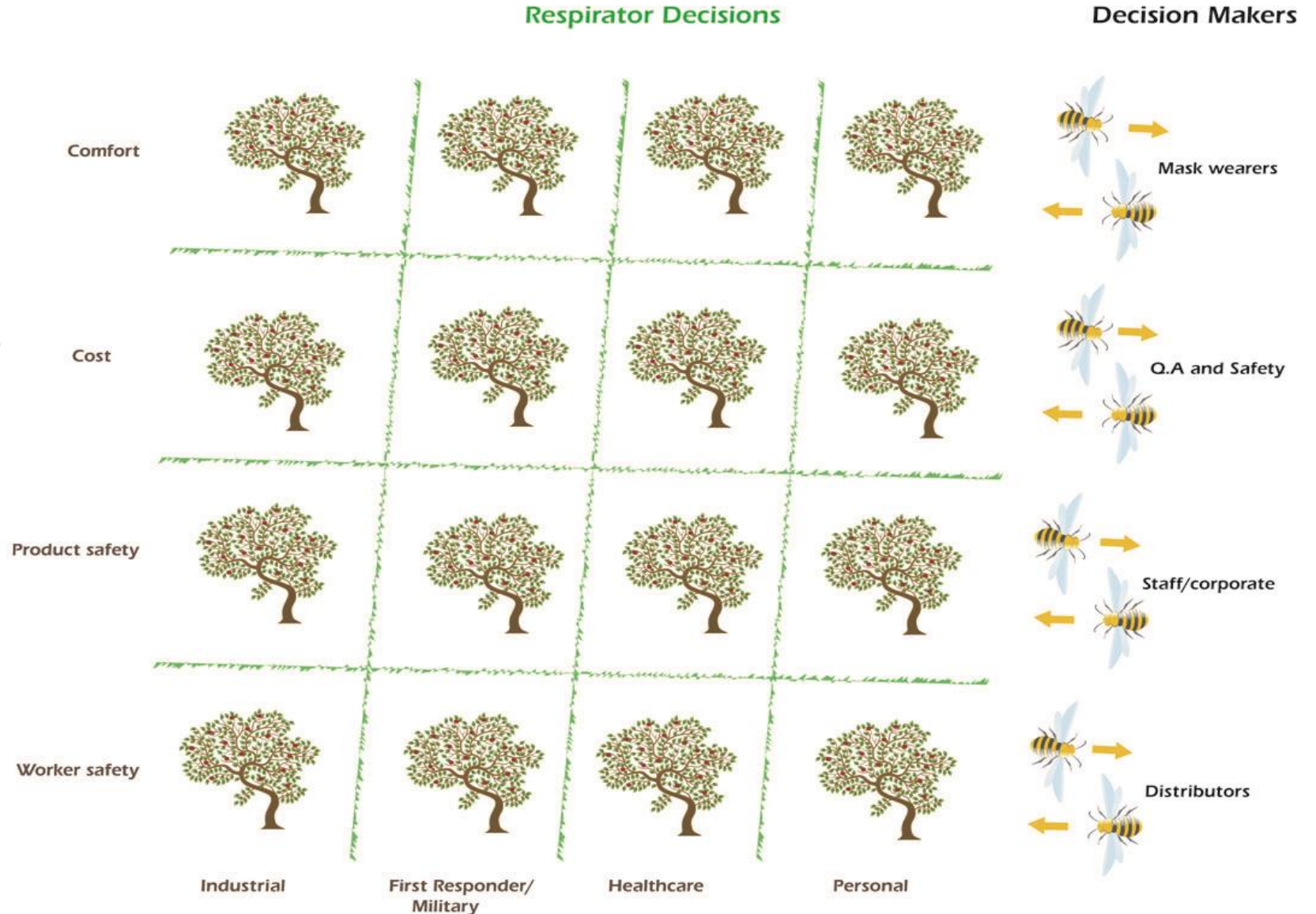
Face Mask & Respirator World Markets

- The face mask and respirator market is being radically transformed by the novel coronavirus pandemic
- The McIlvaine company has been analyzing this market and providing market research for decades.
- The McIlvaine *Face Mask & Respirator World Markets* is being expanded to provide the latest forecasts on masks and media for use in the pandemic.
- Long range aspects such as excess supply of meltblowns or alternatively a pandemic which keeps re-occurring are continually assessed.
- Continuous assessment of the science and technology is undertaken because the market is a function of which products are necessary to provide the necessary results.
- The market is shaped by a number of Decision Trees each of which pollinates the others.
- McIlvaine analyzes each of these Decision Trees.
- McIlvaine is performing this function on an accelerated basis just as it did after the Gulf Oil Spill when it helped NASA and Dissolved Oxygen Analyzer suppliers determine which instrument type was best suited for the underwater drones.
- This report has monthly updates plus more frequent Alerts. It also includes client briefings and webinars.



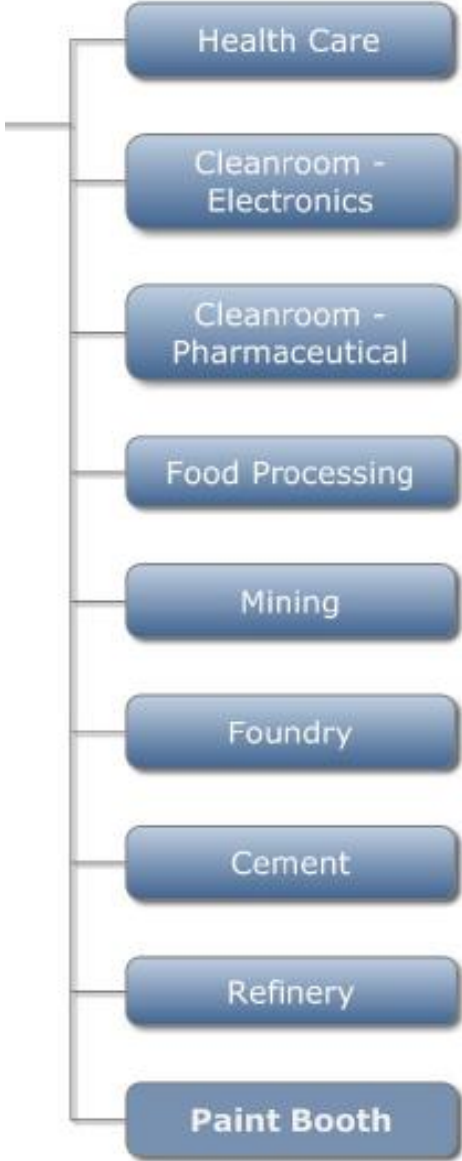
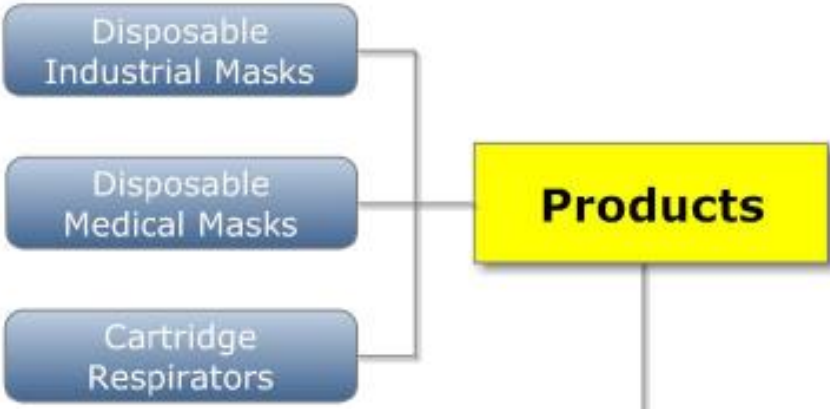
Healthcare is one of many applications covered. The contents are being expanded to provide intense coverage of the Coronavirus and the implications on the market.

The markets are determined by the choices made by individuals relative to safety, cost, and comfort. The choices are influenced by the application. Each Decision Tree is pollinated by the others. The most accurate market forecasting takes into account the whole pollination process. The coronavirus adds a new Decision Tree based on emotion rather than logic.



Sales of Masks and Respirators are forecasted through 2024 with the following segmentation

- Geographically: 80 countries and sub regions, 10 regions, 3 global groups and total world
- By product including media by type and mask by type and respirator by type
- Each application



Healthcare masks are segmented into N95 and disposable medical. Separate forecasts for media are provided.



Number of Semiconductor Workers Wearing Masks - thousands

World Region	2014	2015	2016	2017	2018	2017	2020	2021
Total	194.33	198.89	203.46	208.35	213.76	219.96	226.34	232.91
Africa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CIS	1.15	1.35	1.38	1.42	1.45	1.50	1.54	1.58
East Asia	140.60	145.51	148.85	152.43	156.39	160.93	165.59	170.39
Eastern Europe	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Middle East	0.85	0.90	0.92	0.95	0.97	1.00	1.03	1.06
NAFTA	38.75	37.39	38.25	39.17	40.19	41.35	42.55	43.79
South & Central America	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
West Asia	2.00	2.36	2.41	2.47	2.53	2.61	2.68	2.76
Western Europe	11.83	12.28	12.56	12.86	13.20	13.58	13.98	14.38

Number of Food Industry Workers by Region Wearing Masks – thousands

World Region	2014	2015	2016	2017	2018	2017	2020	2021
Total	115.05	118.95	123.19	127.74	132.62	137.85	143.41	149.35
Africa	4.70	4.90	5.11	5.33	5.57	5.83	6.10	6.40
CIS	4.92	5.00	5.09	5.19	5.30	5.41	5.53	5.66
East Asia	35.09	36.90	38.92	41.09	43.45	46.00	48.73	51.67
Eastern Europe	2.82	2.86	2.91	2.97	3.02	3.08	3.15	3.21
Middle East	6.13	6.29	6.46	6.64	6.83	7.03	7.24	7.47
NAFTA	26.46	27.11	27.78	28.49	29.24	30.01	30.81	31.63
South & Central America	7.41	7.62	7.84	8.07	8.31	8.57	8.84	9.13
West Asia	8.39	8.88	9.40	9.95	10.55	11.19	11.88	12.61
Western Europe	19.13	19.39	19.69	20.01	20.36	20.73	21.14	21.57

Number of Food Workers by Country Wearing Masks - thousands								
Country	2014	2015	2016	2017	2018	2019	2020	2021
Total	115.05	118.95	123.19	127.74	132.62	137.85	143.41	149.35
Algeria	0.38	0.39	0.40	0.41	0.43	0.44	0.46	0.48
Argentina	0.99	1.02	1.05	1.08	1.11	1.15	1.18	1.22
Australia	1.31	1.35	1.39	1.44	1.48	1.53	1.59	1.64
Austria	0.46	0.47	0.47	0.47	0.48	0.48	0.48	0.49
Bangladesh	0.44	0.47	0.49	0.52	0.56	0.59	0.63	0.67
Belarus	0.20	0.20	0.21	0.21	0.22	0.22	0.23	0.23
Belgium	0.54	0.54	0.54	0.55	0.55	0.55	0.55	0.56
Brazil	3.15	3.21	3.27	3.34	3.40	3.48	3.55	3.63
Bulgaria	0.14	0.14	0.14	0.15	0.15	0.16	0.16	0.17
Canada	1.98	2.01	2.04	2.08	2.12	2.16	2.20	2.25
Chile	0.45	0.46	0.47	0.49	0.51	0.53	0.55	0.57
China	18.37	19.66	21.10	22.68	24.39	26.25	28.26	30.4

Market Answers Provided for Media and Mask Suppliers

- How large is the market in each application and each country?
 - Present
 - Future
- How big will government stock piles be in the future? (target likely to be above 5 billion)
- Who will be the key decision makers?
 - Governmental
 - Organization
 - Individual
- How much fluctuation in price will occur between times of high demand and lower demand?
- Will media companies be able to keep up with the needs of the market?
- Will countries impose import or export restrictions on media or masks?
- To what extent will purchasers buy the lowest true cost product rather than the one best advertised?
- Who will be the major competitors for each product in each region?
- What are the routes to market?
 - Retail
 - Distributor/sales rep
 - OEM

Pricing Analysis

There is continued assessment of pricing and the influence of high demand and inadequate supply.

The price of meltblown nonwoven fabric has been surging since the outbreak started, from around 12,000 yuan (\$1,726) per ton to 400,000 yuan per ton. The price surged to 700,000 yuan per ton on Feb 24.

Pricing of SMS laminates and needle felts is also provided. This is based on a detailed analysis. The body of the mask consists of either three or four layers of nonwoven fabric.

One version consists of a hydrophobic spunbonded polypropylene nonwoven fabric outer fabric. In other cases, some manufacturers will construct the outer layer from a hydrophilic spunbonded polypropylene, which incorporates a fabric post-treatment (chemical finish) with the objective to absorb and spread a splash across a wide surface of the outer layer, allowing the meltblown nonwoven woven filter media inner layer(s) of the mask to capture bacteria before it can reach the wearer.

Pricing Analysis, cont.

In a four layer construction, the second layer from the outside often uses a wetlaid polyester/cellulose (wood pulp) nonwoven fabric to help spread the splash further across the mask surface and to act as a pre-filter as well.

The next layer (second layer in the case of a three layer construction or the third layer in the case of a four layer construction) is the bacterial layer whose function is to capture bacteria, which penetrate the outer layer(s). This layer is almost always from a meltblown nonwoven fabric consisting of fine fibers.

The inside layer, next to the wearer, is constructed from either a polypropylene spunbond or wetlaid polyester/cellulose nonwoven fabric, as mentioned earlier. This layer prevents fine fibers from the bacteria layer (meltblown fabric) from migrating to the person wearing the mask. The mask is ultimately finished by either ultrasonically sealing the edges together or sewing a binder ribbon around the edges. The mask is completed with elastic loops or tie strings to hold the mask in place.

Monthly Demand and Supply Analysis

The novel coronavirus has reached pandemic proportions according to the WHO. There is an expectation that the number of cases will soar in the coming months creating a huge demand for masks.

The mask production capacity is far less than the demand when the emotional buying of individuals is included. China has rapidly expanded its mask capacity. Sinopec, a large Chinese petrochemical company has been rapidly building mask assembly plants and supplying them with sufficient melt blown non wovens. On the other hand many mask suppliers do not have access to the roll goods. There is continuous analysis of supply and demand by country.

This takes into account the trade barriers and regulations which are forbidding melt blown export for certain countries such as South Korea.

Mask Supply and Demand – millions/day			
Region	Jan 1	March 8	April
Supply -World	40	120 +	
China	20	100	
Sinopec	0	6	18
Demand World			
		5000	
Chinese Public			
		533	

The monthly updates include supplier capacity expansions and a tally of world capacity on an ongoing basis

Application Information Matched with Media Capabilities

The use of disposable medical masks designed to minimize contagion by the wearer has to be distinguished from the N95 design masks which protect the wearer from contaminants including viruses.

- Where is it appropriate for each design to be used?
- Where will emotion drive and expand markets beyond rational need (593 million Chinese may each want to wear on the average of one mask per day regardless of value)?
- How often should these masks be replaced?
- What changes can be made to improve comfort and safety?
- How can masks be best designed for removal without contamination?
- How effective are
 - Spun bonded
 - SMS laminates
 - Nanofibers
 - Electrostatically charged media (needle felt with two fiber types)

Analysis is Provided of Each Major Supplier Including Revenues and Product Offerings *(as per the example below)*

Superior Felt and Filtration offers nonwovens that can be utilized in masks, air purifiers, medical equipment, personal safety apparel and cleanrooms that are highly efficient against 0.1 micron particles. The electrostatically charged high alpha perm melt blown and needle-punch Technostat® products can be easily molded into masks, pleated and die cut to offer protection over 99.9% against 0.1 micron particles which are considered to be the most penetrating particle sizes (MPPS).

The electrostatic media offers low air flow resistance for more breathable masks or devices that help reduce fatigue & improve comfort levels. Technostat® can also be utilized with breathable laminates, activated carbon and other materials for combined dust and gas filtration. For these reasons, Technostat® is the preferred nonwoven synthetic filter media for respiratory applications. In addition to Technostat® filter media, they also offer Technostat® Plus – a triboelectric media of needle-punched felt that offers 20% improvement in filtration efficiency over standard electrostatic filter media. This nonwoven synthetic fabric produces its triboelectric properties when two dissimilar fibers used during the manufacturing process create a charge that enhances filtration capabilities.

Superior Felt & Filtration also provides electrostatic filter media rolls (electrostatically-charged synthetic needle punch fibers) and melt blown fibers. These nonwoven synthetic fabrics aid in producing some of the highest levels of filtration for health care providers and emergency responders.