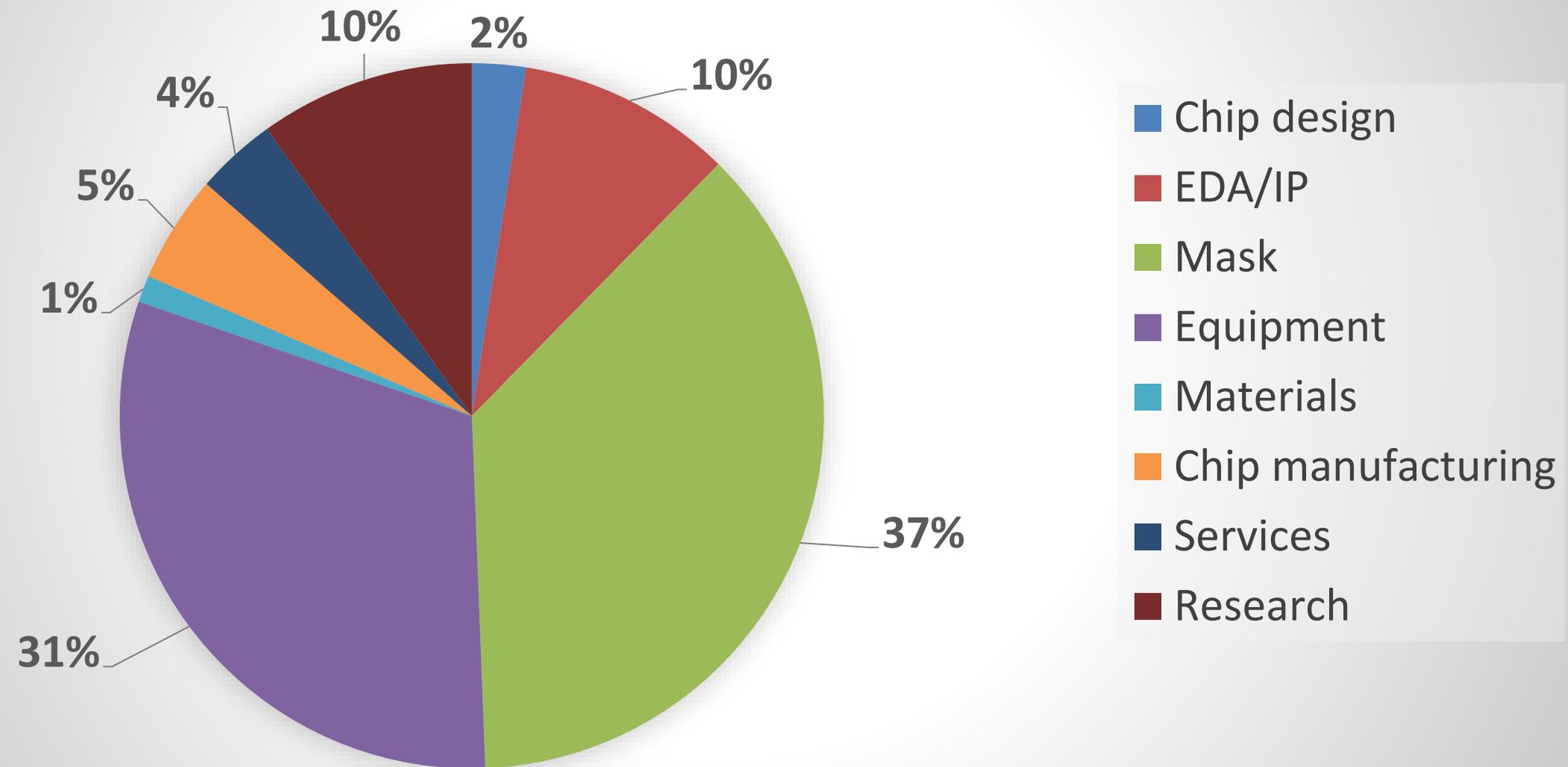


Thank you - 10th Annual Luminaries Survey

81 luminaries across 44 different companies in July 2021



What part of the semiconductor ecosystem is your primary focus?

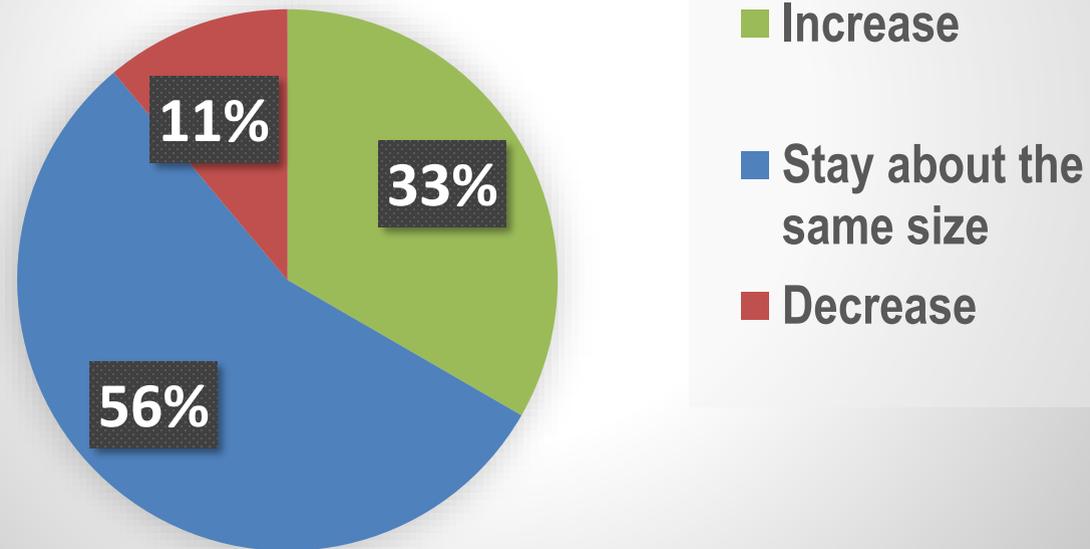


72% Say 2021 Mask Revenues Will Increase

Only 33% predicted increase for 2020 Mask Revenues

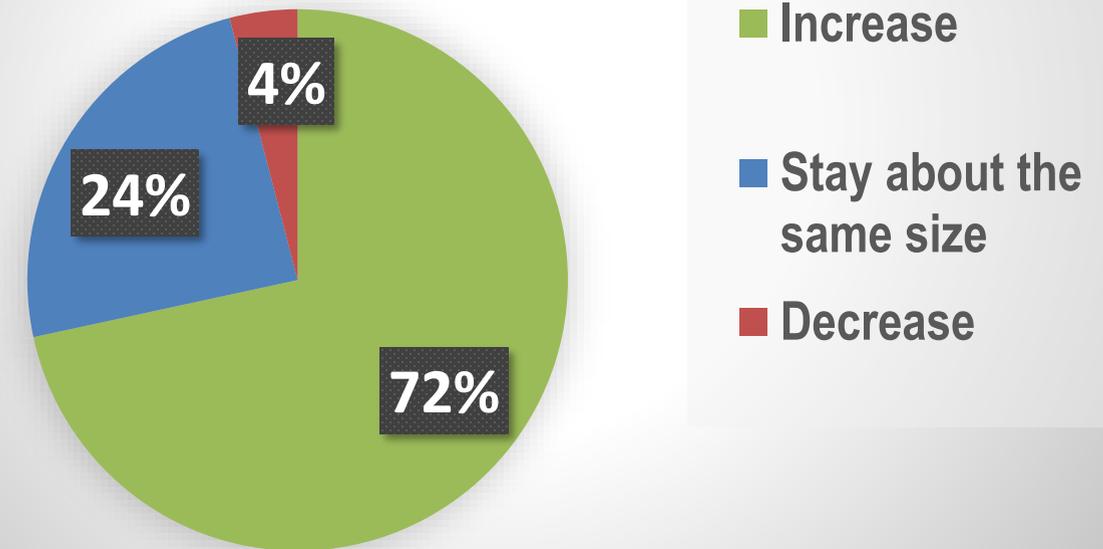
2020 Survey Result

Net of all effects (including COVID-19), what will happen to the size of the 2020 total mask revenues compared to 2019? N=72



2021 Survey Result

Net of all effects (including COVID-19), what will happen to the size of the 2021 total mask revenues compared to 2020? N=74



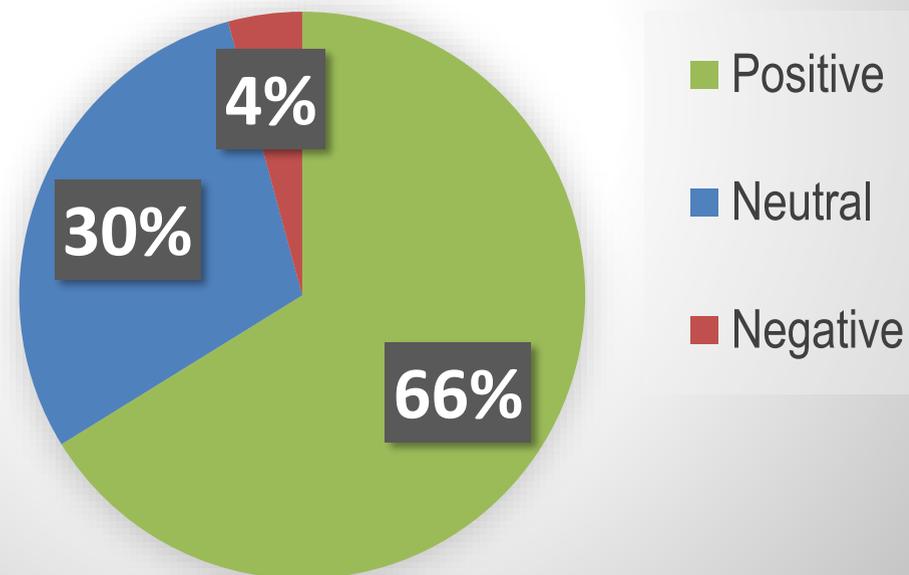
74% Say EUV Contributes to 2021 Mask Revenues

Increased from 66% in 2020



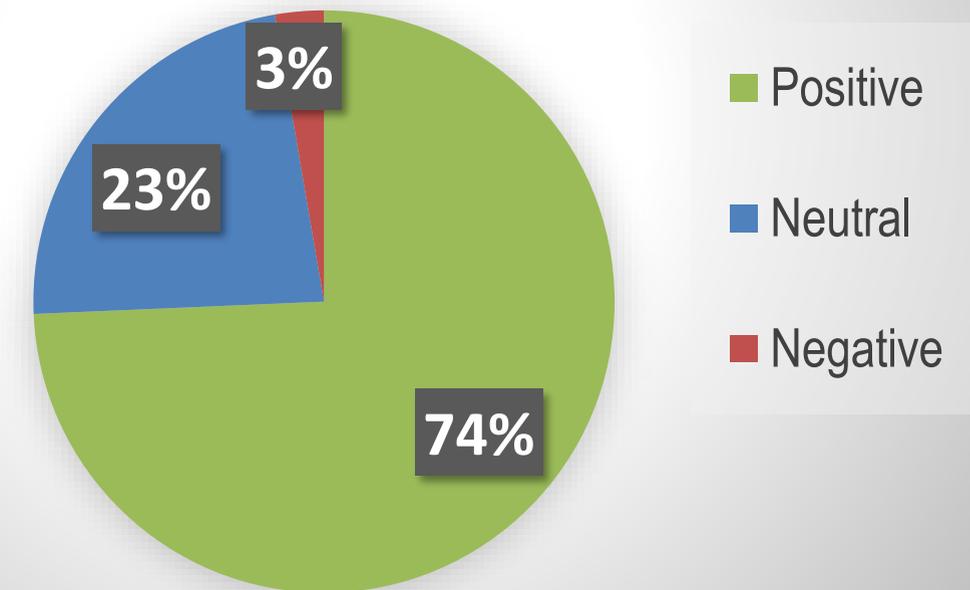
2020 Survey Result

There are fewer masks per wafer with EUV, but each EUV mask is more expensive. Net of all effects, how will the increased use of EUV contribute to the size of total 2020 mask revenues? N=71



2021 Survey Result

There are fewer masks per wafer with EUV, but each EUV mask is more expensive. Net of all effects, how will the increased use of EUV contribute to the size of total 2021 mask revenues? N=74

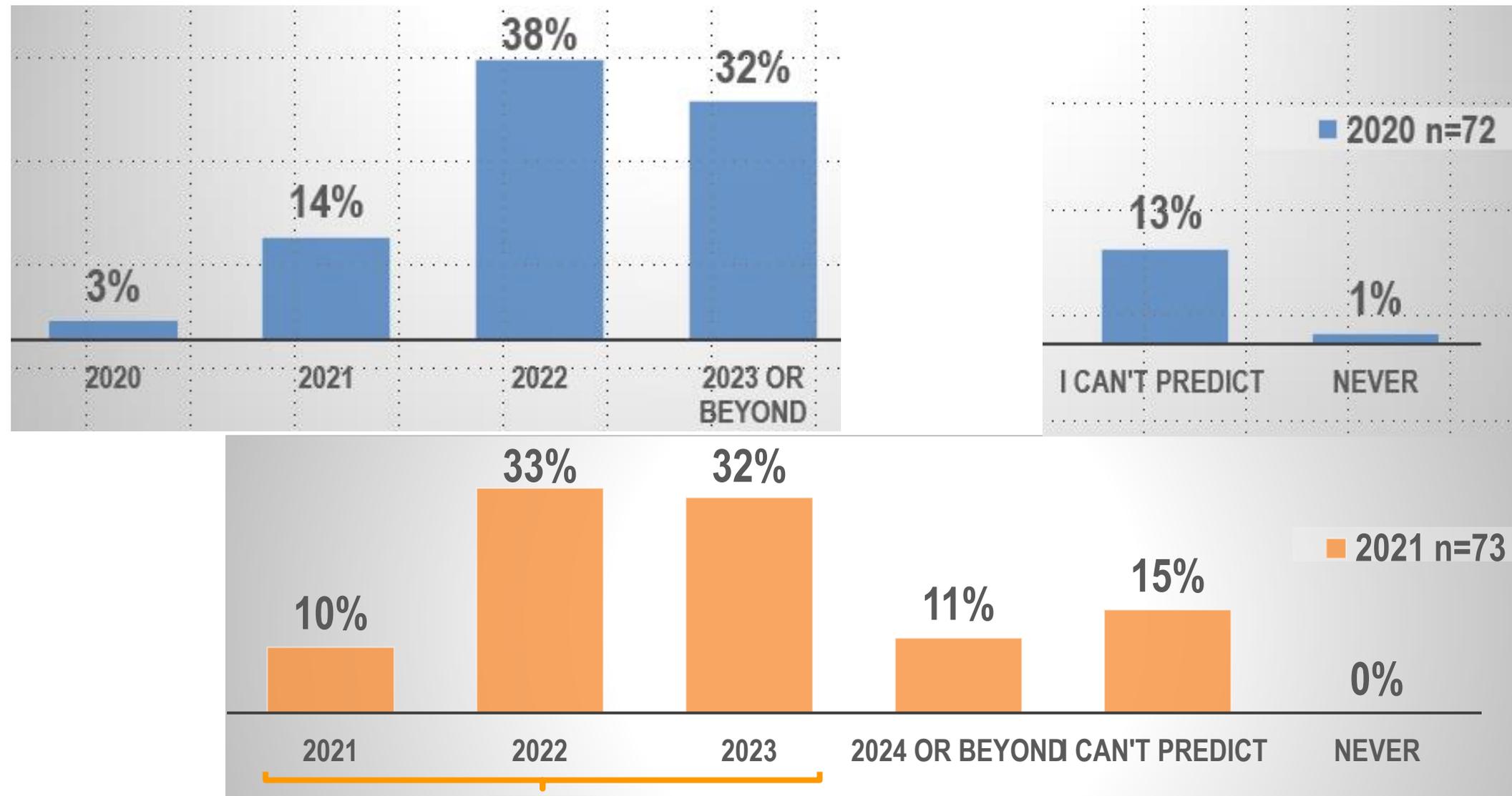


75% Say EUV Pellicles for HVM by 2023

Two year trend points to 2023



EUV pellicles are available, but transmission loss seems to still be an issue. By the end of which year do you predict a pellicle will be used for EUV high volume manufacturing by at least one company?



75%

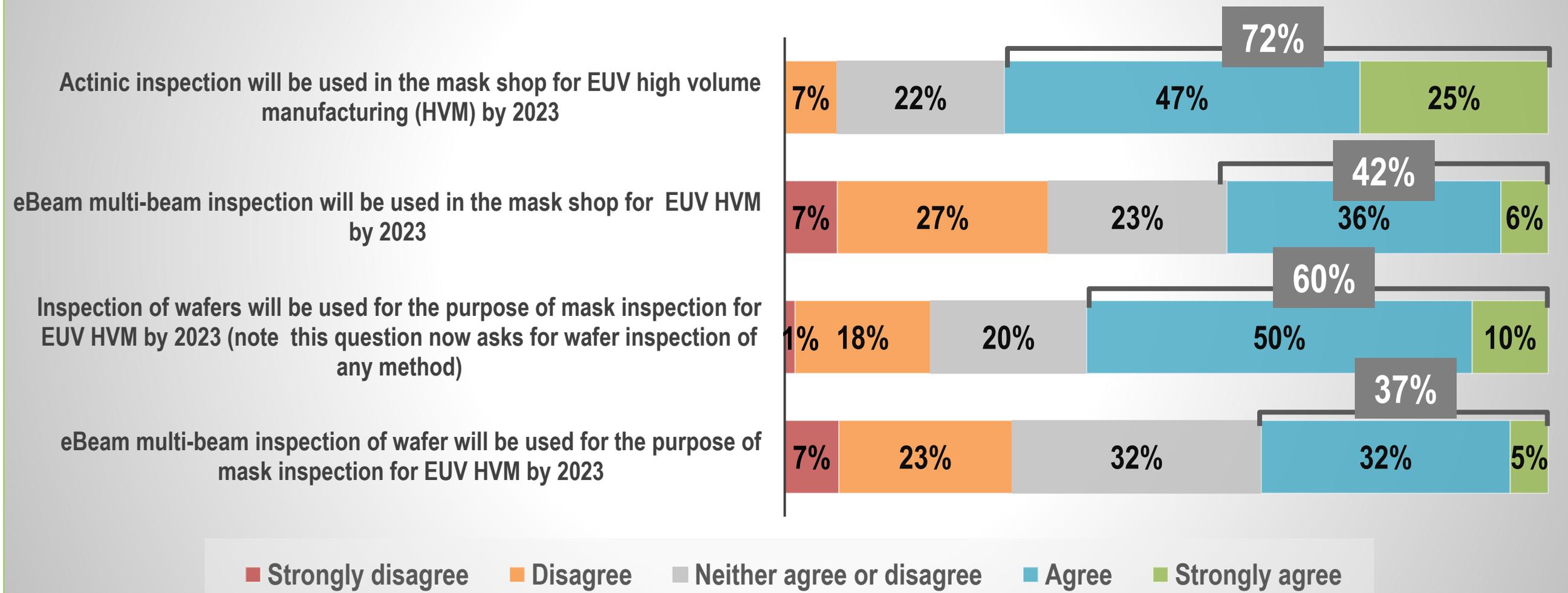
Answer choices expanded in 2021 survey – see X axis in two charts above

Confidence in Actinic EUV Inspection Remains High

72% say actinic inspection for EUV HVM by 2023



Regarding EUV mask pattern inspection, please indicate your level of agreement with the following statements:

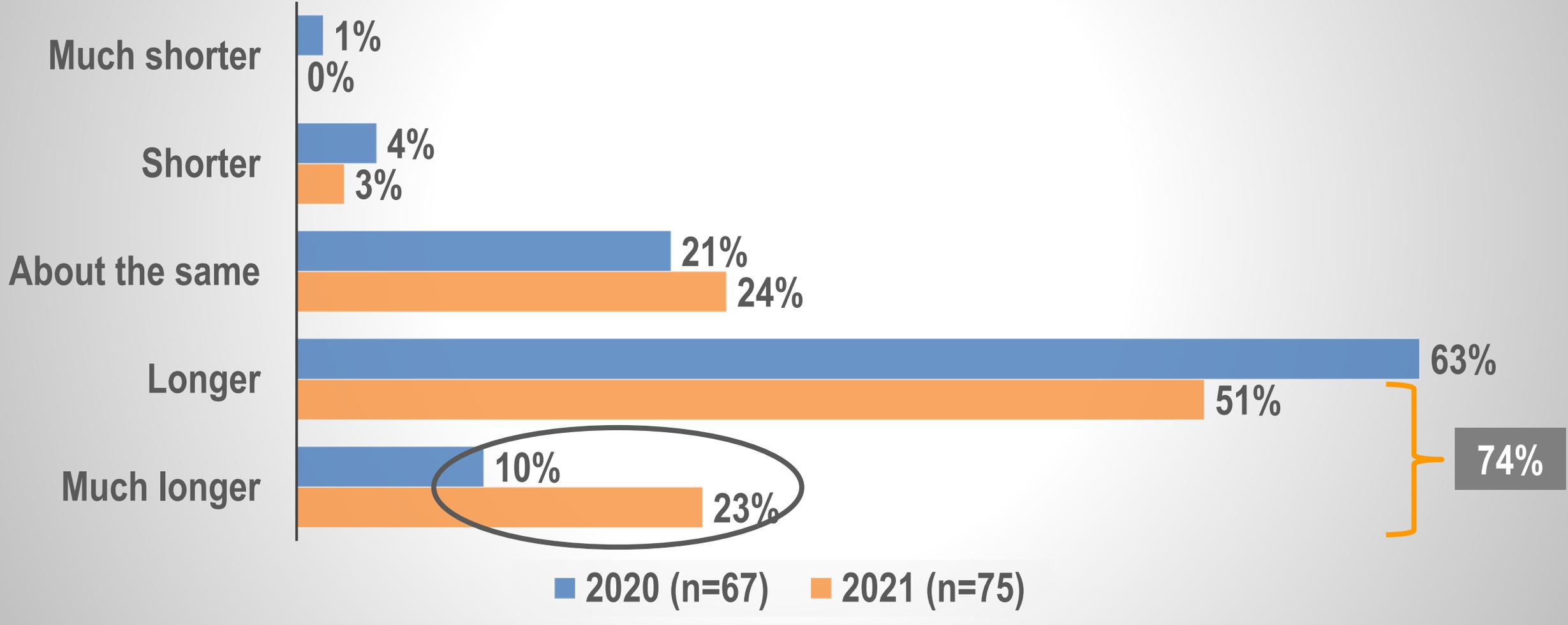


More Think EUV TAT is “Much” Longer

23% say EUV TAT “much longer” vs 10% last year



Turnaround time is critical to the mask business. How will EUV mask turnaround times in 2023 compare to leading-edge 193i mask turnaround times of today?

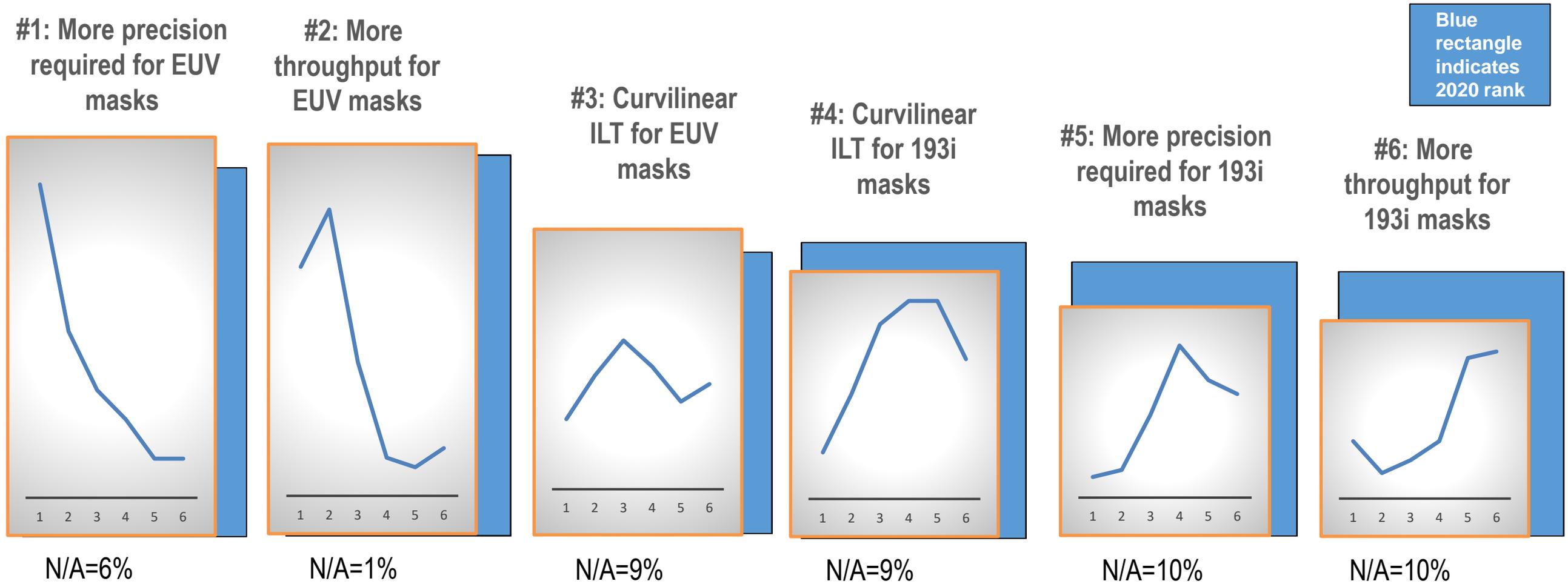


EUV Remains Top Reason to Buy Multi-Beam Writers

EUV precision ranked #1 reason in this year's survey



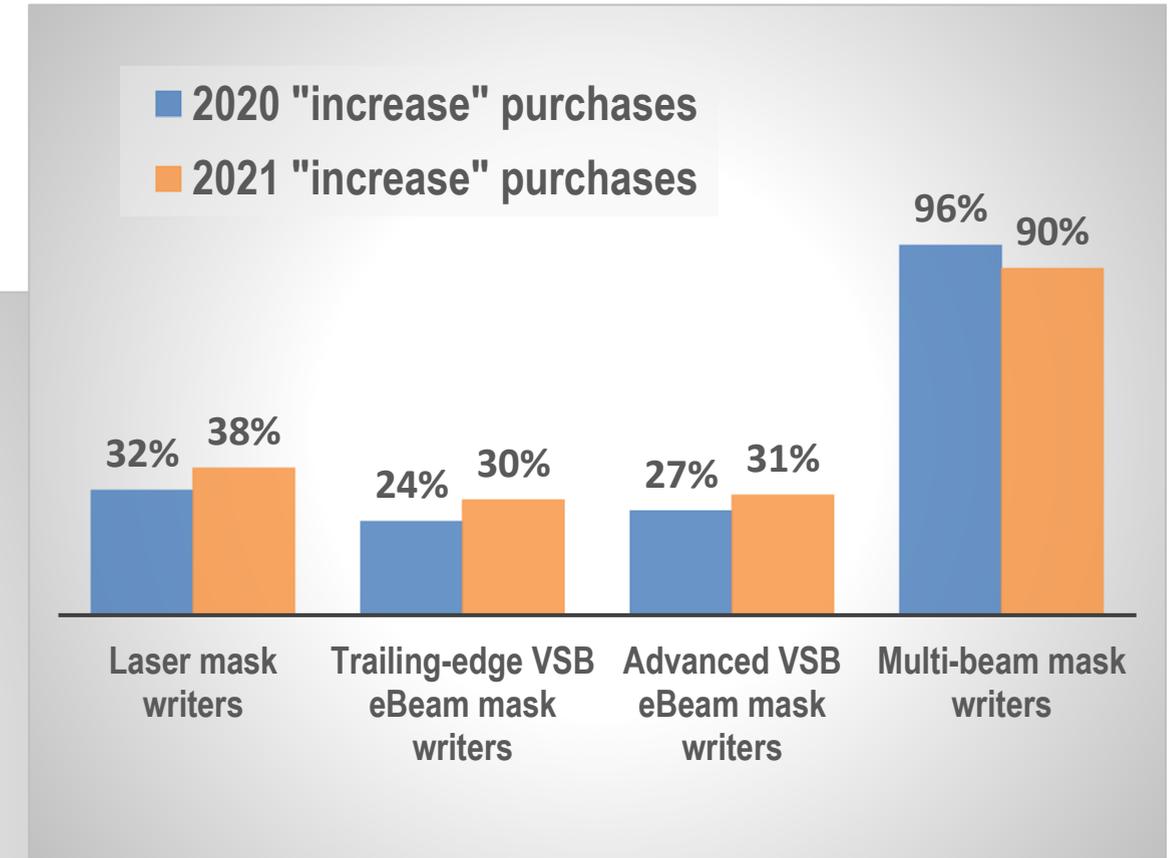
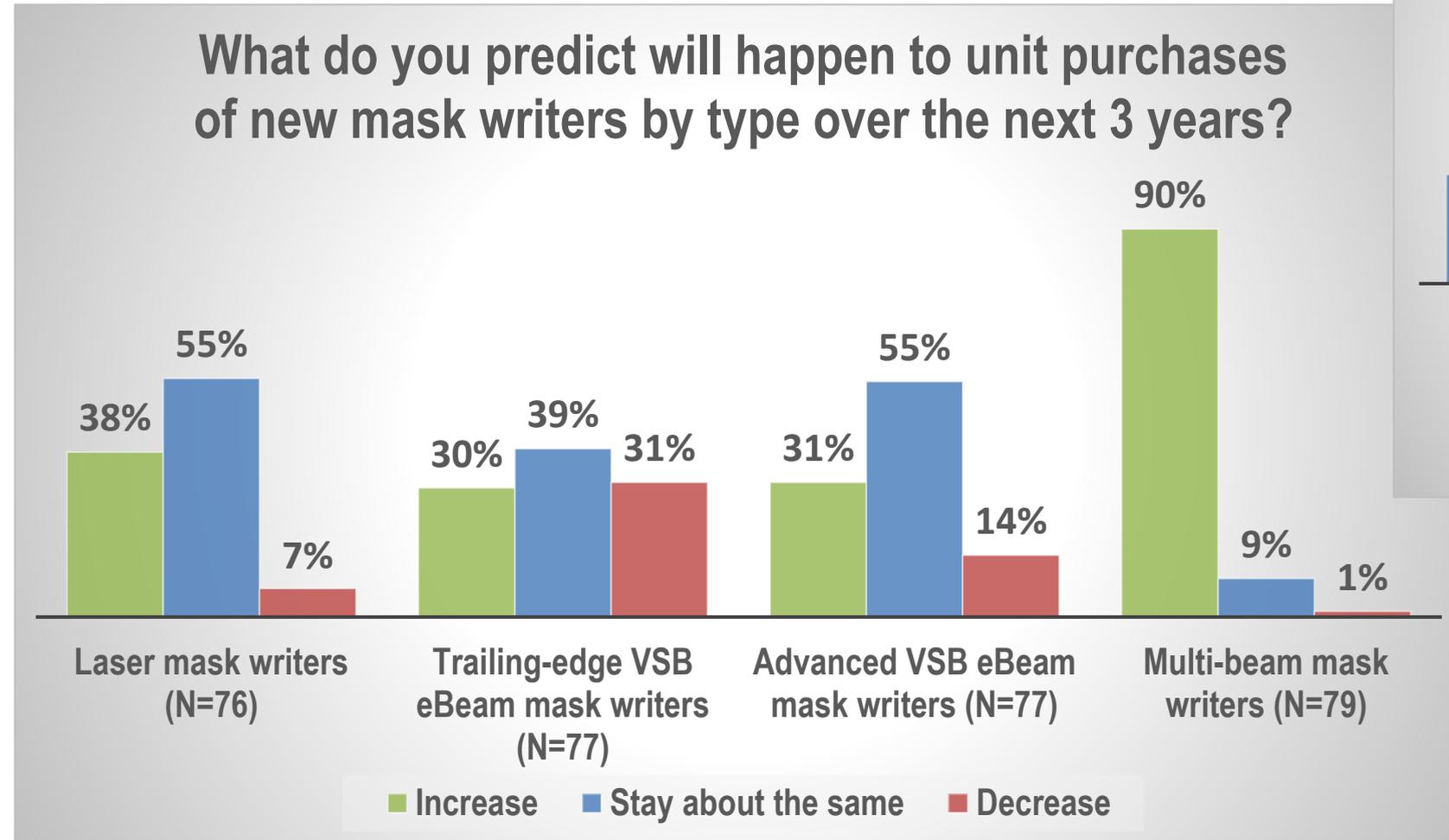
Please rank the primary reasons for purchasing multi-beam mask writers. Note in the answers below, precision refers to CD uniformity as well as placement accuracy. n=81



Note: 1-6 on X-axis indicate # of respondents that ranked that question as that ordinal number with 1 = highest.

Purchasing Sentiment Rises for Laser, VSB Writers

Multi-Beam sentiment remains high at 90%

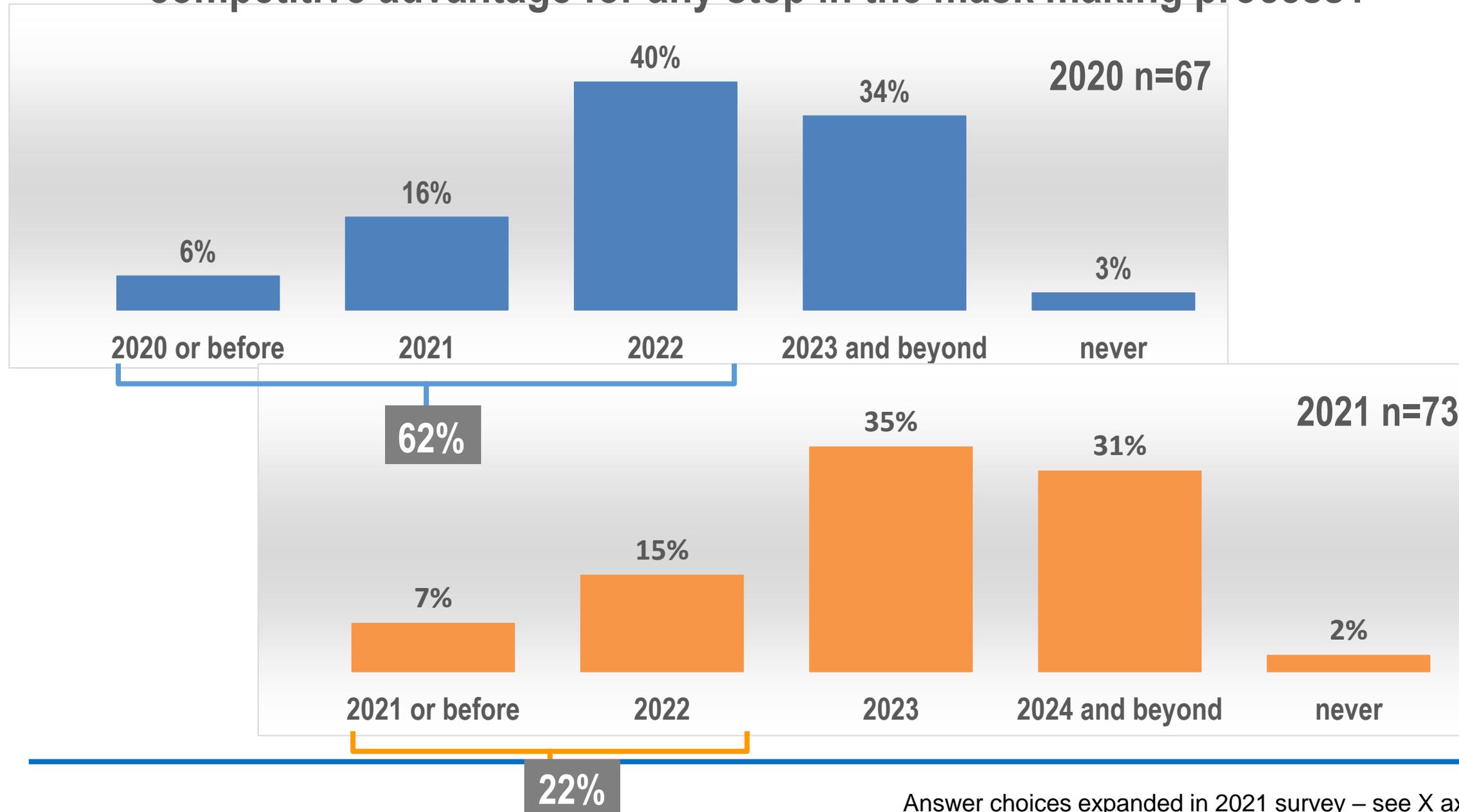


Deep Learning Predictions Shift to 2023 & Beyond

Only 22% say 2022 vs 62% in last year's survey



In the mask industry, when will capabilities based on deep learning become a competitive advantage for any step in the mask making process?

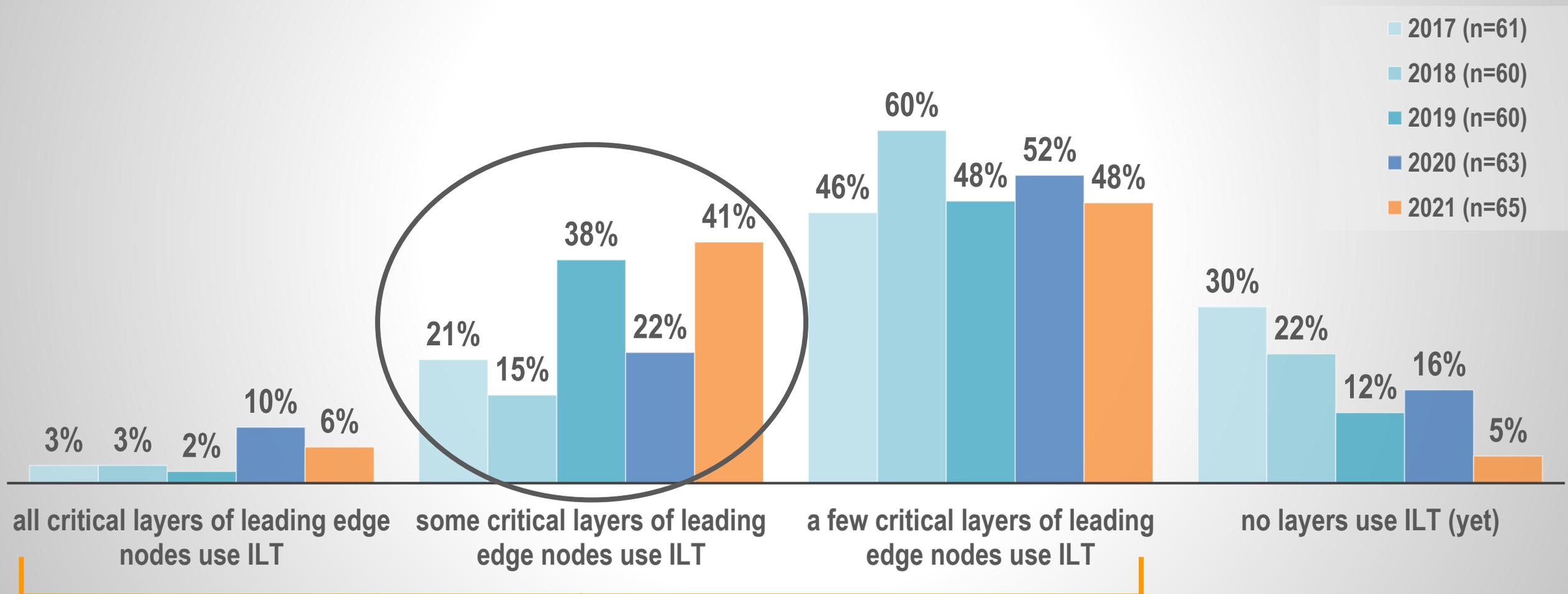


Answer choices expanded in 2021 survey – see X axis in two charts above

95% Say ILT in Use Today

41% say "some critical layers" use ILT

How broadly is inverse lithography (ILT) used for production chips today (2021)? (use includes for hot spots only)

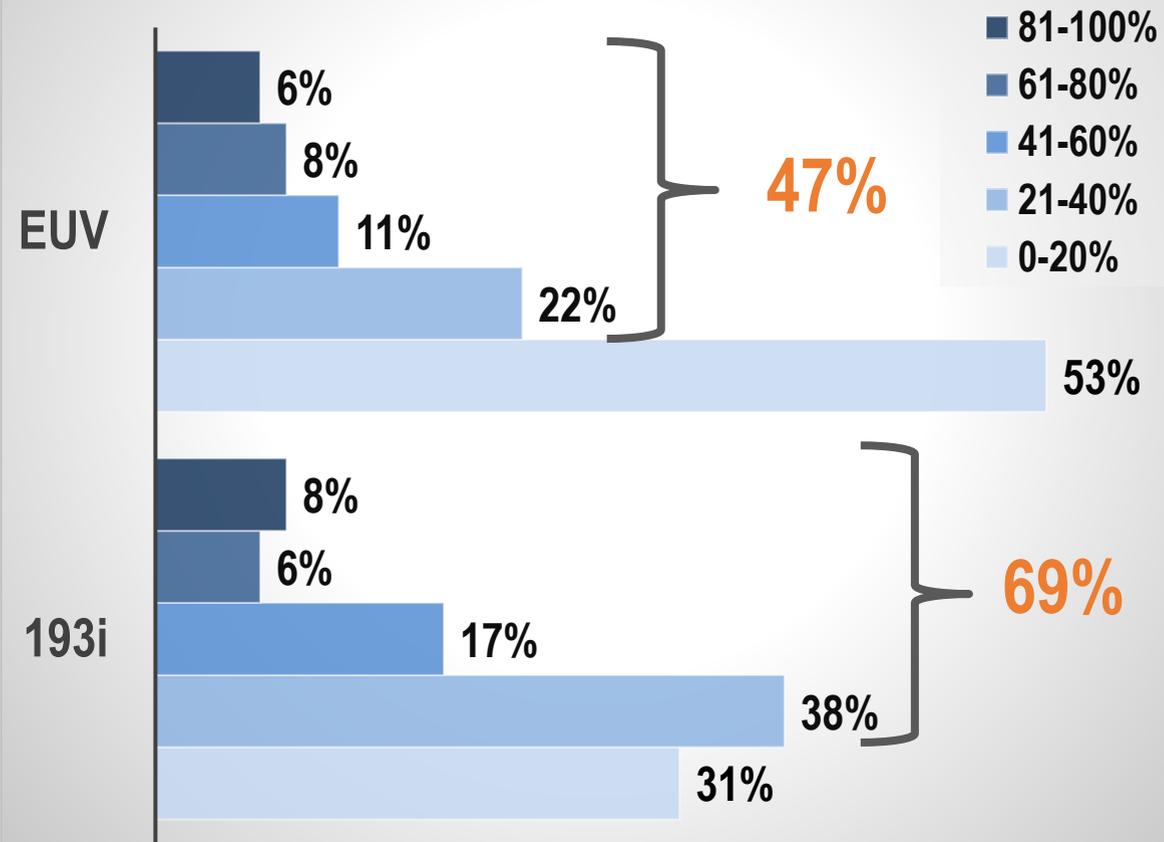


95%

More Curvilinear Predicted for 193i vs EUV

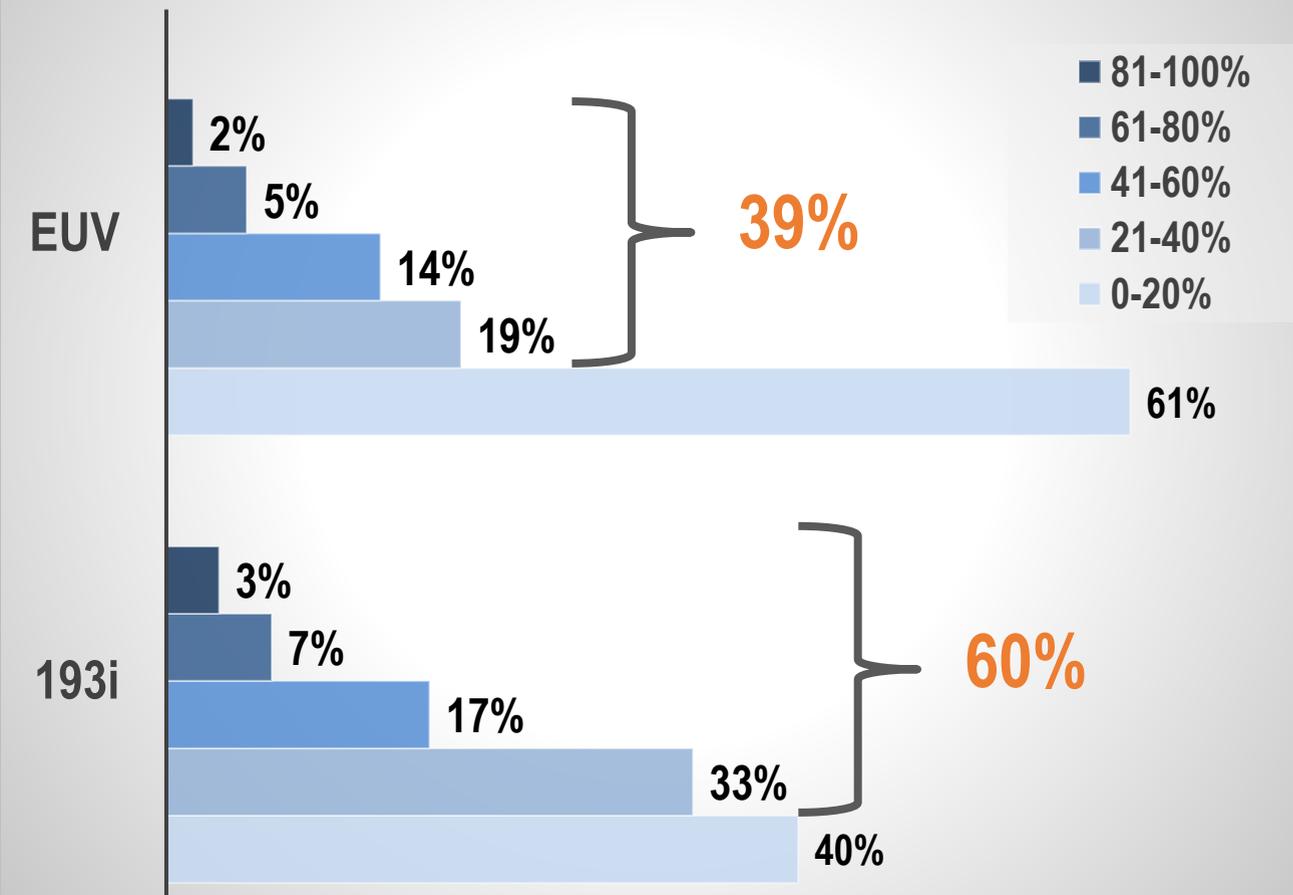
Highest %

Among the 193i or EUV masks used in high volume manufacturing in 2023, what do you expect will be the highest percentage of curvilinear shapes on any given mask? (Curvilinear shapes can be piecewise linear polygons of some resolution, or spline-like form)



Average %

Among the 193i or EUV masks used in high volume manufacturing in 2023 that contain curvilinear features, what do you expect will be the average percentage of curvilinear shapes for such masks?

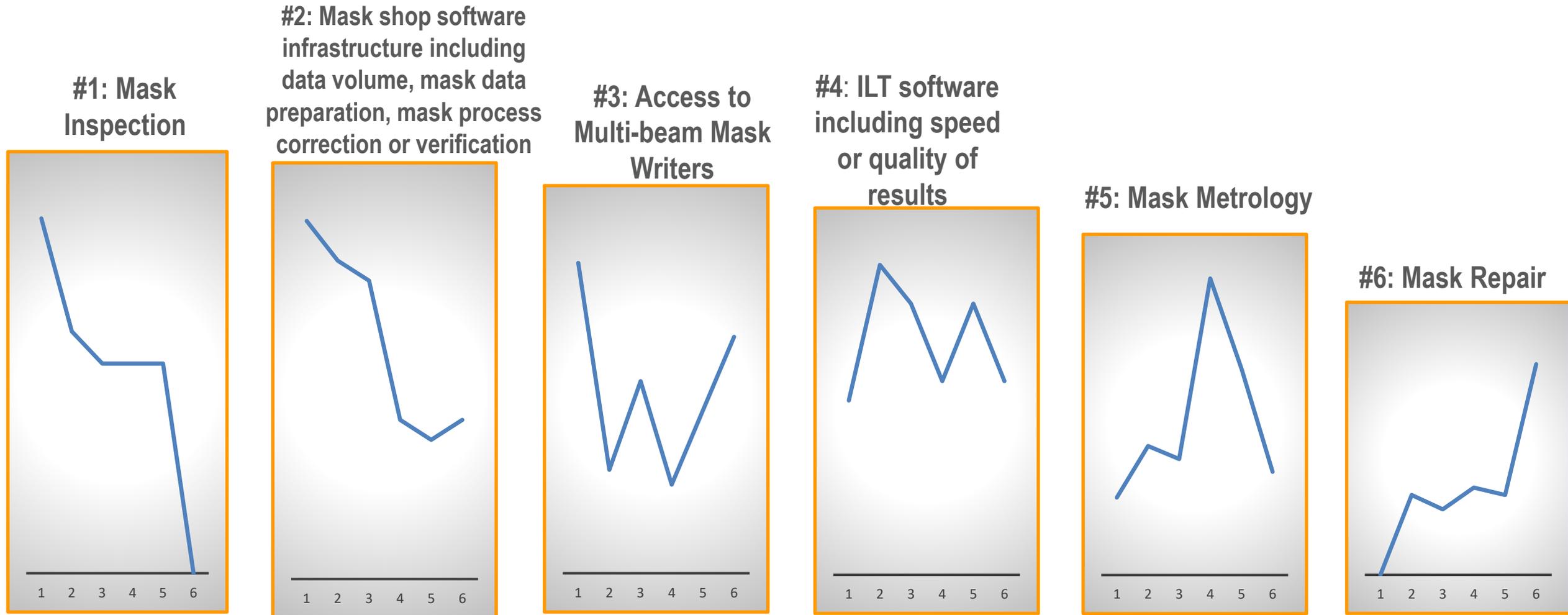


Inspection, Infrastructure Top Curvilinear Concerns

Survey participants ranked six biggest curvilinear mask concerns



Please rank your biggest concerns in producing curvilinear masks n=81



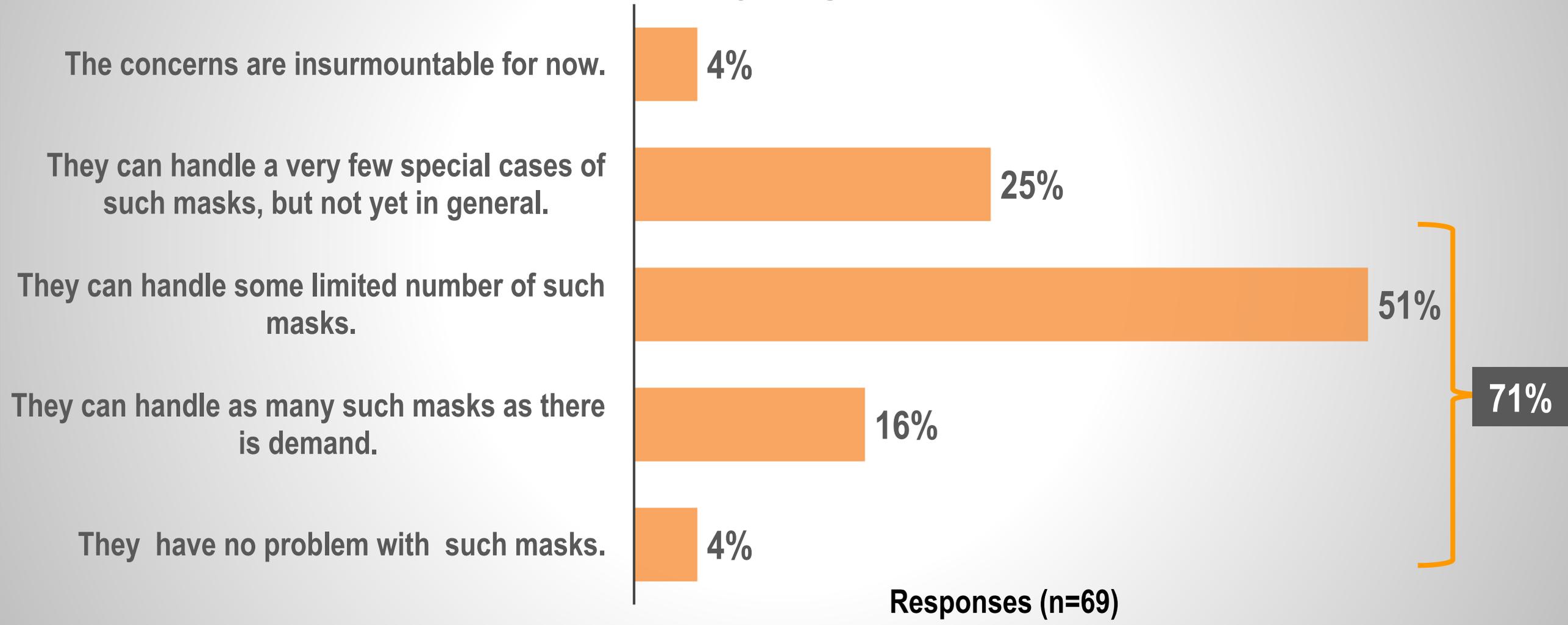
Note: 1-6 on X-axis indicate # of respondents that ranked that question as that ordinal number with 1 = highest

Only 4% Say Curvilinear Concerns Insurmountable

71% say LE mask shops can handle at least limited number



Are the concerns in HVM of masks containing curvilinear features insurmountable for the leading-edge mask shops by end of 2022? Please select the statement you agree with most.



Luminaries Say Mask Revenue to Increase in 2021



- **Sentiment that mask revenue is increasing grew stronger**
- **Mask writer purchasing sentiment increased for Lasers and VSB machines while Multi-Beam remains high**
- **Luminaries' confidence in curvilinear mask making is high**

**Thank you to those who participated
in the survey!**

Luminaries survey results available on www.ebeam.org