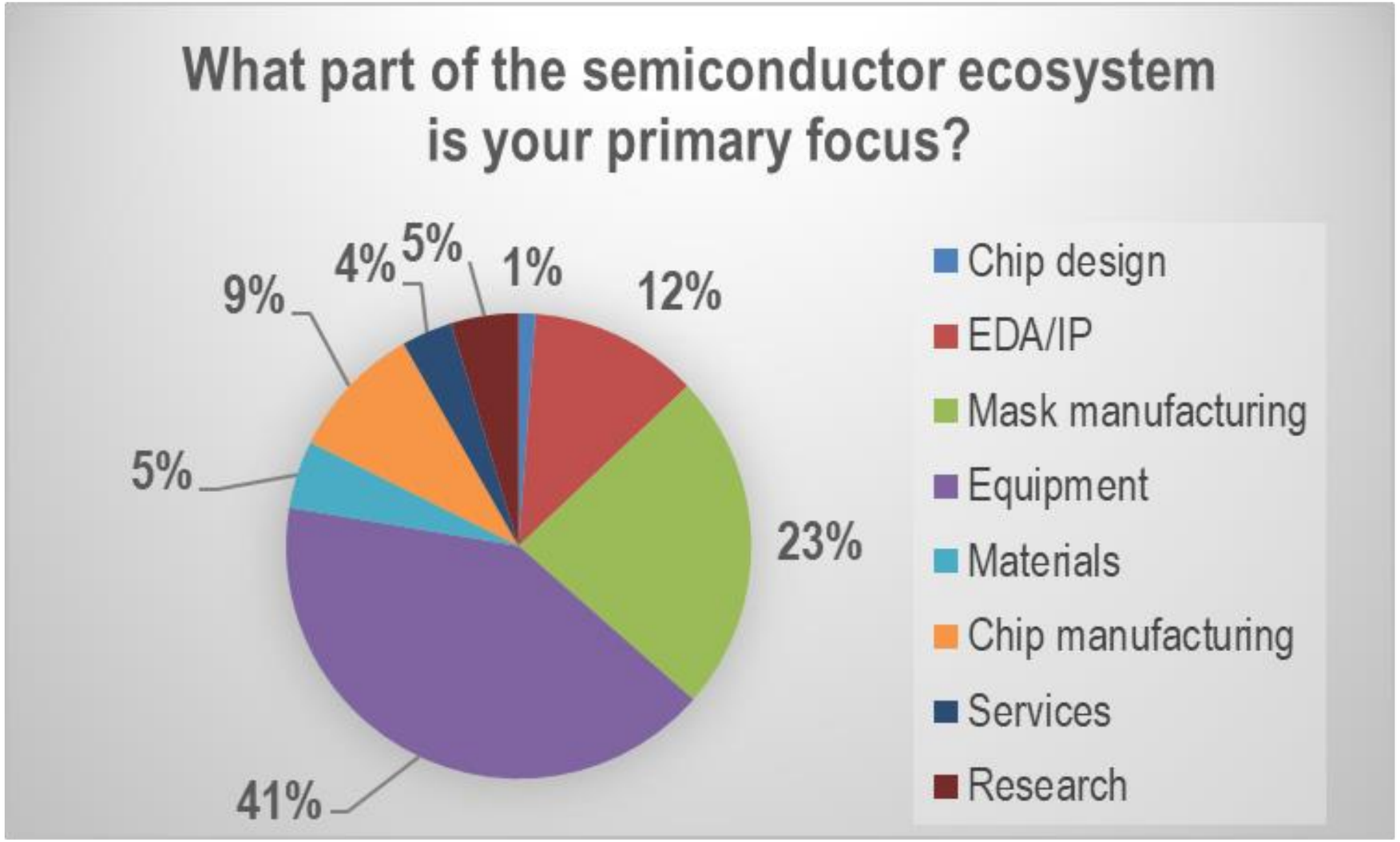

eBeam
Initiative

85 Luminaries Participated in the 12th Annual Survey

Representing 47 different companies in July 2023



Luminaries Confident in High-NA EUV and Curvilinear Masks

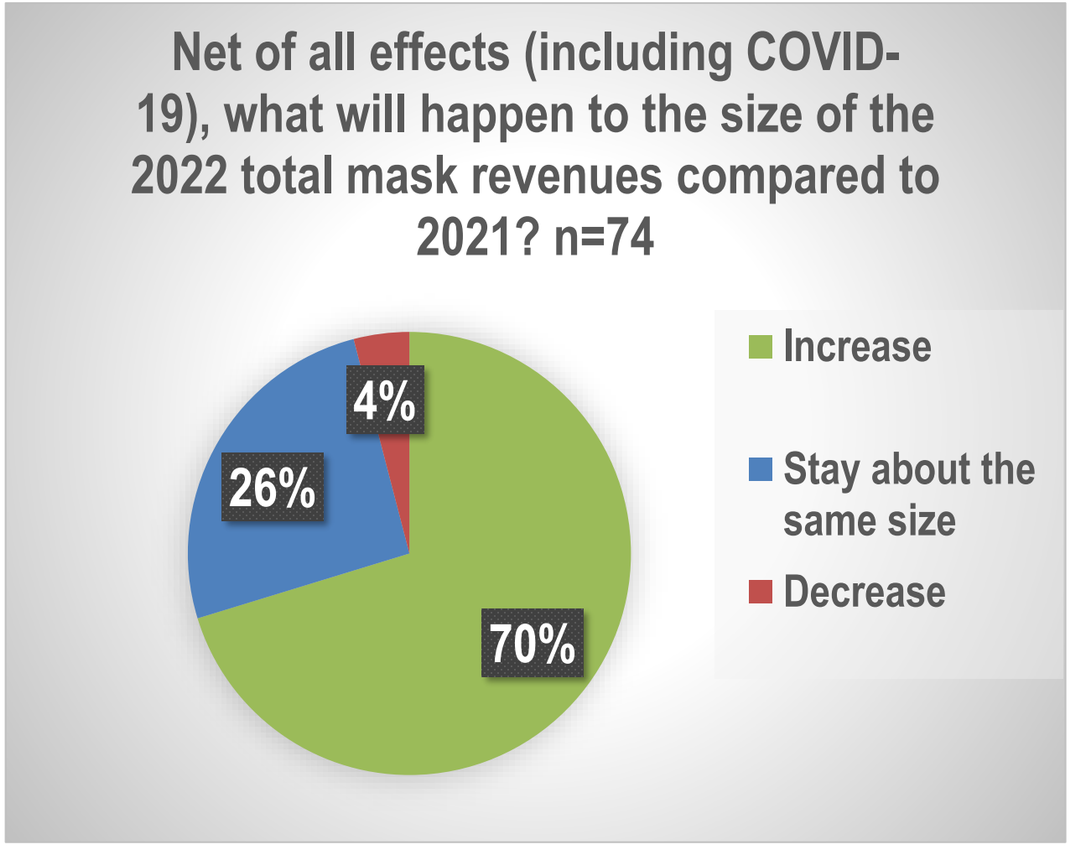
12th Annual Luminaries Survey - July 2023

- Luminaries remain confident in broad High-NA EUV adoption by 2028
- Confidence doubled in leading-edge mask shops handling curvilinear mask demand
- Curvilinear masks aren’t just for EUV
- Luminaries are more confident about 2023 mask revenues than SEMI

83% Say 2023 Mask Revenues Increase or Stay the Same

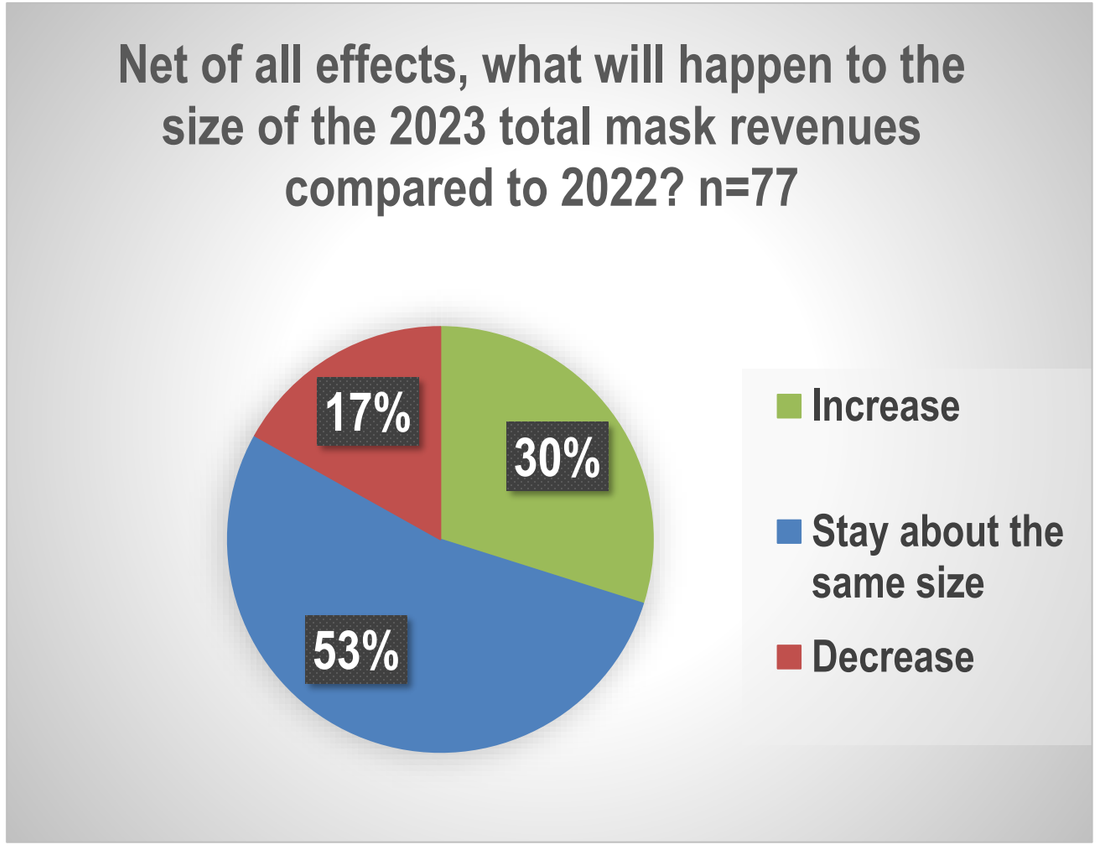
While SEMI predicts a 3% contraction for 2023

2022 Survey Result



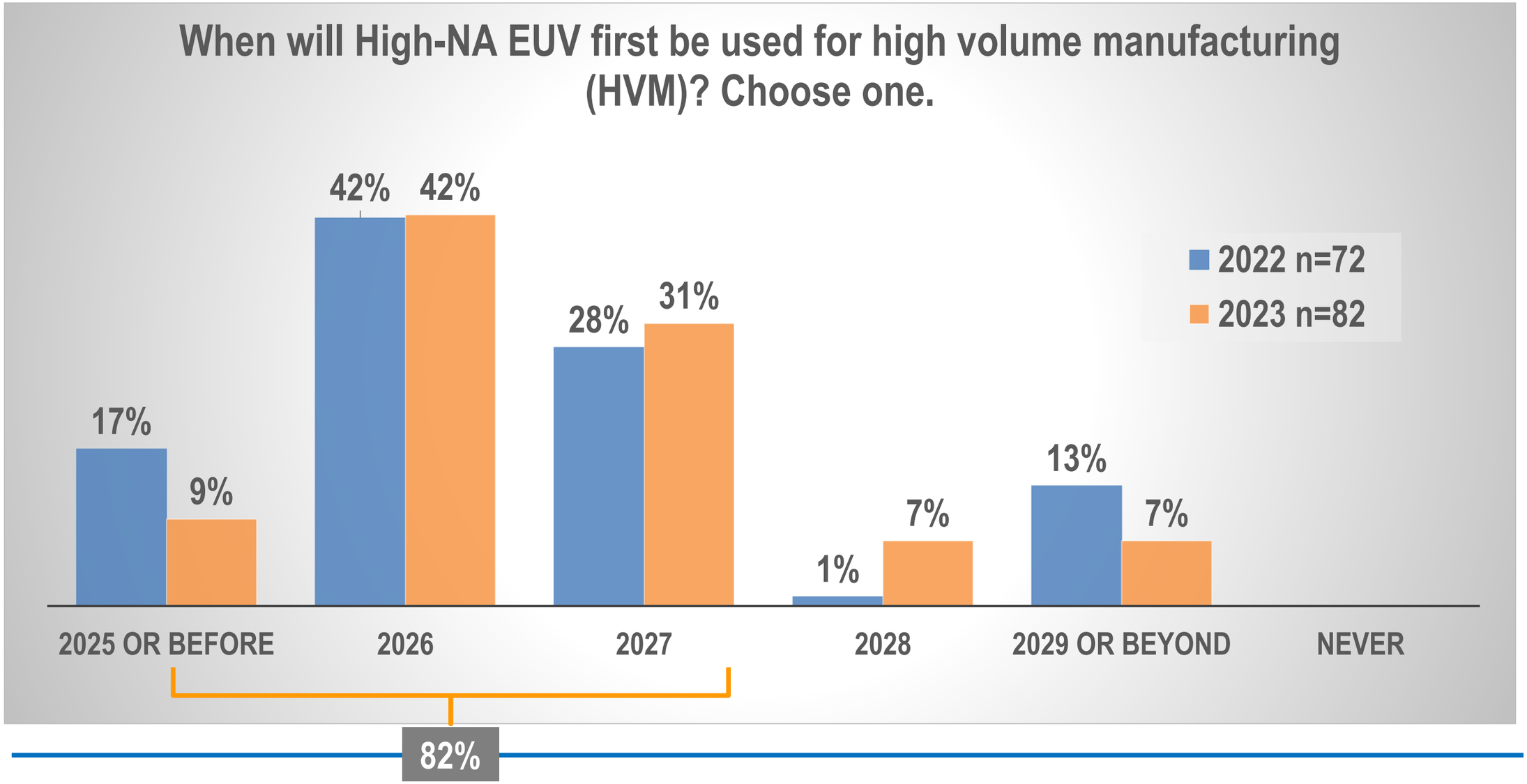
2023 Survey Result

According to SEMI's 2022 Photomask Characterization Study, the worldwide semiconductor photomask market achieved its tenth consecutive year of growth in 2022 amounting to $5.5 billion. A contraction of 3% is projected by SEMI in 2023 due to the macroeconomic headwinds and the overall semiconductor industry slowdown.



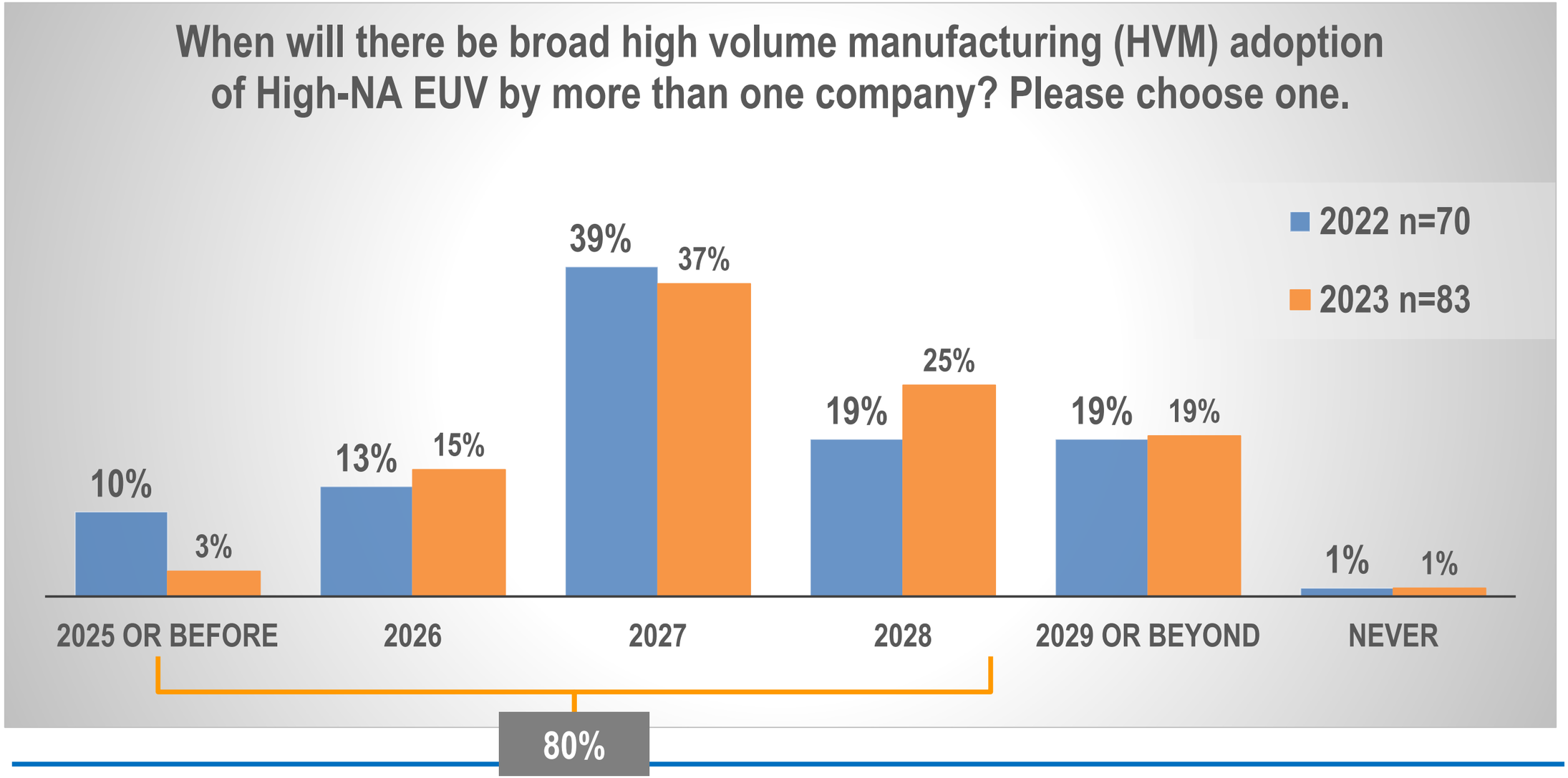
82% Predict High-NA EUV First HVM Usage by 2027

Similar to last year

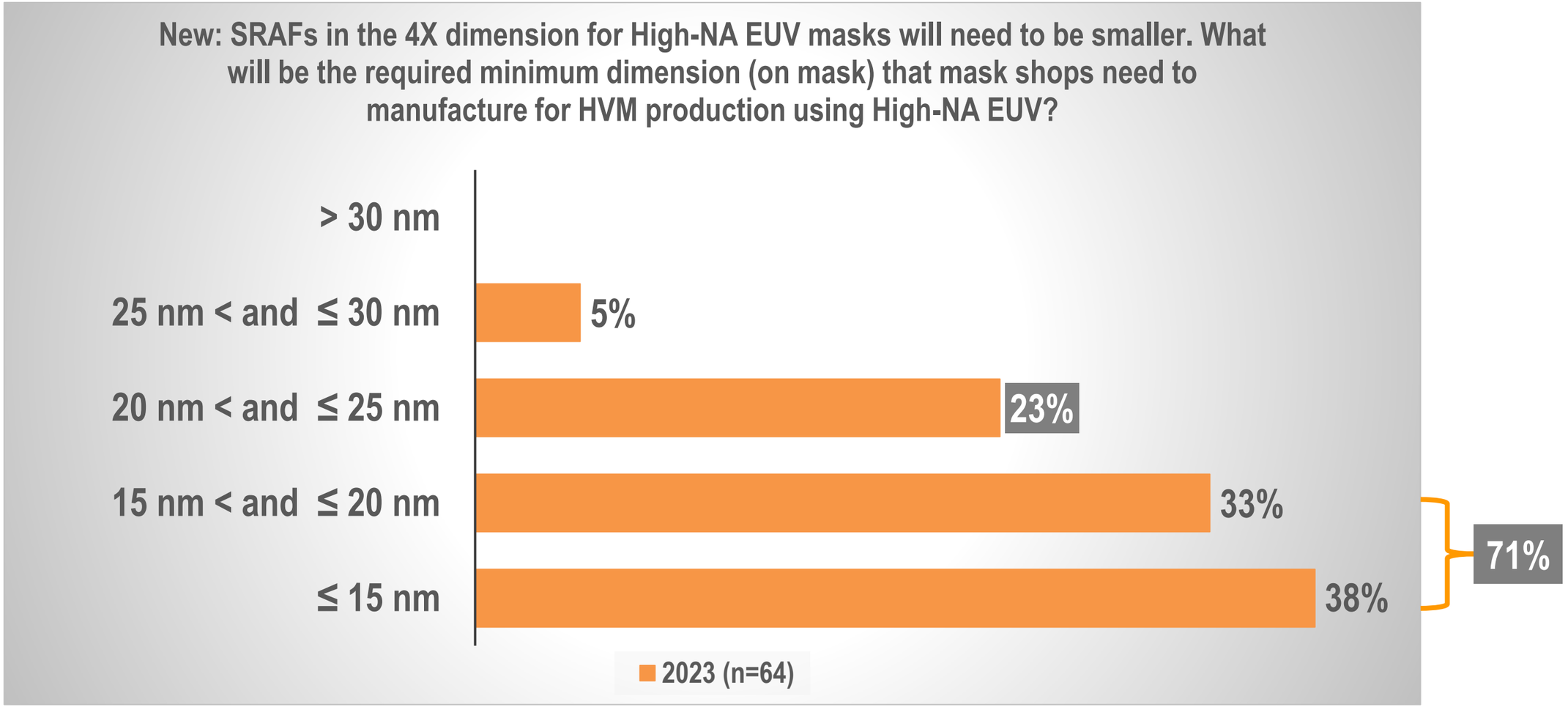


Broad High-NA EUV Adoption to Ramp Up by 2028

80% say by 2028 or before, same as last year

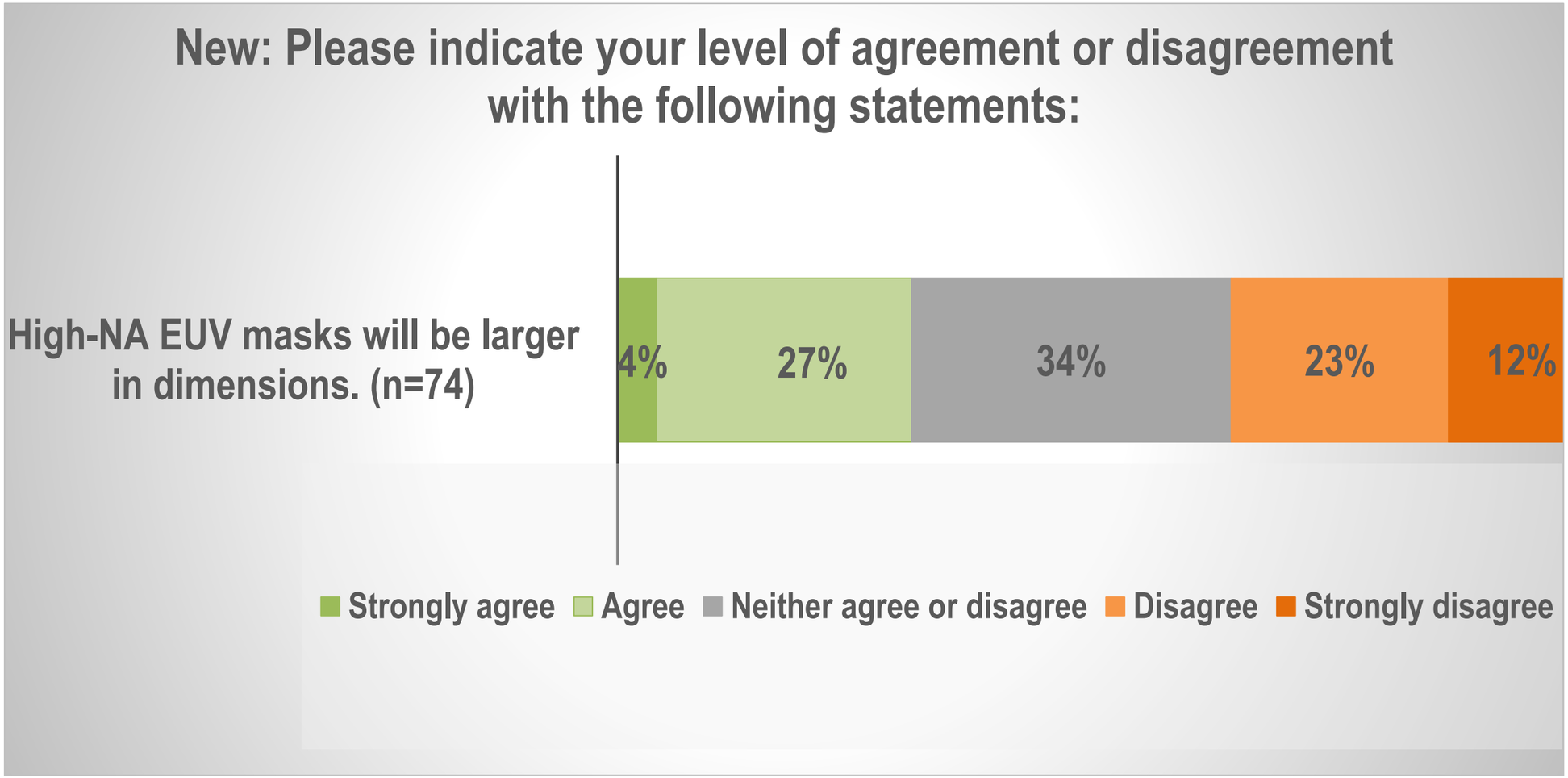


71% Say Min Mask Dimension for High-NA EUV ≤20nm



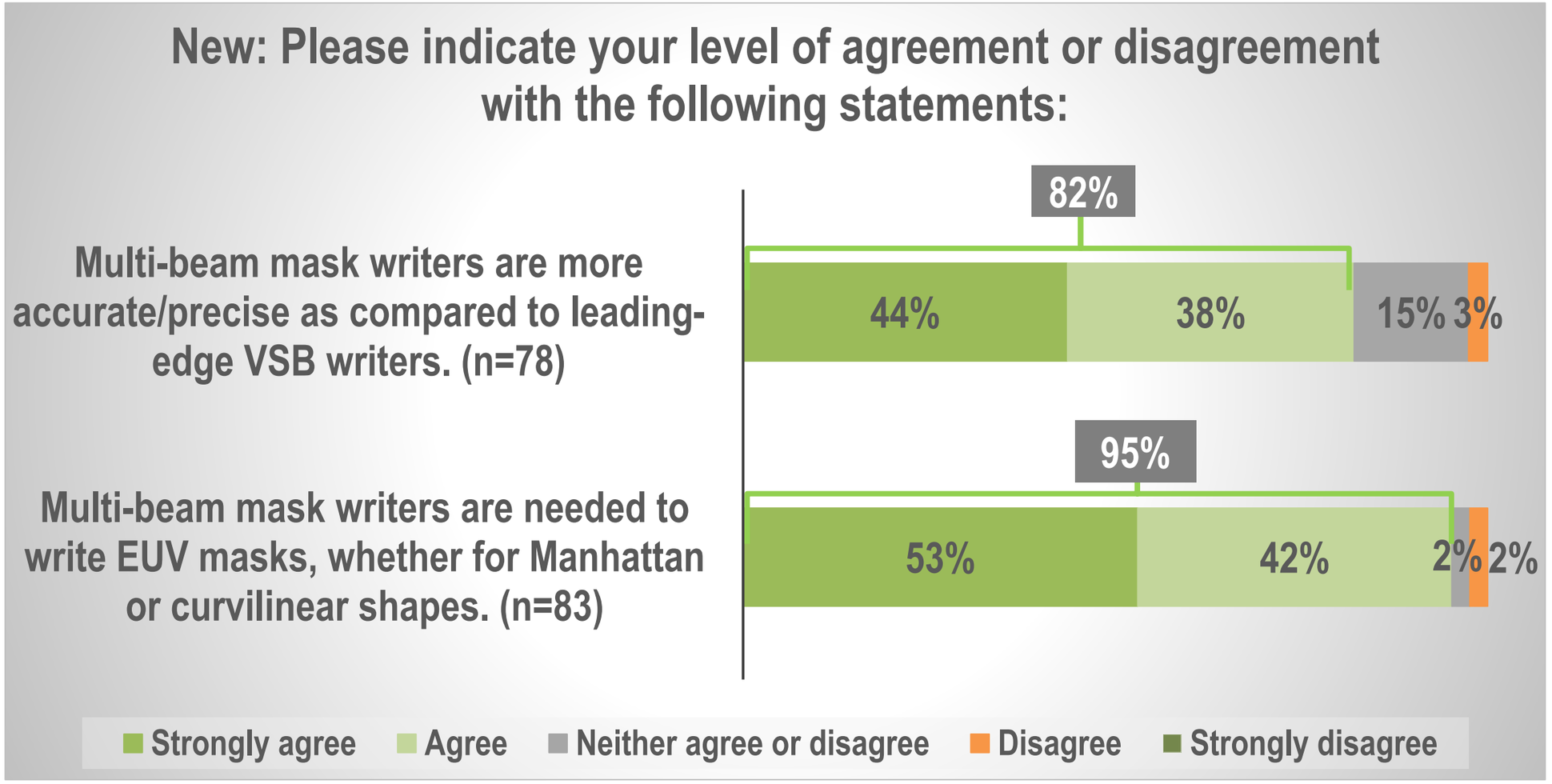
No Agreement on Larger High-NA EUV Mask Size

New question may have been confusing



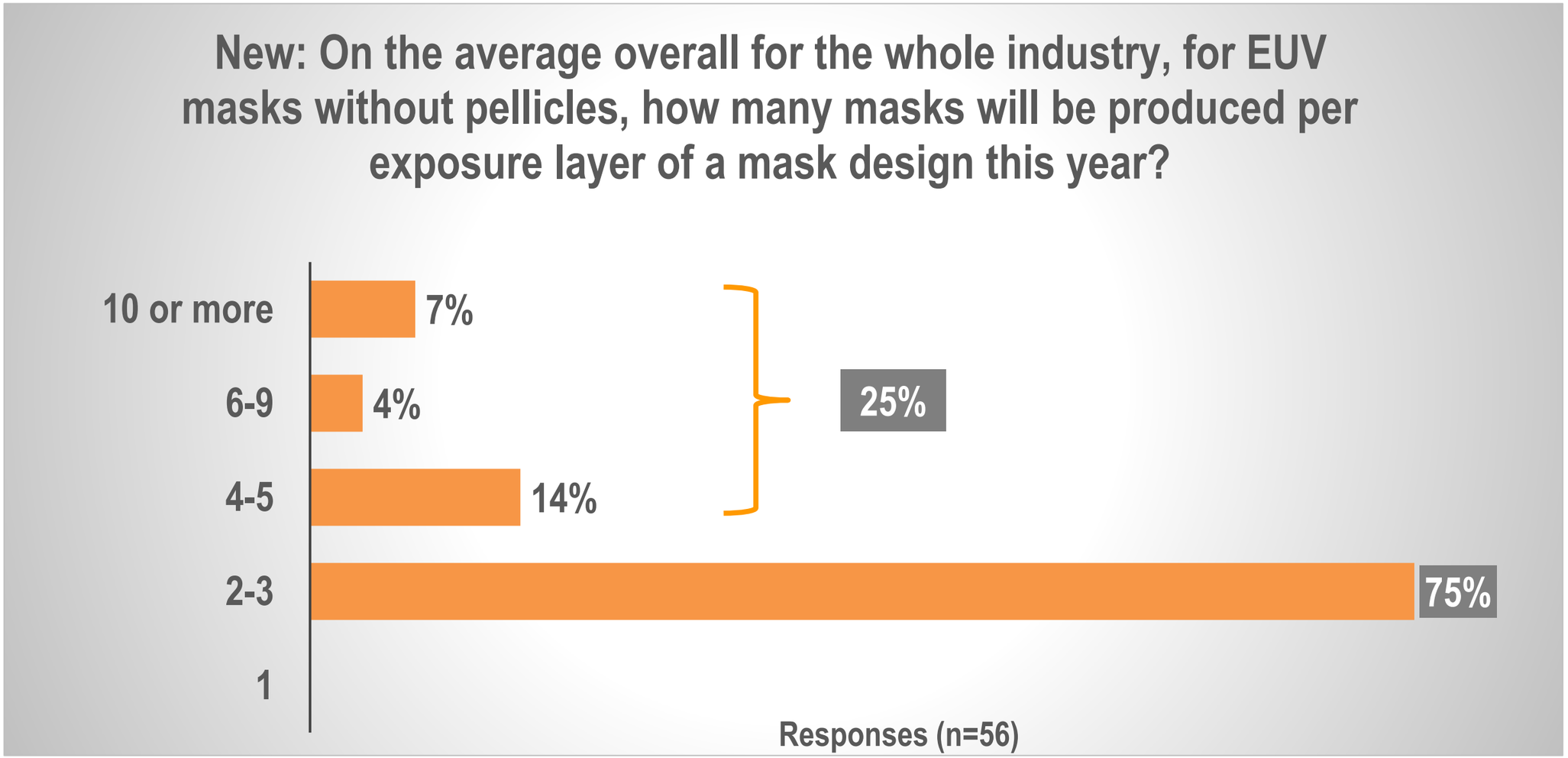
95% Agree Multi-Beam Mask Writers Needed for EUV

82% agree they are more accurate/precise vs leading-edge VSB



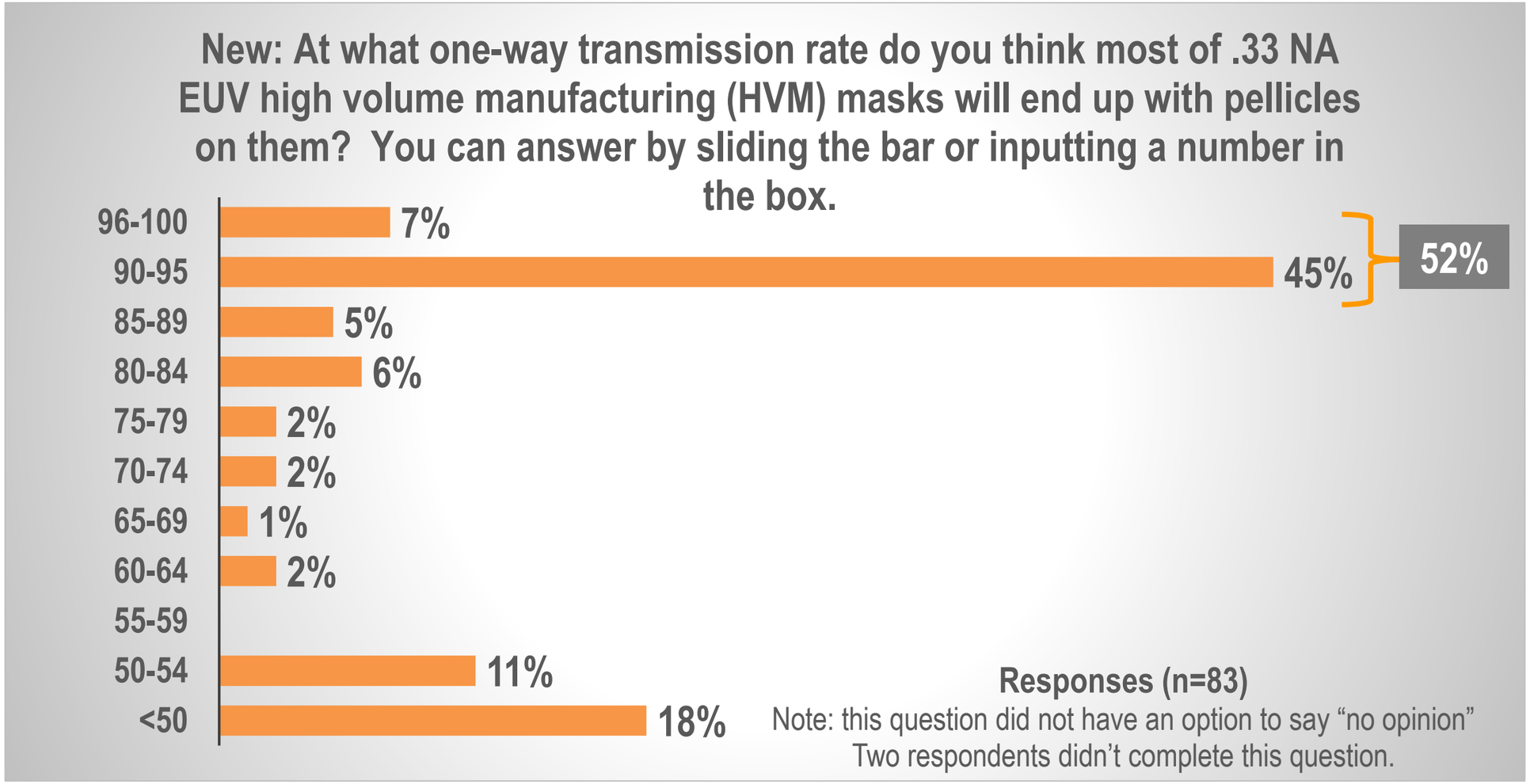
75% Say 2-3 EUV Masks Needed If No Pellicle

25% think 4 or more, some much more



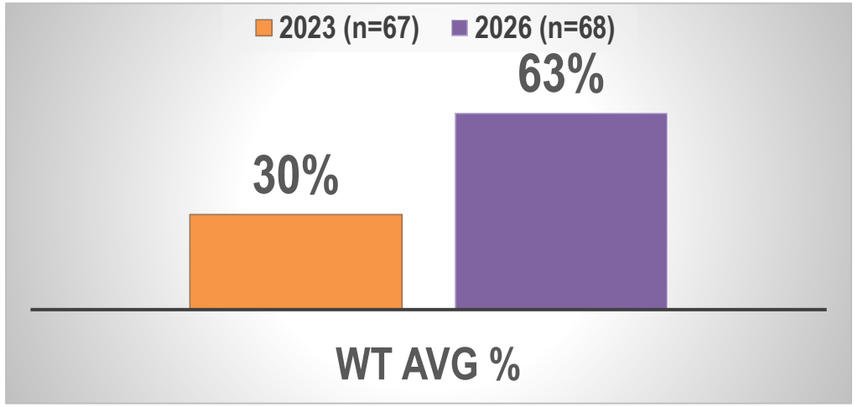
Half Say ≥ 90% Transmission Rate to Use EUV Pellicle

Wide range expressed by other half of respondents

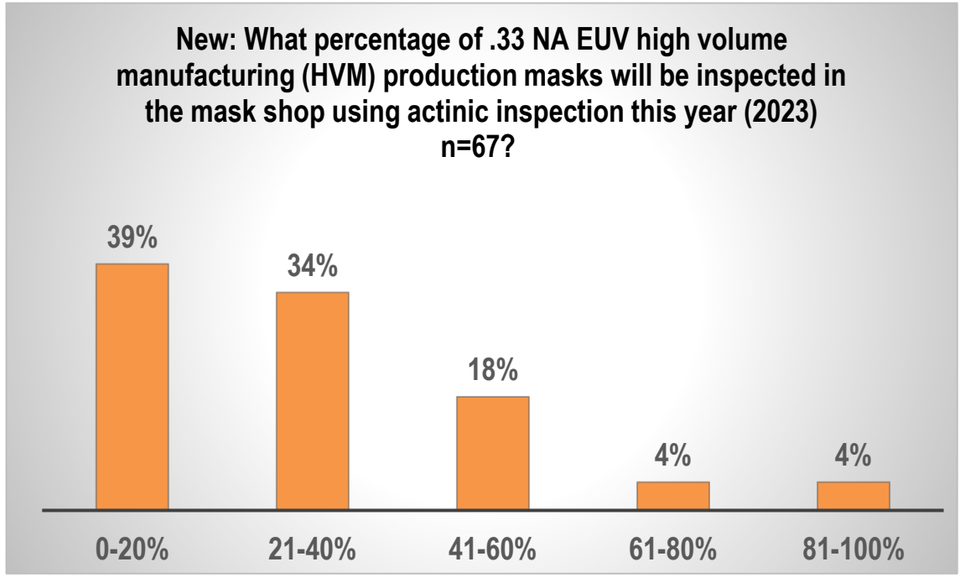


EUV Masks Inspected by Actinic to Double in 3 Years

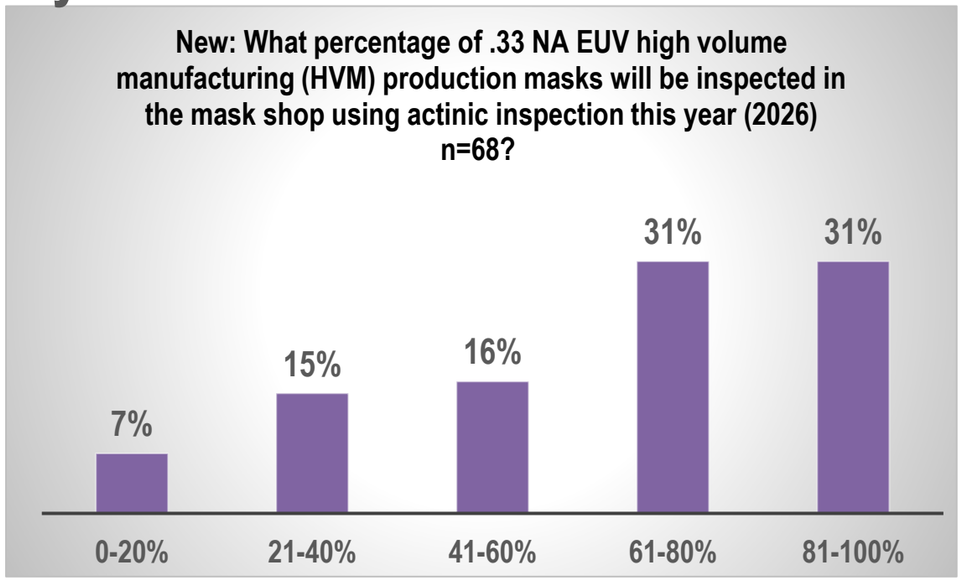
Survey says it will double to >60% by 2026



By 2023

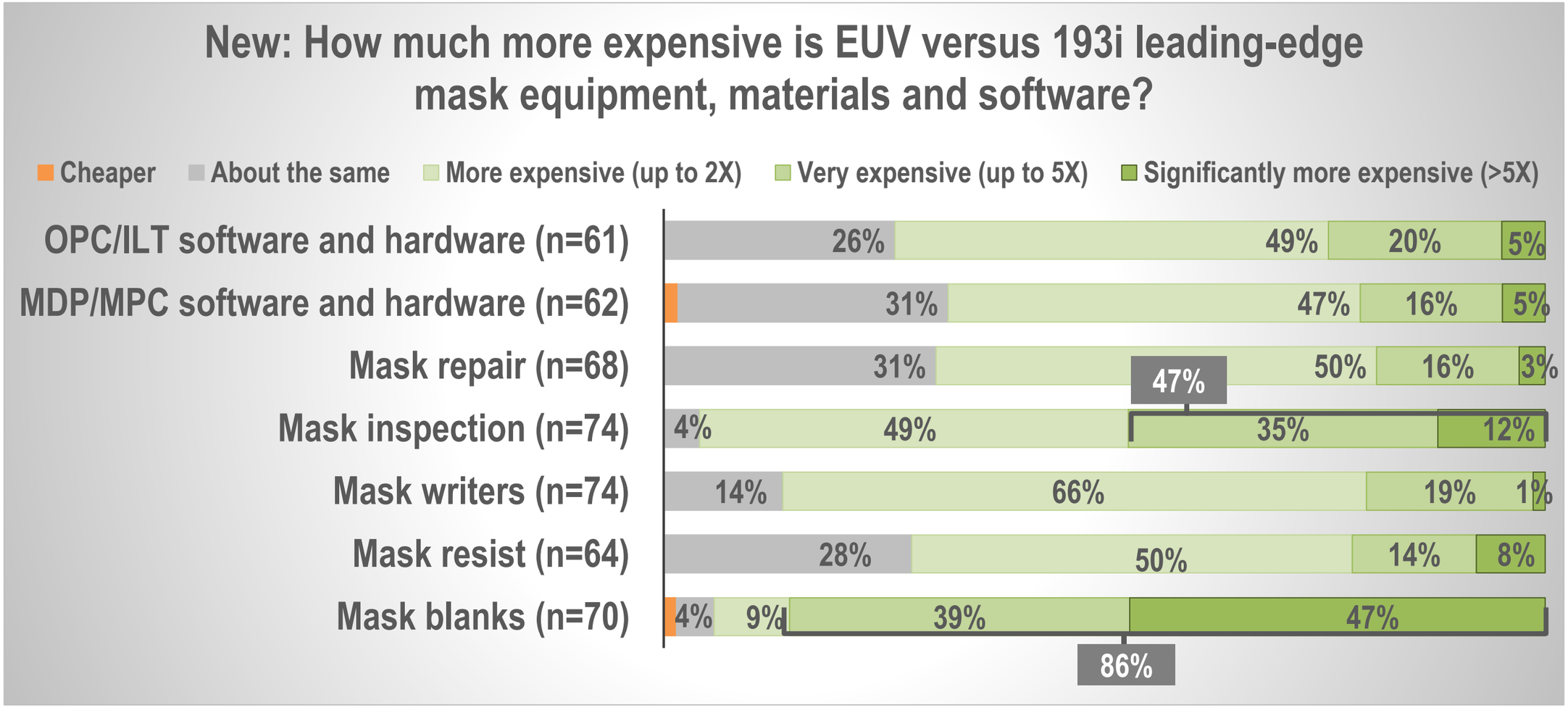


By 2026

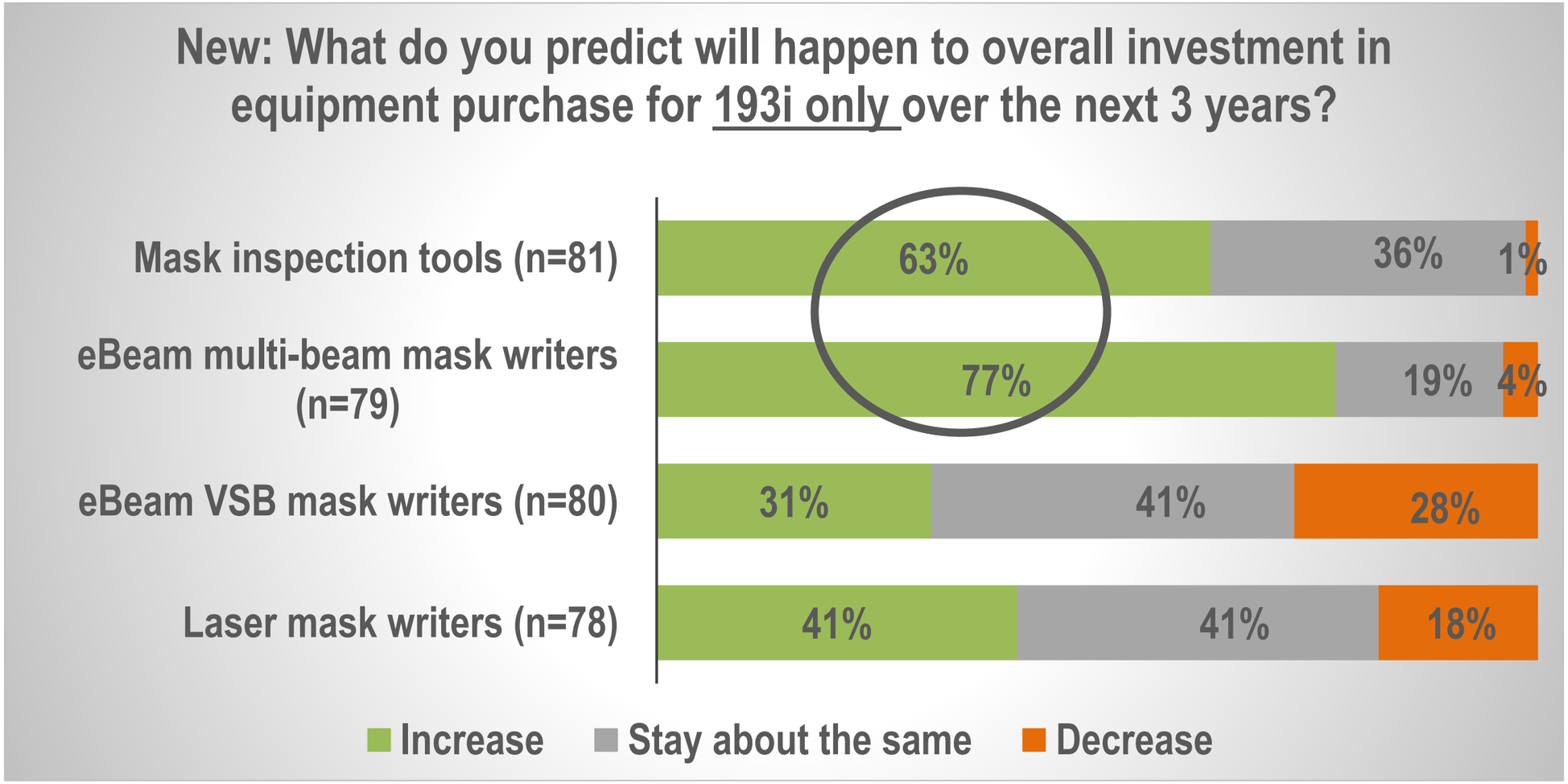


Majority Say All of EUV Mask Making is More Expensive

86% say EUV blanks, 47% say EUV inspection equipment >2X cost of 193i



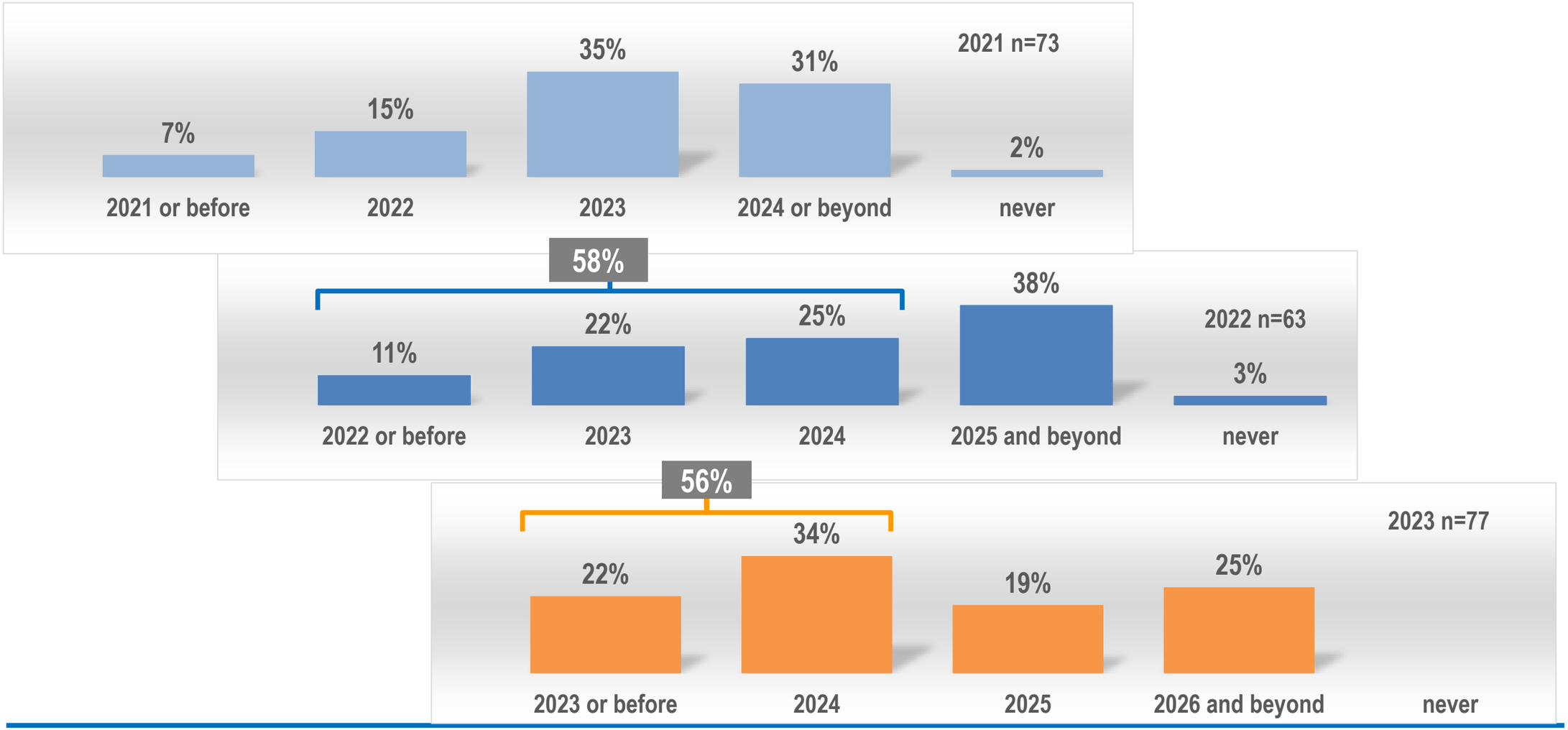
Mask Inspection and Multi-beam Mask Writer Investment Predicted to Increase for 193i



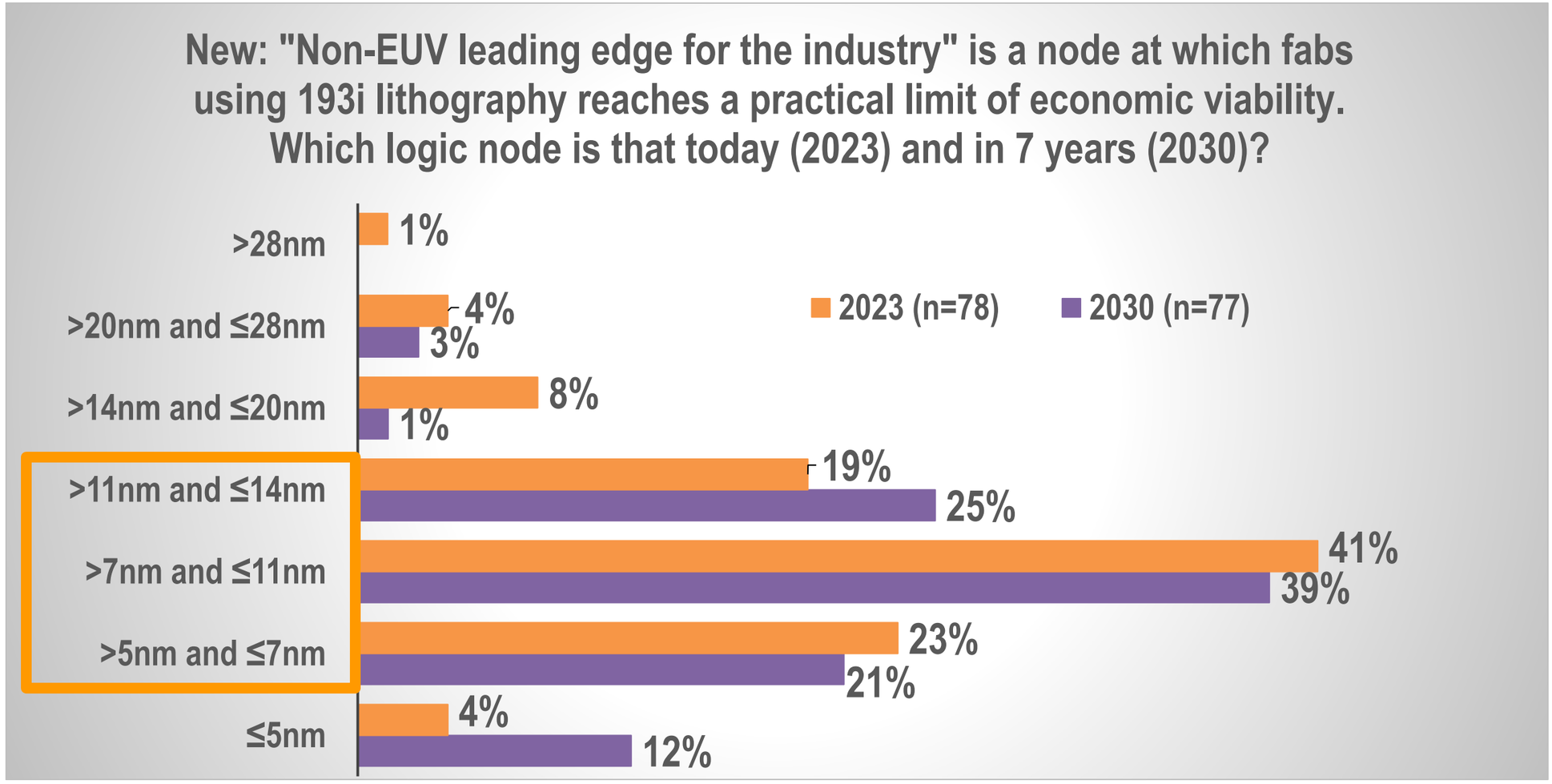
Deep Learning Perception No Longer Shifting Into Future

56% say 2024 or before this year and 58% last year

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

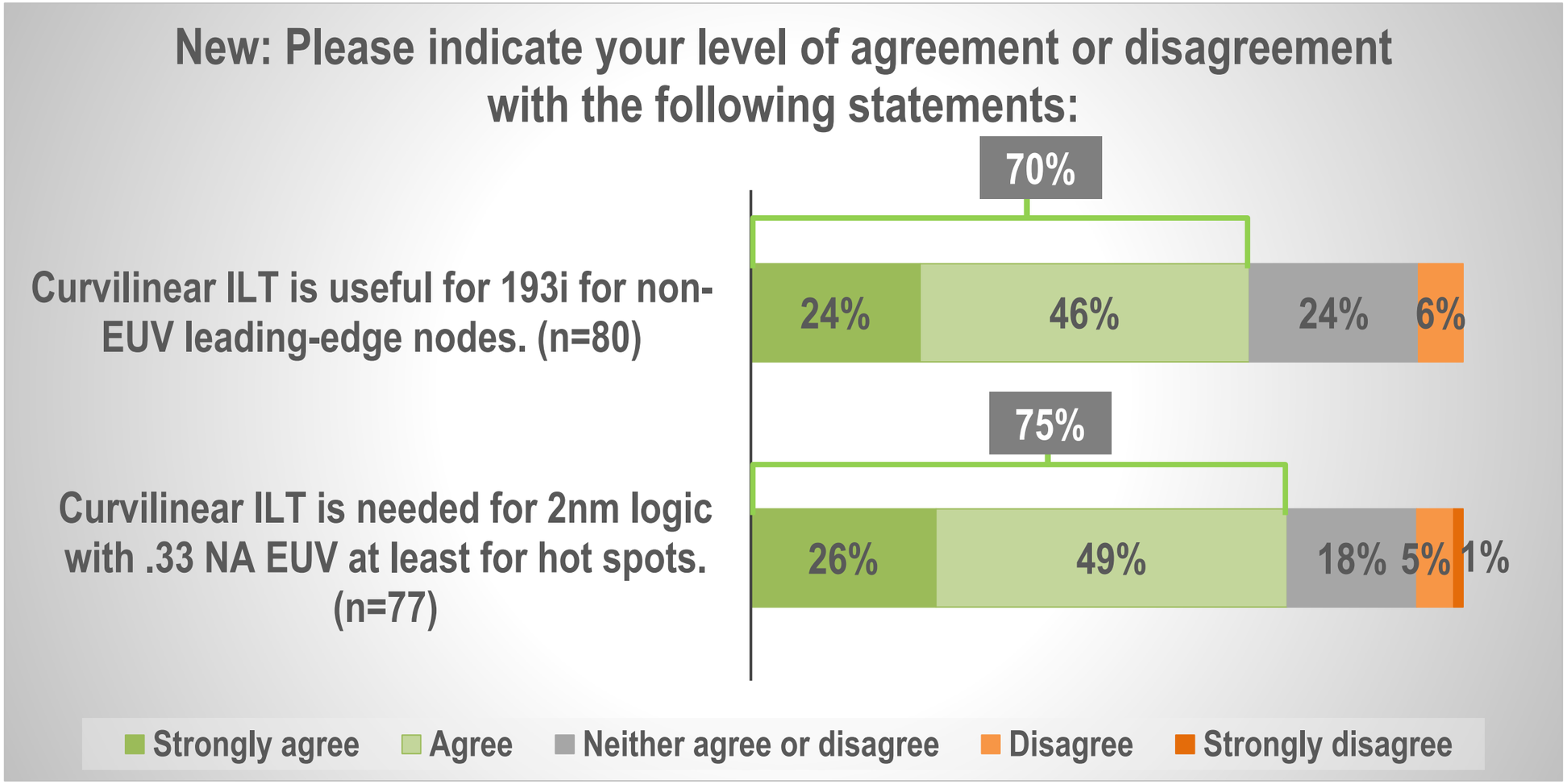


“Non-EUV Leading Edge” Node Ranges >5nm to ≤ 14nm



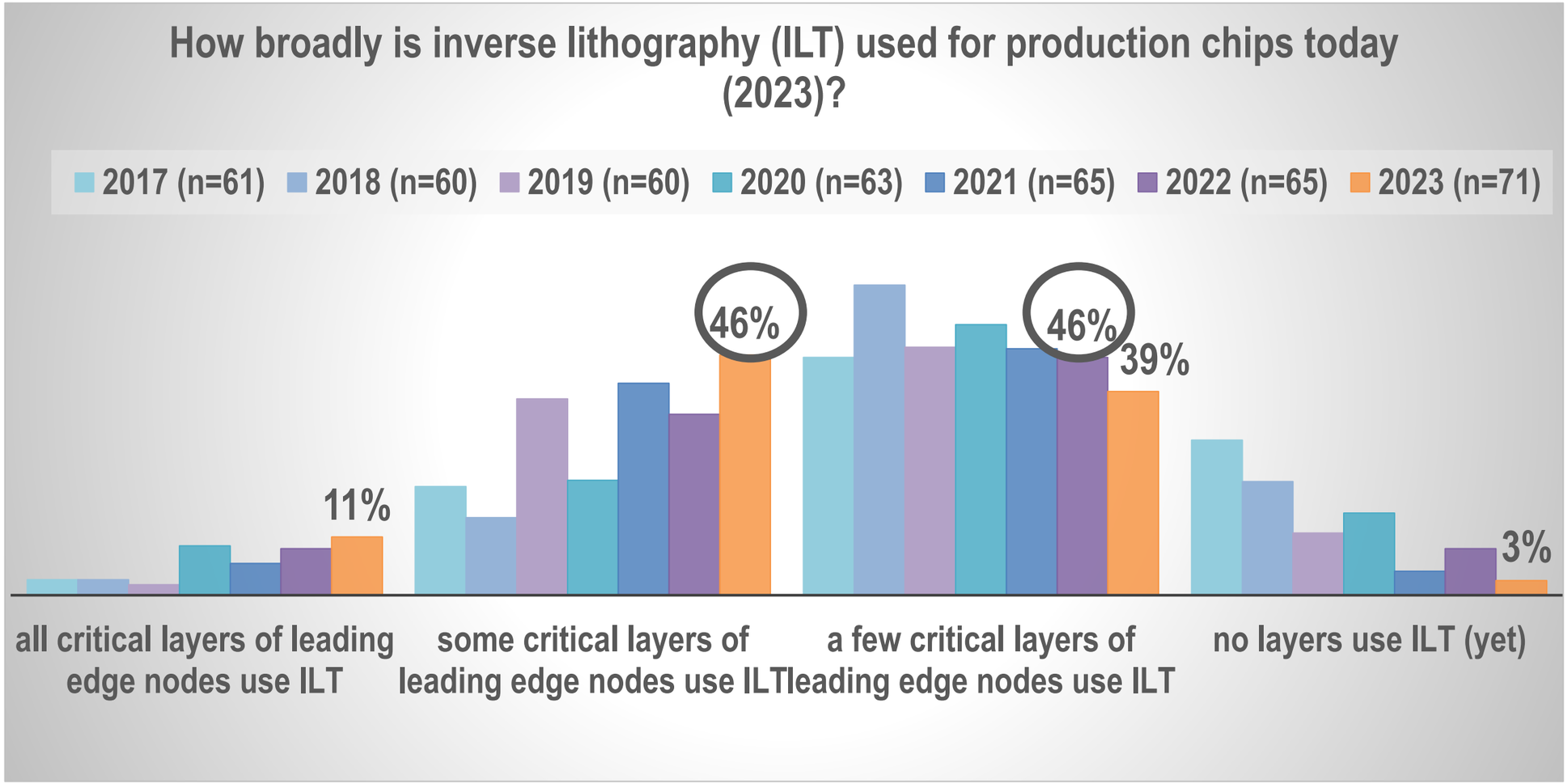
Survey Predicts Curvilinear ILT for 193i as well as EUV

70% agree useful for 193i, 75% agree needed for 2nm .33 NA EUV



Survey Trend is Towards More Critical Layers Using ILT

46% say “some critical layers” in 2023 vs 46% said a “few” in 2022



No Major Change in Curvilinear Mask Making Concerns

Please rank your biggest concerns in producing masks with curvilinear* shapes. n≥71

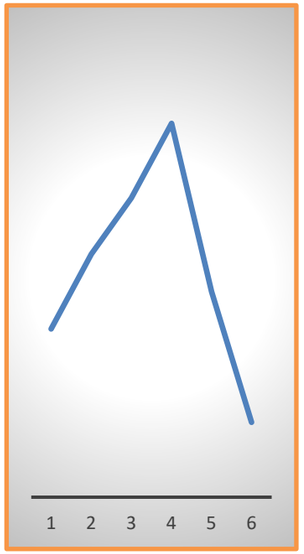
#1: Mask shop software infrastructure

N/A=14%

#2: Mask Inspection

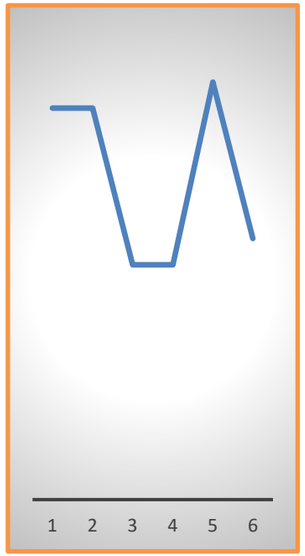
N/A=13%

#3: Mask Metrology



N/A=14%

#4: ILT software



N/A=13%

#5: Access to Multi-beam Mask Writers

N/A=16%

#6: Mask Repair

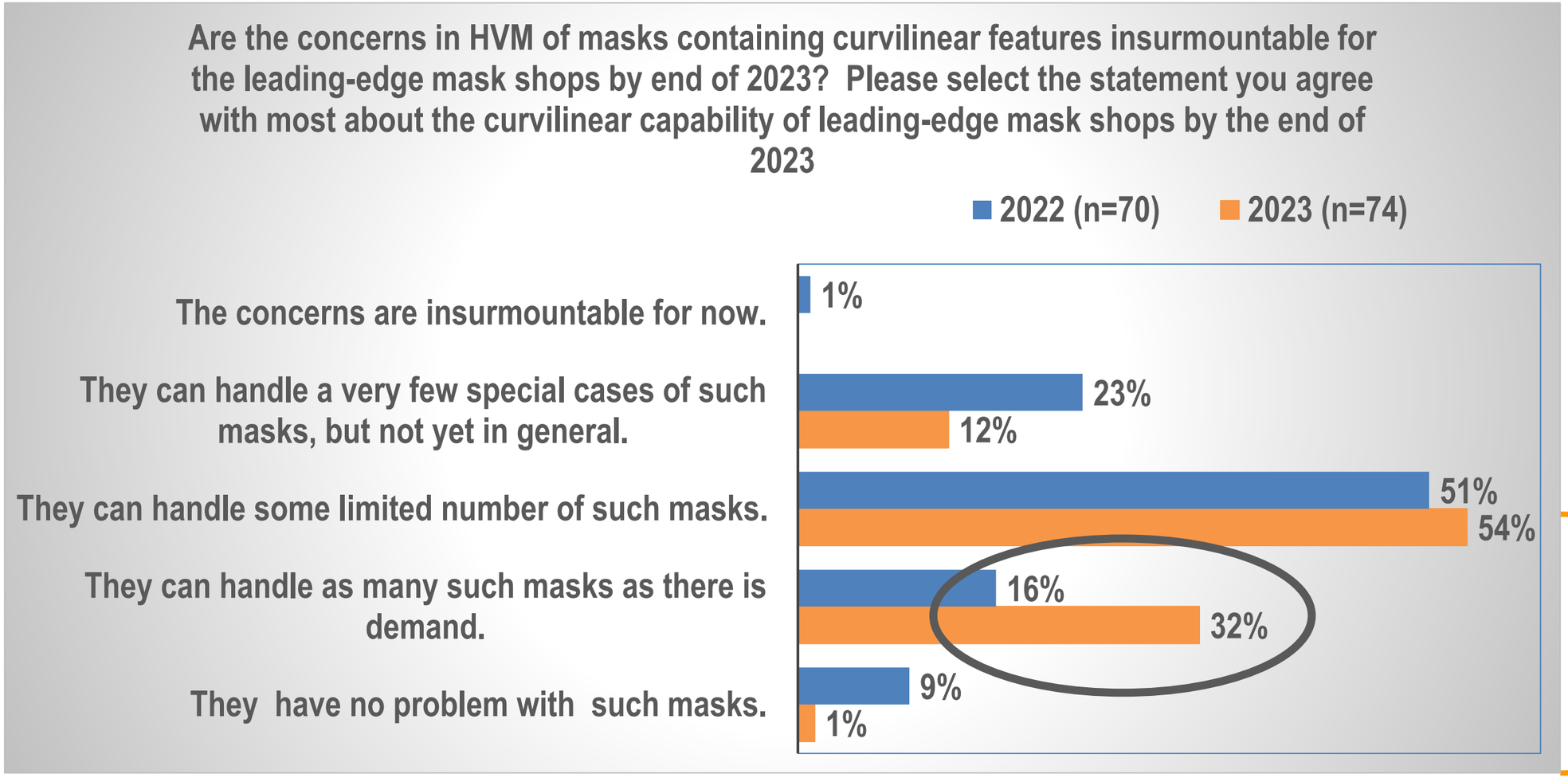
N/A=15%

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

* The survey question included "Curvilinear shapes can be piecewise linear polygons of some resolution, Bezier, B-spline or other curved-edge descriptions, but excludes shapes that only contain Manhattan or 45-degree straight edges."

Confidence Doubled in Handling Curvilinear Mask Demand

87% say leading-edge mask shops can handle at least limited number



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- **Luminaries remain confident in broad High-NA EUV adoption by 2028**: 80% of Luminaries surveyed say more than one company will adopt High-NA EUV by 2028, same as last year.
- **Confidence doubled in leading-edge mask shops handling curvilinear mask demand:** 32% said they can handle the demand vs 16% last year; while 87% of Luminaries say leading-edge mask shops can handle at least a limited number.
- **Curvilinear masks aren't just for EUV:** 70% of Luminaries say curvilinear masks are useful for non-EUV leading edge nodes.
- **Luminaries are more confident than SEMI about 2023 mask revenues:** 83% of Luminaries say 2023 mask revenues will increase (30%) or stay the same (53%) despite SEMI forecasting a contraction of 3%.

Thank you to those who participated in the survey!

Luminaries survey results available on www.ebeam.org