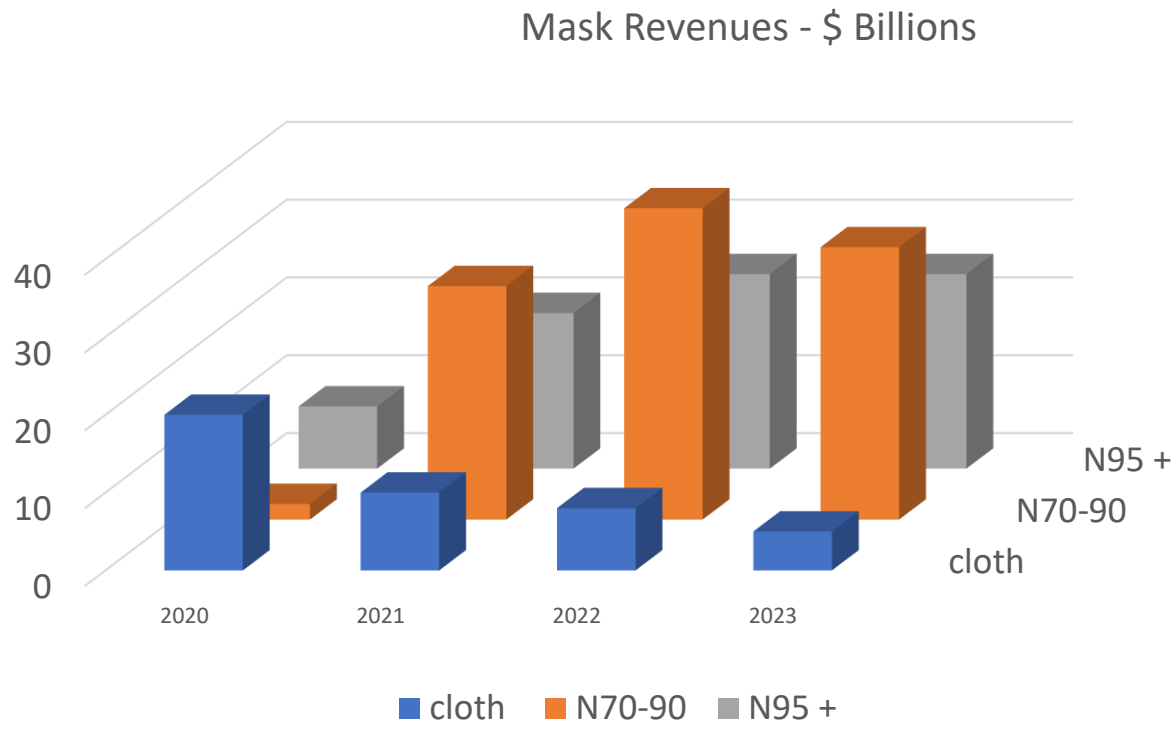
High Efficiency Mask Market and Proactive Program for Suppliers

A service offered by the
McIlvaine Company

Evidence is growing that highly efficient rather than cloth masks will be needed to vanquish COVID. A proactive program by mask and media suppliers would greatly reduce COVID and generate very large revenues for suppliers of media and masks.



Cloth masks are not efficient at removing small aerosols and in fact there is growing support for the thesis that they are aerosol generators. Validation and communication of differences between cloth masks and more efficient masks/respirators will enlarge the market opportunity by many billions of dollars.

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McIlvaine is providing enough information in the daily alerts and analysis to make it possible to justify the investment in a specific type of mask for a specific location and activity and determine the risk reduction. Many influencers and purchasers do not differentiate between masks and are therefore not investing in the right products to reduce their risk to levels they believe acceptable.

As a result the market for efficient masks is much smaller than it will be when buyers and influencers are presented with reliable cost/benefit information. There is the opportunity for the suppliers to greatly increase sales by joining in a program to

1. Ascertain reliable cost/benefit information for every application in every country for each type of individual
2. Communicate that information to the influencers and decision makers with webinars, magazine articles, and white papers
3. Receive market forecasts for the thousands of individual opportunities with an understanding of competitive advantages and disadvantages

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High Efficiency Mask Market and Proactive Program for Suppliers

Contents and Costs

Scope

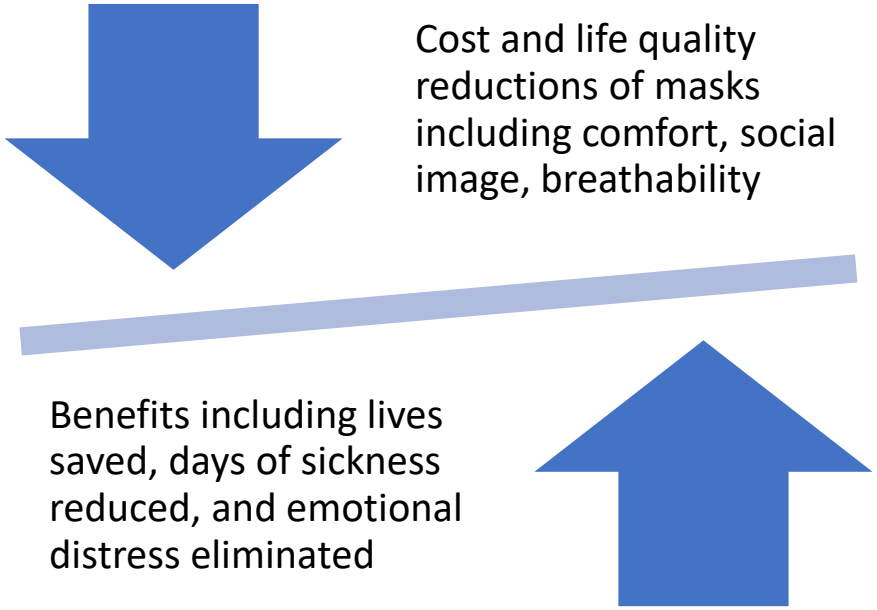
- Coronavirus Technology Solutions
  - Daily Alerts and Analysis
  - Webinars and White Papers
  - Easy search capabilities
- home.mcilvainecompany.com/index.php/markets/air/82ai-coronavirus-market-intelligence
- Mask Market Program
  - True cost evaluations of all options
  - Continuously updated and comprehensive market forecasts
  - Five recorded interviews
  - Participation in general webinars
  - Participation in important decisions such as ways to define the market (but also the customer choices)
  - Ability to shape the market with input to Alerts and webinars

Deliverables and Costs

- Provision of the daily alert to any designated individual within the company
- Custom website to encourage intra company discussions
- Display of the forecasts for each country continually revised and displayed
- Intra company sales and technical discussions
- All services for 12 months for the price of $8900

Shaping the Market through Analysis and Collaboration

The investment in masks is a function of perceived life quality net impacts. A true cost analysis will be performed for each mask type in each application. A common metric to measure all harm and good was originally developed through a contract with a major surgical gown supplier but it is uniquely applicable to all COVID related choices. Since this metric incorporates the life quality risk choices as well as tribal and discounted future values, it is a true reflection of the will of the people rather than imposed morality.



Many of the factors such as comfort and breathability are those within the control of suppliers. Collaboration among suppliers can result in shaping the basis for true cost. For example, a major filter media company has volunteered to test the aerosol generation from cloth masks. With this program and collaboration of the participants the market can be shaped to the benefit of everyone.

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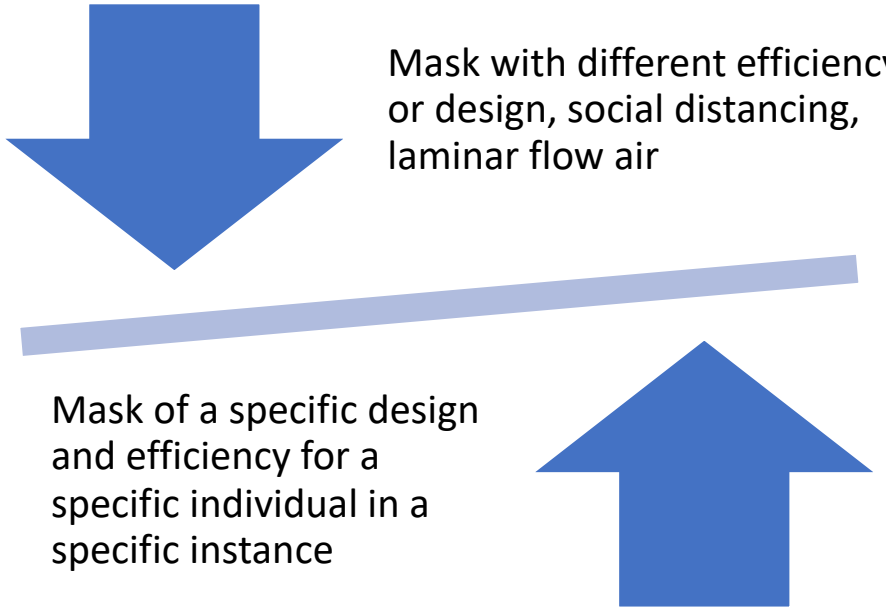
True costs need to be determined for each circumstance. Everyone agrees that there are high virus load situations where N100 masks are unquestionably the choice. In a crowded subway an N95 mask may be the best choice. A more comfortable N70 mask may be the best choice walking down a city street.
This is likely to result in individuals using several different mask types during the day.



The mask comparison includes the common metric of Quality Enhanced Life Days (QELD). Every minute we drive in a zone with a 65-mph limit reduces life expectancy by 30 seconds . If we went back to the 55-mph limit, we would statistically lose 25 seconds of life for each minute spent traveling. The difference is a few days over a lifetime. But we make many decisions such as eating ice cream that shorten life but enhance life quality. We can probably justify a lower mask efficiency equal to the risk of a 65-mph speed limit, but few people will want to take the risk of raising the limits to 100 mph or wearing an inefficient mask which adds that much extra risk.

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FACTORS AFFECTING THE AVAILABLE MARKET

Parameter	Factors
Mask Performance	How efficient are various masks at capturing virus particles? Do cloth masks simply become aerosol generators after stopping large cough droplets?
Virus Parameters	How big are aerosols when released initially versus after evaporation or release from surfaces? How long are viruses active and are they revived in the lungs? How many virus particles are released? What Is the minimum viral load? Do inefficient masks capture cough droplets and become aerosol generators?
Disease Parameters	What is the average severity and duration of the disease? How many additional people are infected by each new case?
Mask Media Types	Electrostatically charged meltblowns vs nanofibers and other media
Mask Media Availability	What is the availability of meltblown media worldwide as well as in specific countries? What is the availability of alternative high efficiency media? What will it take to produce 500 million masks per day?

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FACTORS AFFECTING THE AVAILABLE MARKET

Parameter	Factors
Mask Physics	What is the importance of fit? What is the comfort and breathability for various alternatives? What about the expanded media area with respirators and or pleats?
Mask Cleaning	What are ways to decontaminate meltblowns without losing electrostatic effect? How many cleanings are possible? How are nanofiber masks cleaned and how many wearings can be achieved at acceptable performance levels?
Mask Cost	What is the cost per wearing for various mask types?
COVID Nationalism	What are the implications for adequate availability of masks in each country versus restrictive policies of some countries?
Co-benefits of Air Pollutant Capture	Efficient masks are already used in many countries to protect against air pollutants such as fine particles which penetrate the lungs.
Country Specific Factors	Important factors are GDP per capita, % of people previously infected, population density, and specific mitigation programs in place.

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Mask Market by Media Type - $ Millions								
Subject	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**
Total	x	x	x	x	x	x	x	x
Meltblown	x	x	x	x	x	x	x	x
Membrane	x	x	x	x	x	x	x	x
Nanofiber	x	x	x	x	x	x	x	x
Other	x	x	x	x	x	x	x	x

This segmentation differentiates based on the media used for removing the smallest particles. Meltblown capacity is limited based on equipment backlogs of one year or more. Alternative media is more available but breathability, comfort, and other factors must be considered. Mask reuse is one factor and is less of a challenge for media which does not rely on electrostatic charging. Some of the alternatives are listed in subsequent slides.

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Mask Market by Scope - $ millions								
Subject	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**
Media	x	x	x	x	x	x	x	x
Mask	x	x	x	x	x	x	x	x

Media are forecasted in tons per year and $ for major media types. Mask revenues are forecasted in $/yr. for masks based on the price obtained by the mask manufacturer. There is analysis of the distribution chain and mark ups through the supply chain. The forecasts take into account artificial price pressures exerted by governments concerned about available PPE supply.

Forecasts are constantly revised. The longer-range forecasts are shaped by the availability of vaccines and therapies. Since McIlvaine also publishes *Coronavirus Pharmaceutical Solutions* it has the perspective to evaluate this impact.

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Mask Market by Country - $ millions								
Subject	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**
Argentina	x	x	x	x	x	x	x	x
Bolivia	x	x	x	x	x	x	x	x
Brazil	x	x	x	x	x	x	x	x
Chile	x	x	x	x	x	x	x	x
Columbia	x	x	x	x	x	x	x	x

Forecasts are provided for each mask type in each application in each of 80 countries and sub regions. The forecasts are then aggregated by region. The forecasts take into account the air pollution as well as COVID mitigation in China and other Asian cities. For underdeveloped countries, the U.N. assistance programs are evaluated.

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Mask Market by Filter Efficiency - $ millions								
Subject	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**
N 70	x	x	x	x	x	x	x	x
N 90	x	x	x	x	x	x	x	x
N 95	x	x	x	x	x	x	x	x
N 99	x	x	x	x	x	x	x	x

The proactive program will convince wearers that they need a mask which is relatively tight fitting and will remove 70% of 0.3 micron particles. The term mask is used when in fact respirator would be the correct description because the goal is to protect both the wearer and others. The present very large market for cloth masks will shrink and be replaced with more efficient masks as segmented above.

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Mask Market by Design - $ Millions								
Subject	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**
Surgical Masks	x	x	x	x	x	x	x	x
Respirators	x	x	x	x	x	x	x	x

Surgical masks are loose fitting and designed to protect others from coughs and sneezes. If these masks are shown to be aerosol generators the market for them in the future will be very limited. Instead N70 – N100 respirators will capture most of the market. Another issue is valved vs non-valved masks. If both wearer and recipient are wearing N95 masks with valves the recipient could receive only 5% of the virus load. If both are wearing N70 masks without valves the maximum load for the recipient is 9%. So N95 masks with valves for everyone is better than N70 masks without valves for everyone. Respirators with replaceable cartridges such as made by MSA and Draeger have advantages and are evaluated.

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Market by Application

- Efficient masks will be a primary weapon to vanquish COVID. The use by healthcare workers will be a small percentage of the total use. There are 3 billion people who are routinely congregating with others. If we could invest in the amount per capita we did on head gear for astronauts on Mars or even workers in a Class 1 semiconductor cleanroom there would be no transmission of COVID. The question is not whether masks will solve the problem but whether the investment can be justified and whether people will wear them.

- The new evidence that much of the transmission is by small aerosols which can travel long distances means that masks become the first line of defense.

- Selection of mask efficiency will be influenced by the viral load. This means that the individual will want to wear one type of mask on the subway and another around his residence. The mask he wears for dining out will be distinct from the one he wears in his meat packing plant.

- The most accurate way to forecast mask use in any country is to analyze the use in each of these applications rather than just use total population figures. Mask use per day in hospital settings will be different than mask use per day for sports and entertainment.

Mask Market by Application - $ Millions								
Subject	2018	2019	2020	2021	2022	2023	2024	2025
Commercial	x	x	x	x	x	x	x	x
Education	x	x	x	x	x	x	x	x
Government	x	x	x	x	x	x	x	x
Hospitals	x	x	x	x	x	x	x	x
Nursing homes	x	x	x	x	x	x	x	x
Food processing	x	x	x	x	x	x	x	x
Other healthcare	x	x	x	x	x	x	x	x
Other industrial	x	x	x	x	x	x	x	x
Residential	x	x	x	x	x	x	x	x
Transportation	x	x	x	x	x	x	x	x
Entertainment, dining, sports	x	x	x	x	x	x	x	x

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Analysis of the Technology

- The market is shaped by developing knowledge and technology. The Daily Alerts, interviews and webinars are providing insights which change the outlook. The amount of new information and resultant potential progress is unprecedented. Many suppliers have made the COVID problem their # 1 priority.
- The following listing shows some of the newer media technologies which are being evaluated in the daily alerts.
- They are listed chronologically with the latest reports first.
- They include ways to make meltblowns more efficient, an N70 washable medium, and media constructed from membranes and nanofibers.
- They include transparent media and microglass cartridges.
- New designs are being introduced on an almost daily basis.
- The Daily Alert is 10 pages in length. This extensive coverage is necessary to keep up with the developments
- The following lists cover the period of July 25 back to March 30.

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Analysis of Newer Media Options to Compete with Meltblowns

Ambrust American	N95	meltblown	Unique charging for higher efficiency
Berry	N90	composite	Single layer for public use
H&V	N99	microglass	HEPA cartridges for respirators
Freudenberg	N95	spunbond	Unique NWI media
Ahlstrom Munksjo	N90	new?	Partnering with sportswear company
Ascend	N99	nanofiber	Both nanofiber and microfiber versions
Suominen	95	nonwoven	New media
O2 Canaada	N95	insert	Media inserted into a reusable filter
AKAS	N95	layered	Outperformed N95
Shinshu University	N95	nanofiber	Washable
Purdue	N95	meltblown	New elastic band

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Analysis of Newer Media Options to Compete with Meltblowns, cont.

Espin	N95	nanofiber	Small production capacity
Hifyber	N95	nanofiber	3-layer media available in volume
BigNano	N95	meltblown	Smaller diameter fibers
NXT Nano	N95	nanofiber	Also MERV 16 media
Mogul	N90	microfiber	For general public
Fibertex	N95	nanofiber	Also have 70% efficiency for public
Vogmask	N95	layered	Washable with and without valve
BWF	N90	nonwoven	Designed for nonmedical
TTG	N95	membrane	PTFE membrane is middle layer
Swiss Federal	N95	membrane	Transparent to view lip movement

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Analysis of Newer Technologies to Compete with Meltblowns, cont.

King Abdullah Univ.	N99	membrane	Replaceable silicon membrane insert
FET	N95	meltblown	Alternative to polypropylene
Neatrition	N95	nanofiber	Washable
Nexera	N95	polyester	With Agion anti-microbial
Kuban state U	N95	nanofiber	Developed by Russian researchers
Cambridge	N95	spunbond	Small carbon fibers
IQ Air	N99	microglass	Originally designed for air pollution
Moden Healthcare	N80	nonwoven	Aimed for public in Taiwan
Bondex	N95	entangled	Hydroentangled
Asiatic Fiber	N95	layered	Includes anti-bacterial layer
Start X Med	N90		Small insert into other masks
22 Mask	N95	5 layers	Upscale reusable mask
Exxon Mobil	N95	meltblown	Replaceable filter in rubber mask
Sindat	N95	membrane	Replaceable membrane
Cummins	N95	membrane	Using same Dupont membrane as for engine

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