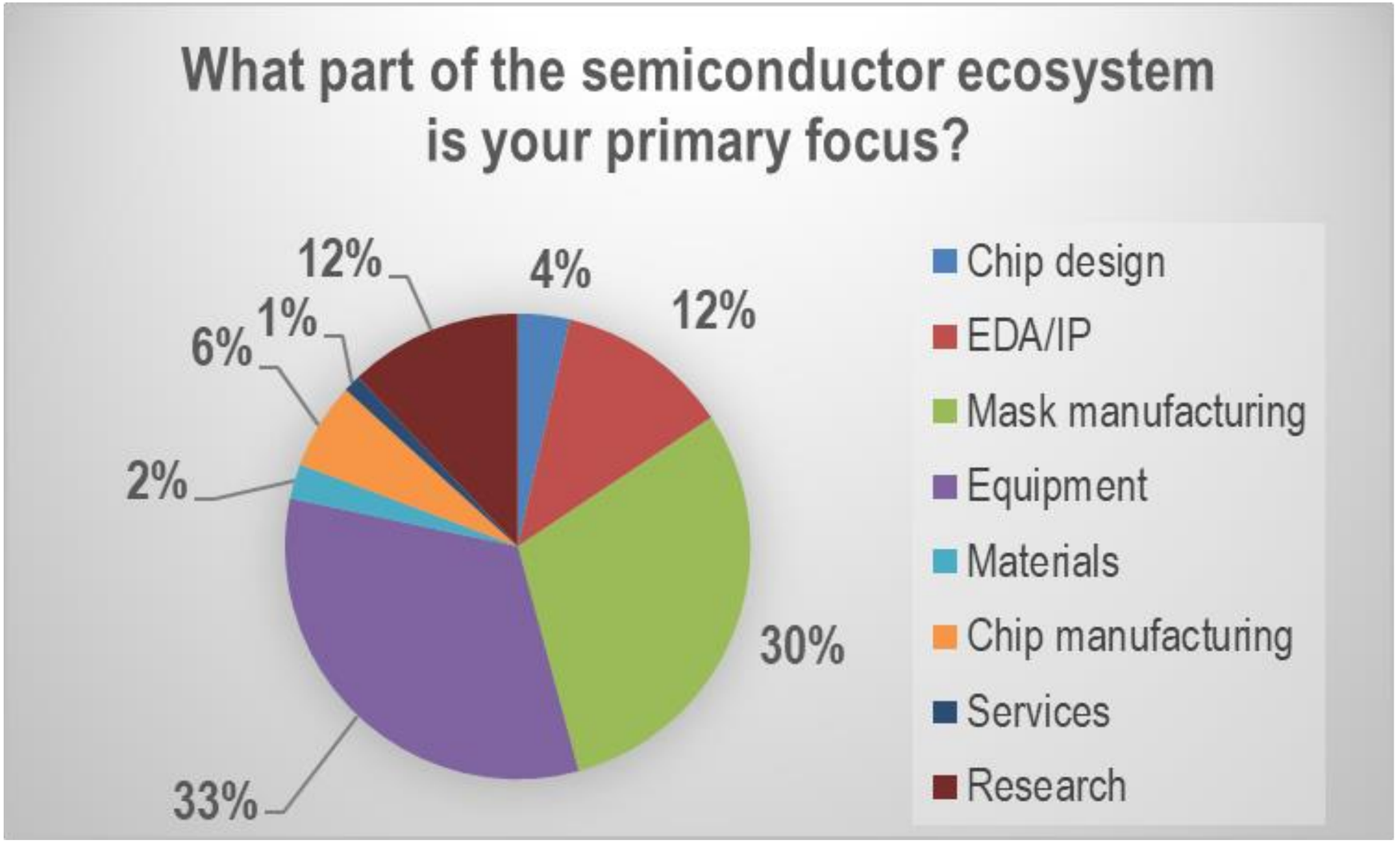
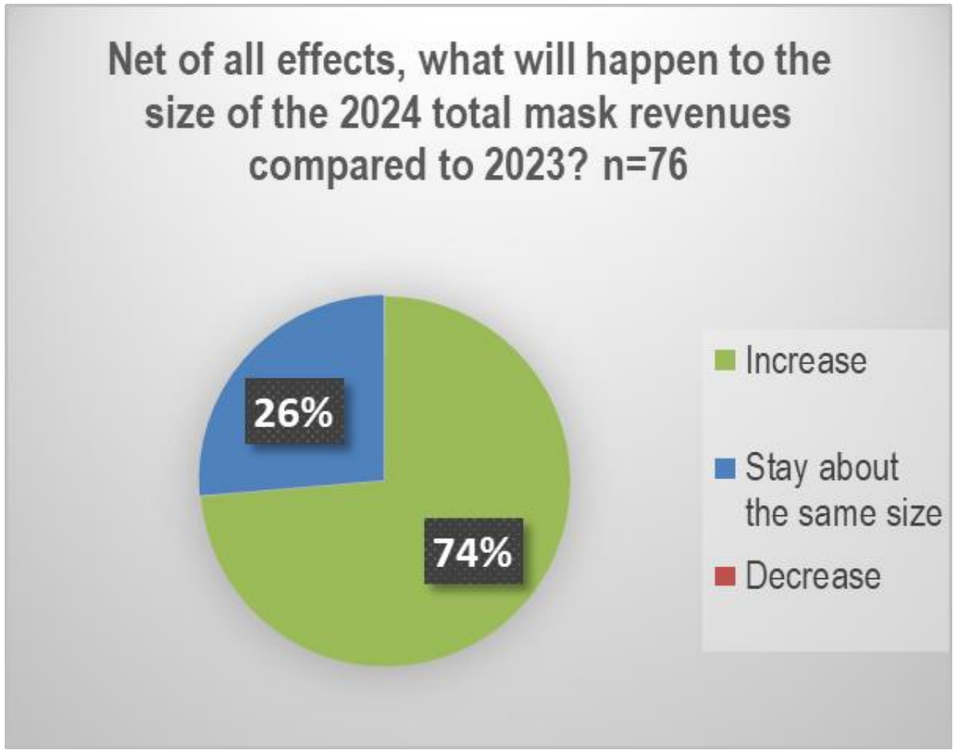
84 Luminaries Participated in the 13th Annual Survey

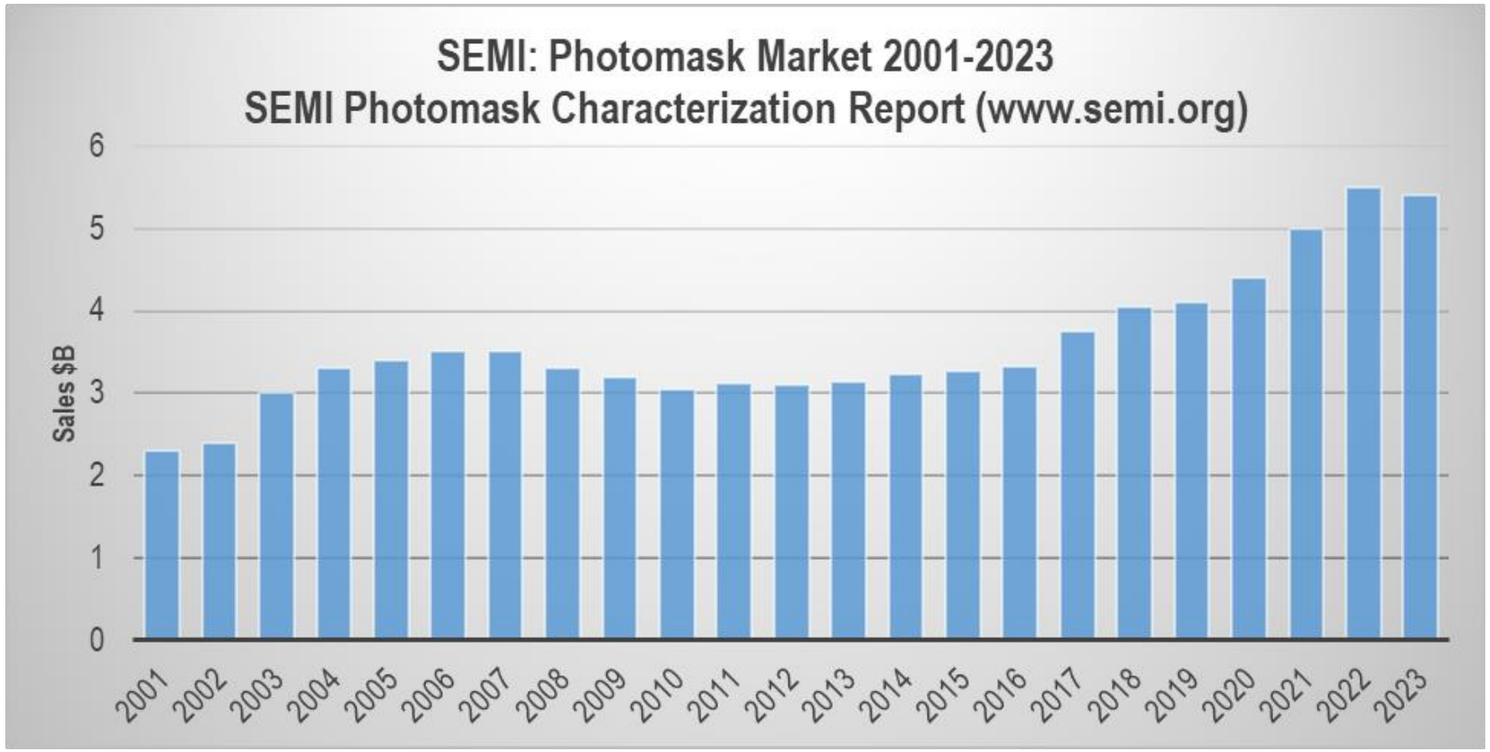
Representing 49 different companies in July 2024



74% Say 2024 Mask Revenues Will Increase Over 2023

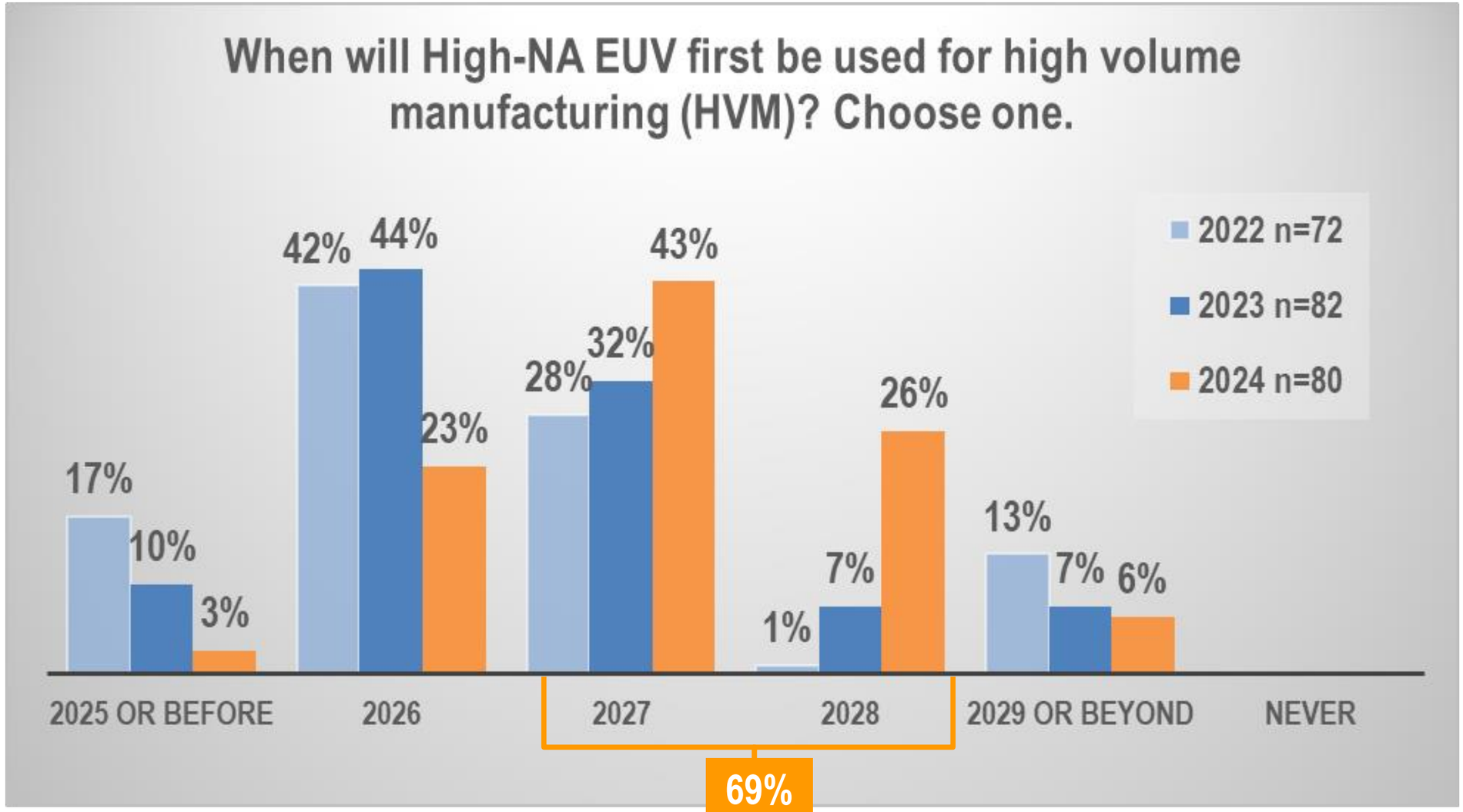
SEMI reported $5.4B for 2023 – 7.2% CAGR since 2016!





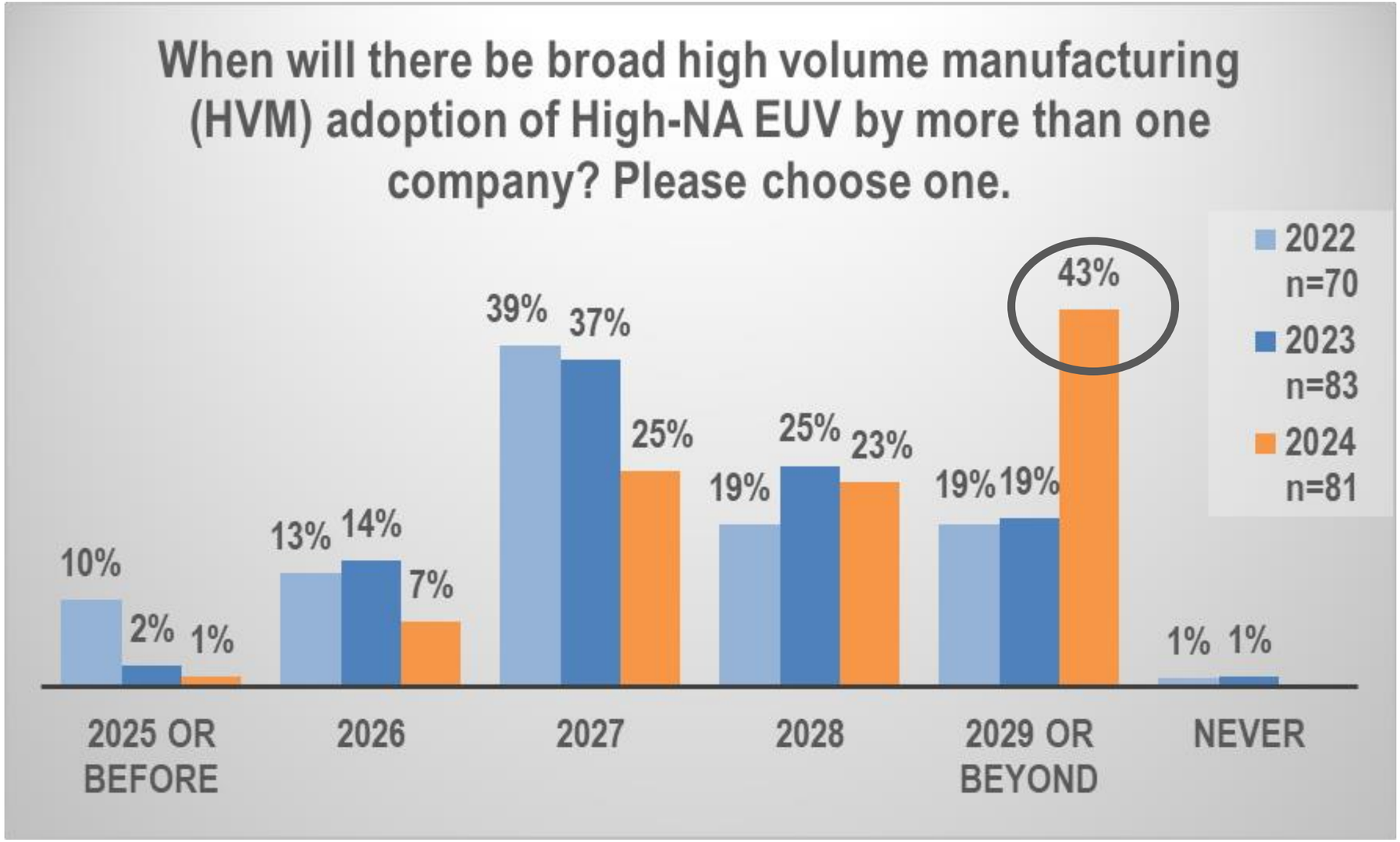
Opinion for High-NA EUV First HVM Usage is Clearer

69% of Luminaries say 2027 or 2028



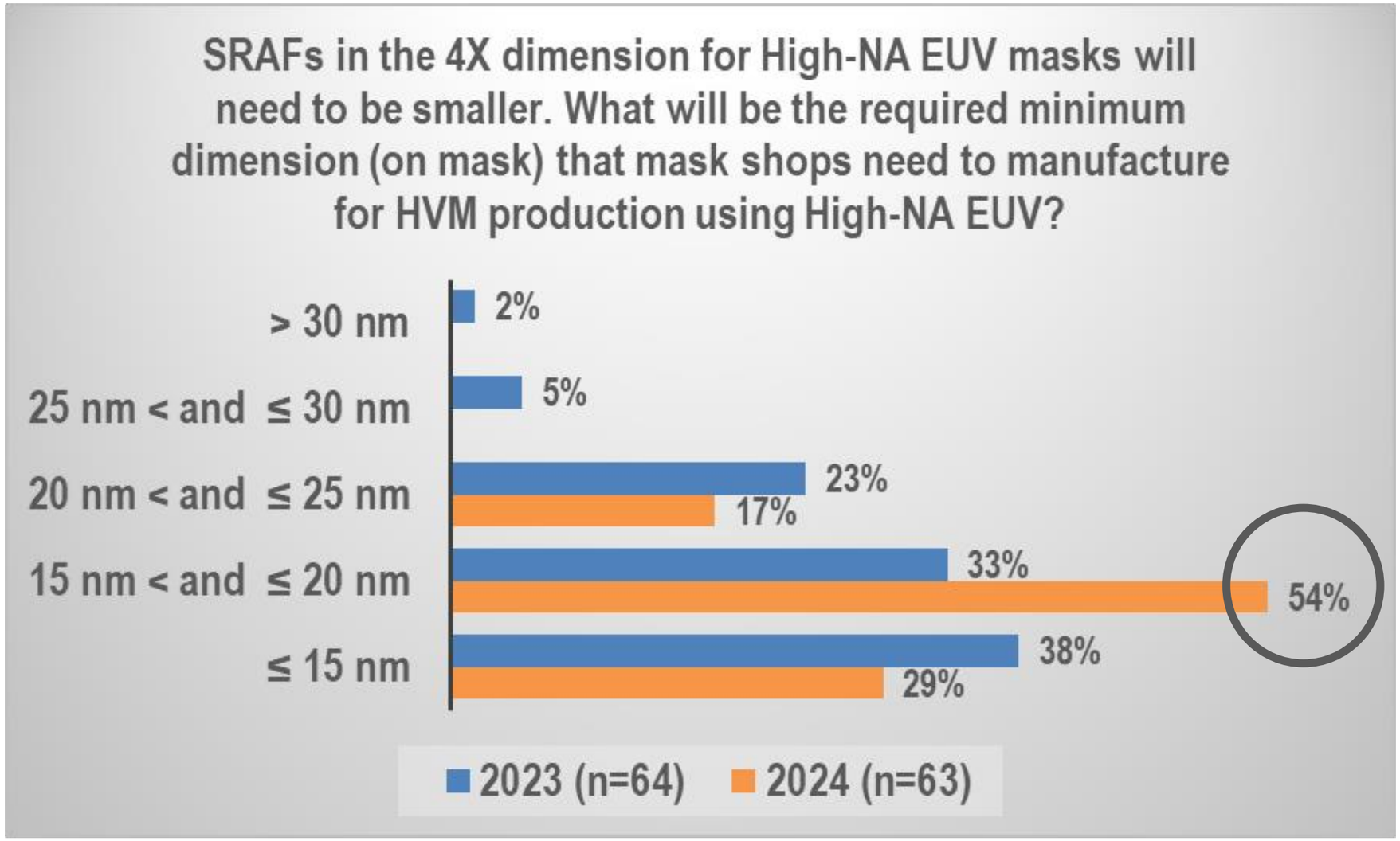
Estimates of High-NA EUV Broad Usage Shift to 2029 or Beyond

19% said that in 2023 and 43% in 2024, but no one says “never”



54% Say Min Mask Dimension High-NA EUV >15nm and ≤20nm

33% said that in 2023

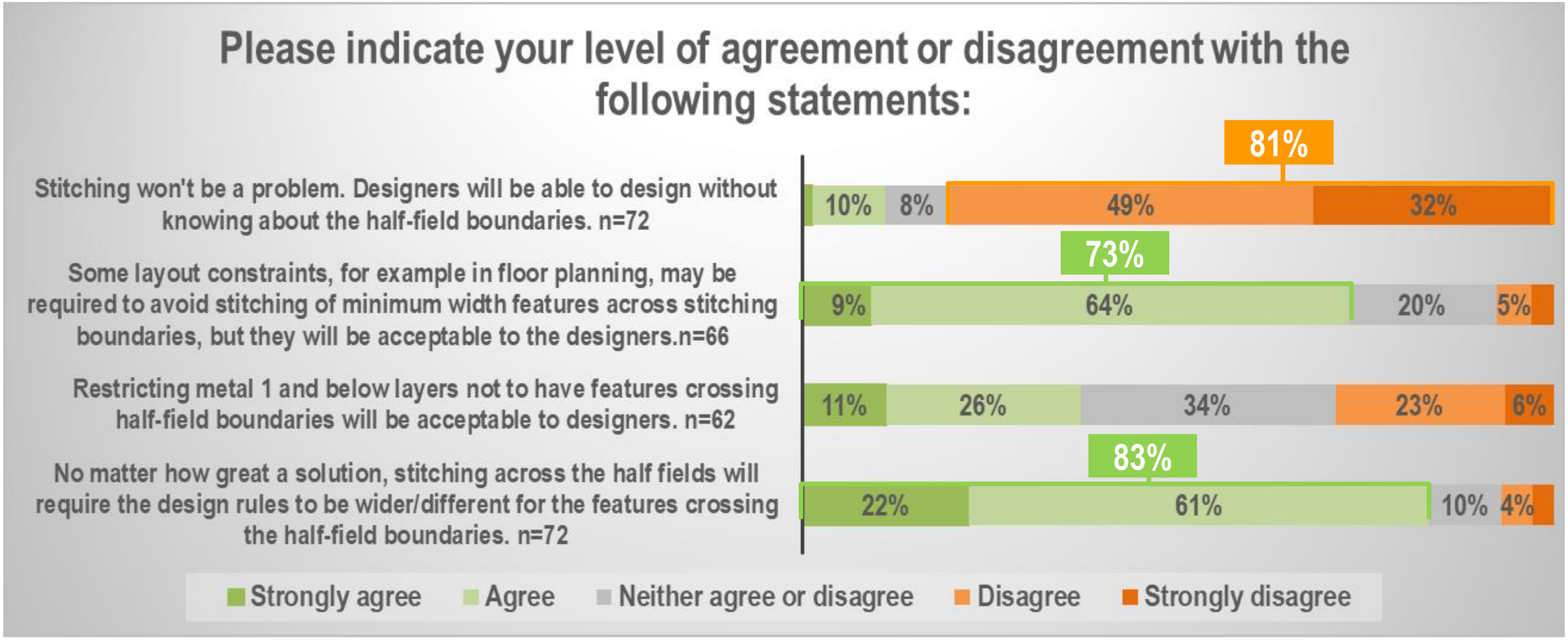


New Questions on Stitching for High-NA EUV Masks

81% Disagree with “stitching won’t be a problem”

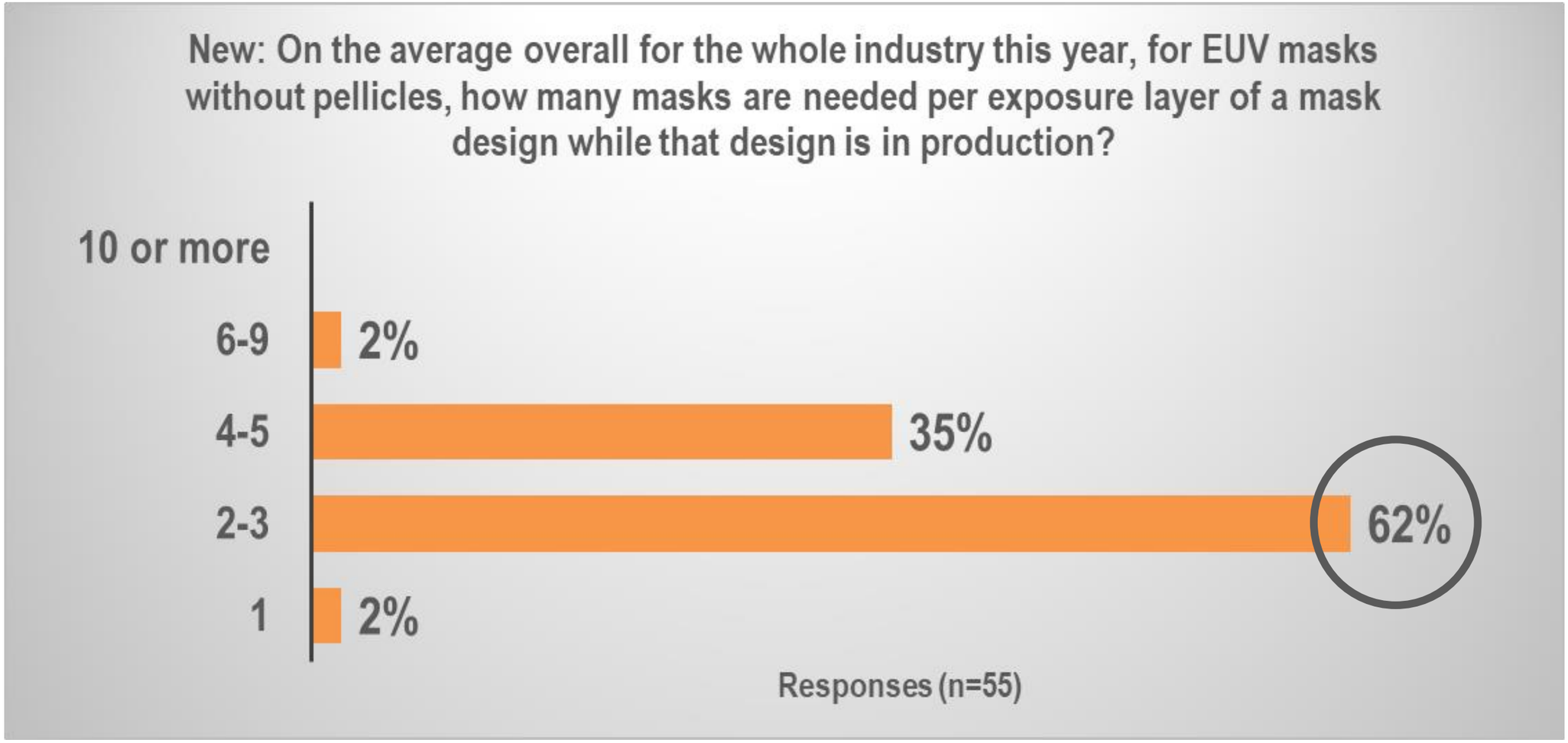
73% Agree some layout constraints acceptable to designers to avoid stitching

83% Agree stitching portion requires different design rules



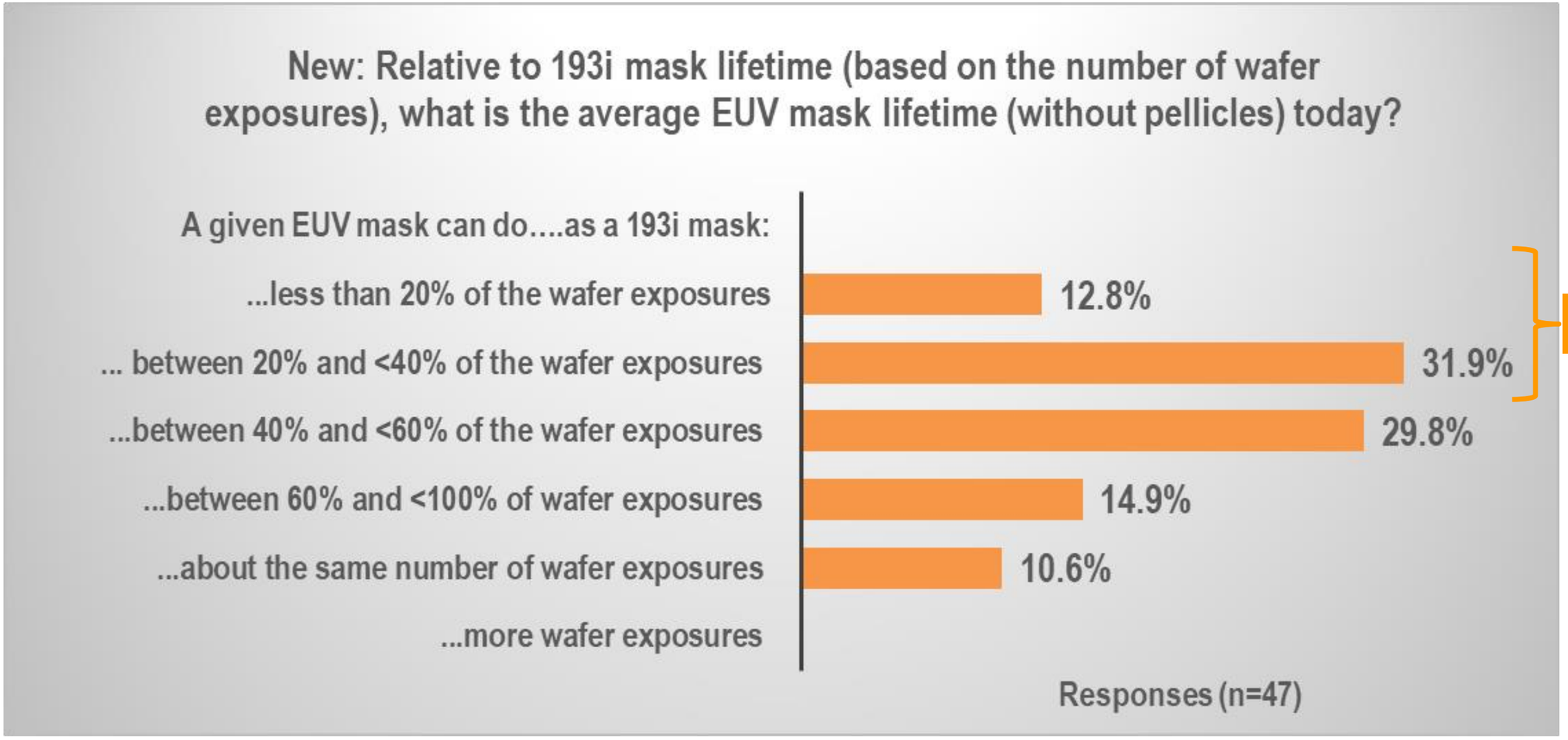
62% Say 2-3 EUV Masks Per Layer Needed if No Pellicles

While design is in production (question reworded from 2023)



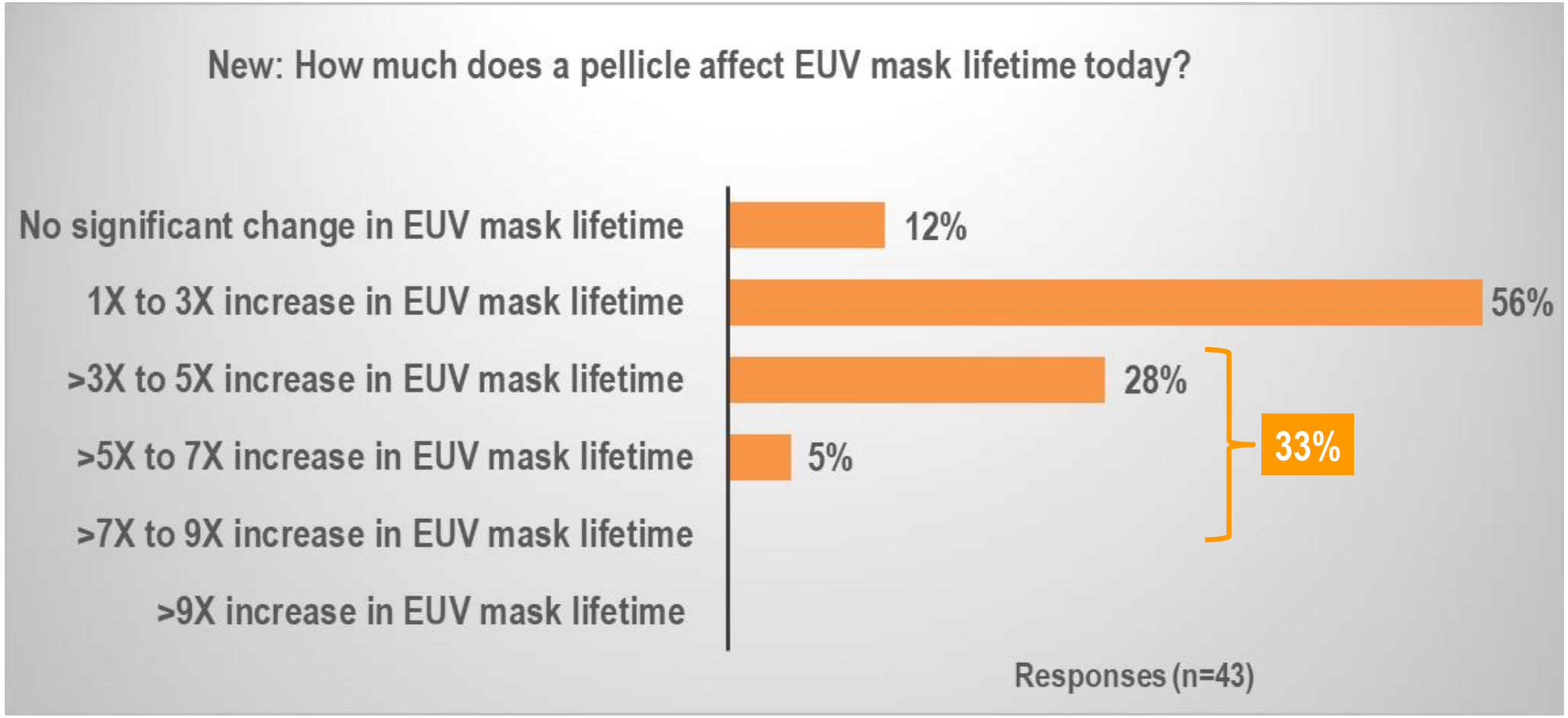
45% Say EUV Masks w/o Pellicles Have <40% Lifetime of 193i

New question (n=47) asks about pellicle impact on lifetime



33% Say Pellicles Increase EUV Mask Lifetime at least 3X

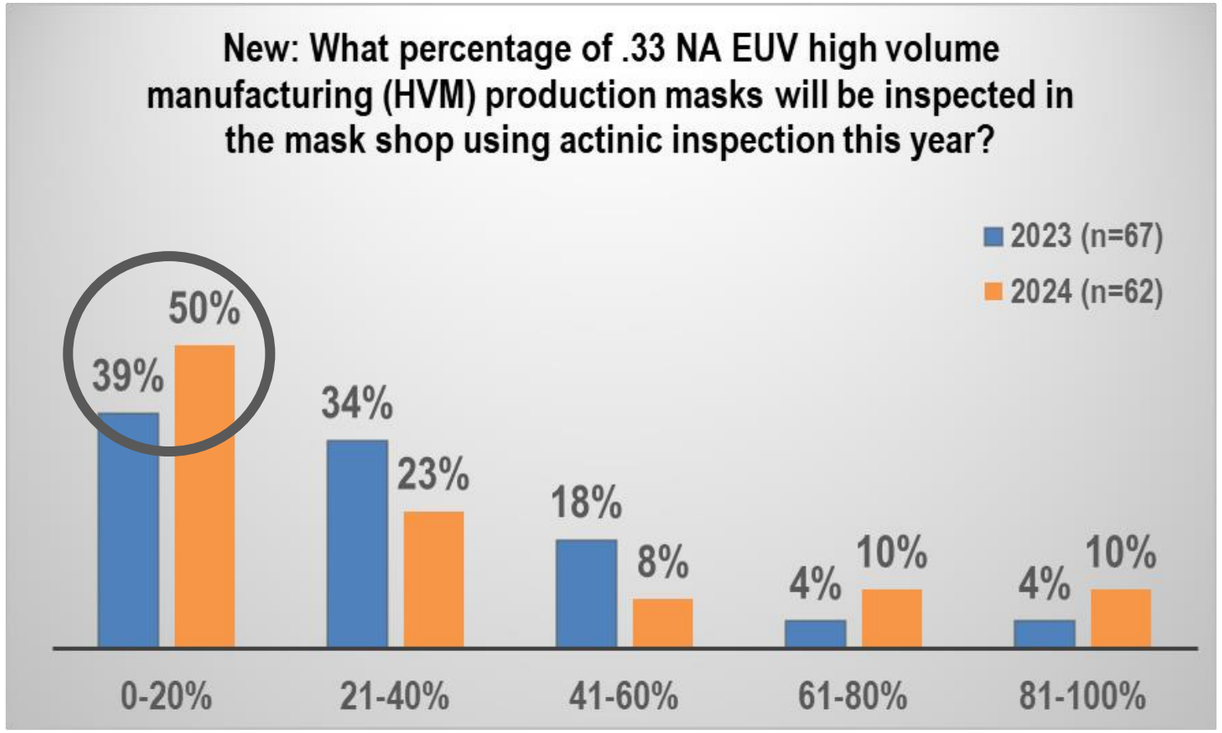
New question in 2024 (n=43)



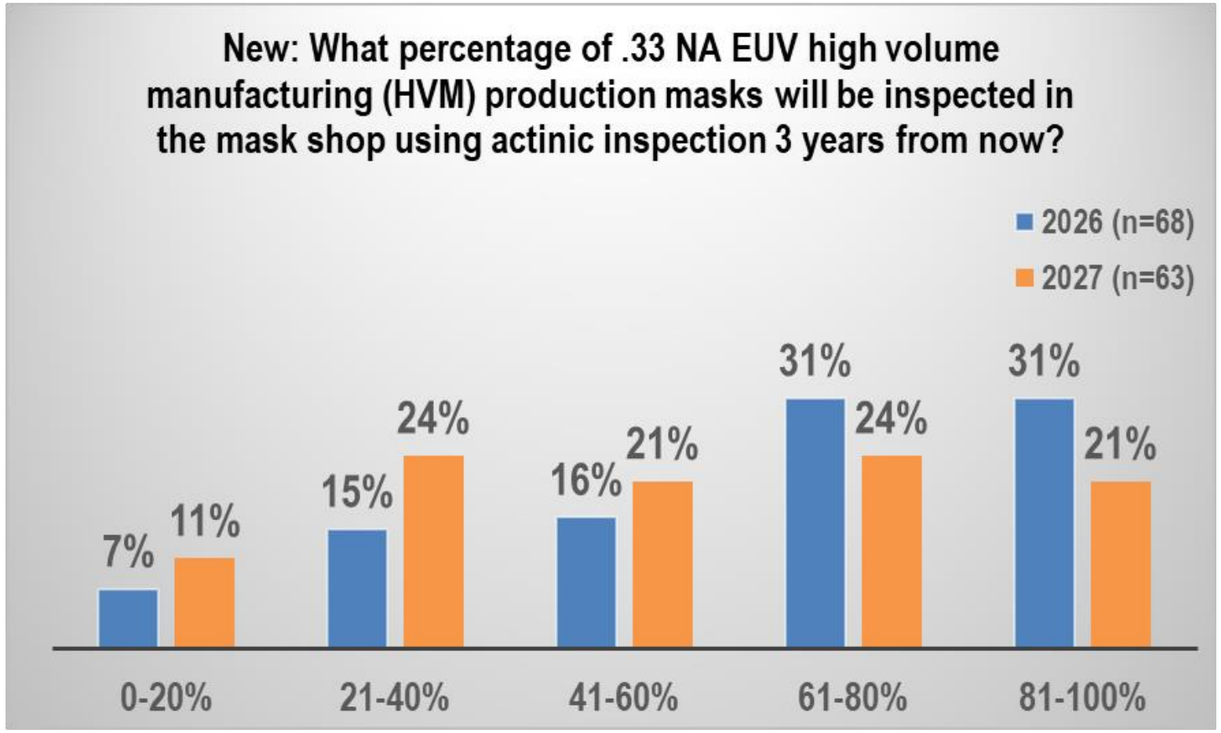
Opinions on Actinic EUV Mask Inspection Clear for Today

50% say ≤ 20% of HVM masks vs 39% last year; no clear trend in 3 years

Predictions for Today

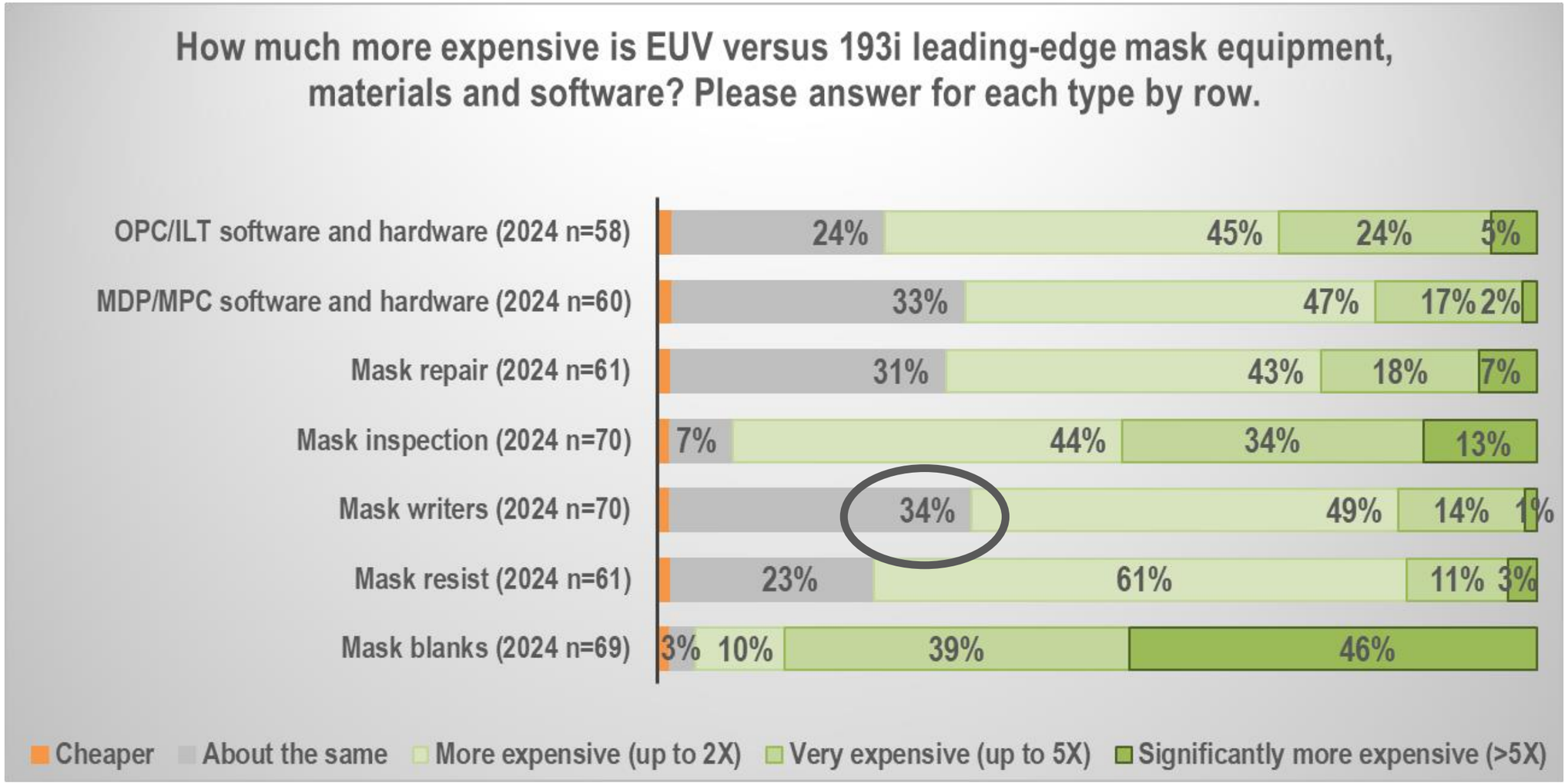


Predictions in 3 Years



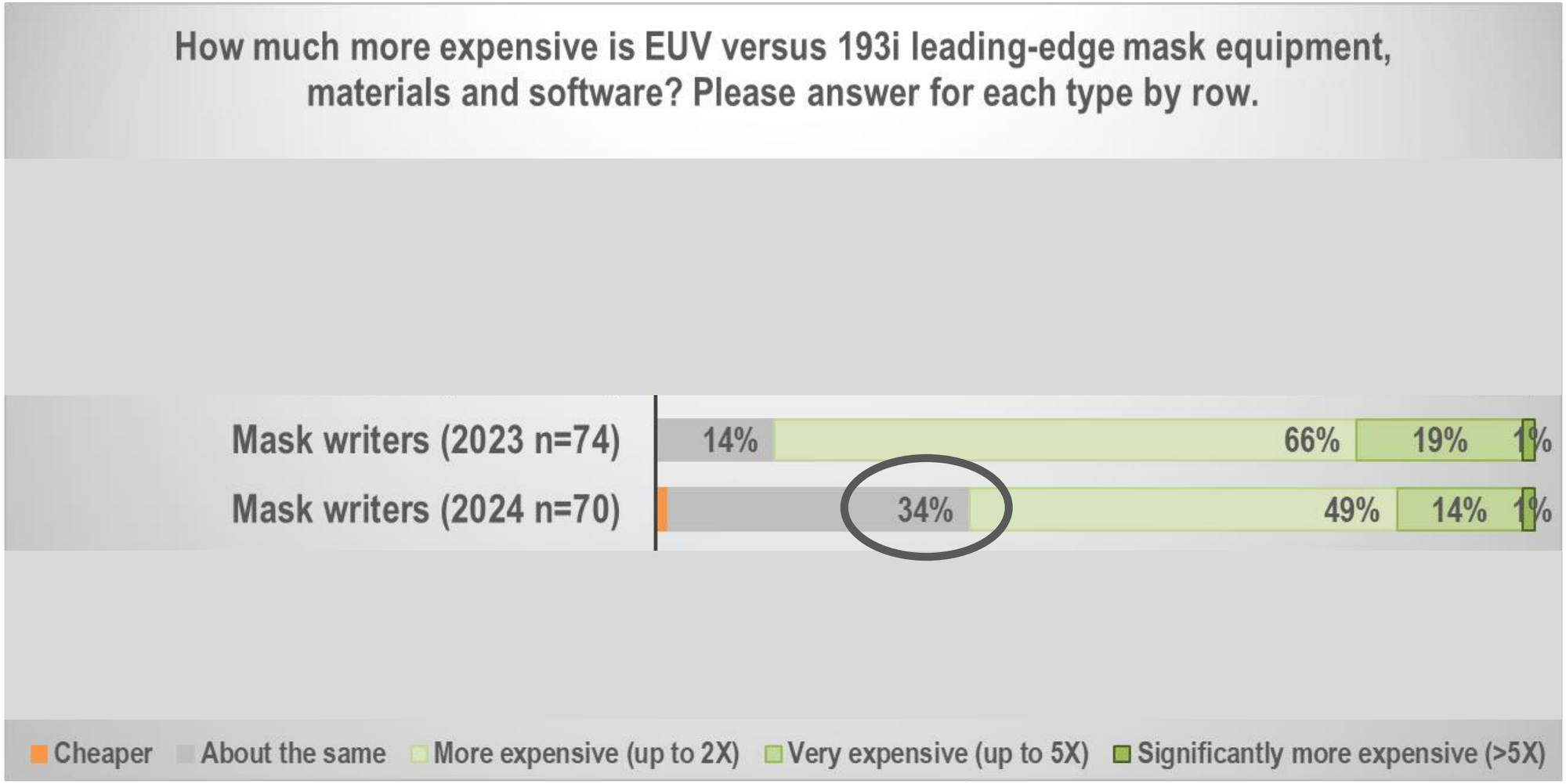
Overall Trend for EUV > 193i Mask Costs Unchanged

Opinion that mask writers are about the same cost increased to 34% from 14%



Overall Trend for EUV > 193i Mask Costs Unchanged

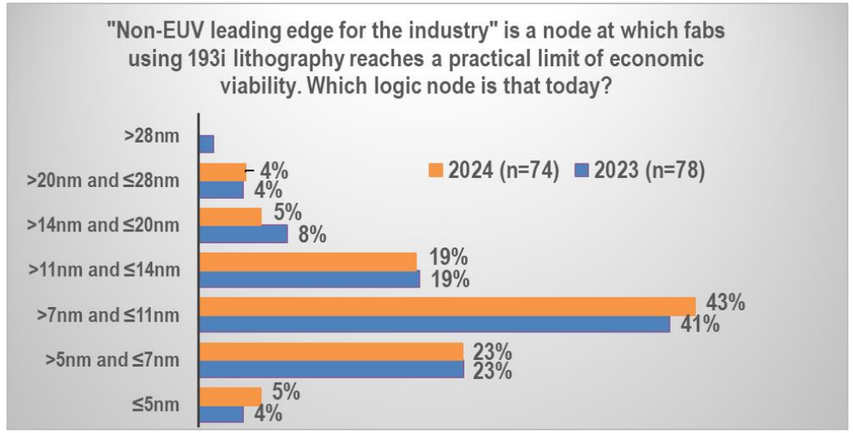
Opinion that mask writers are about the same cost increased to 34% from 14%



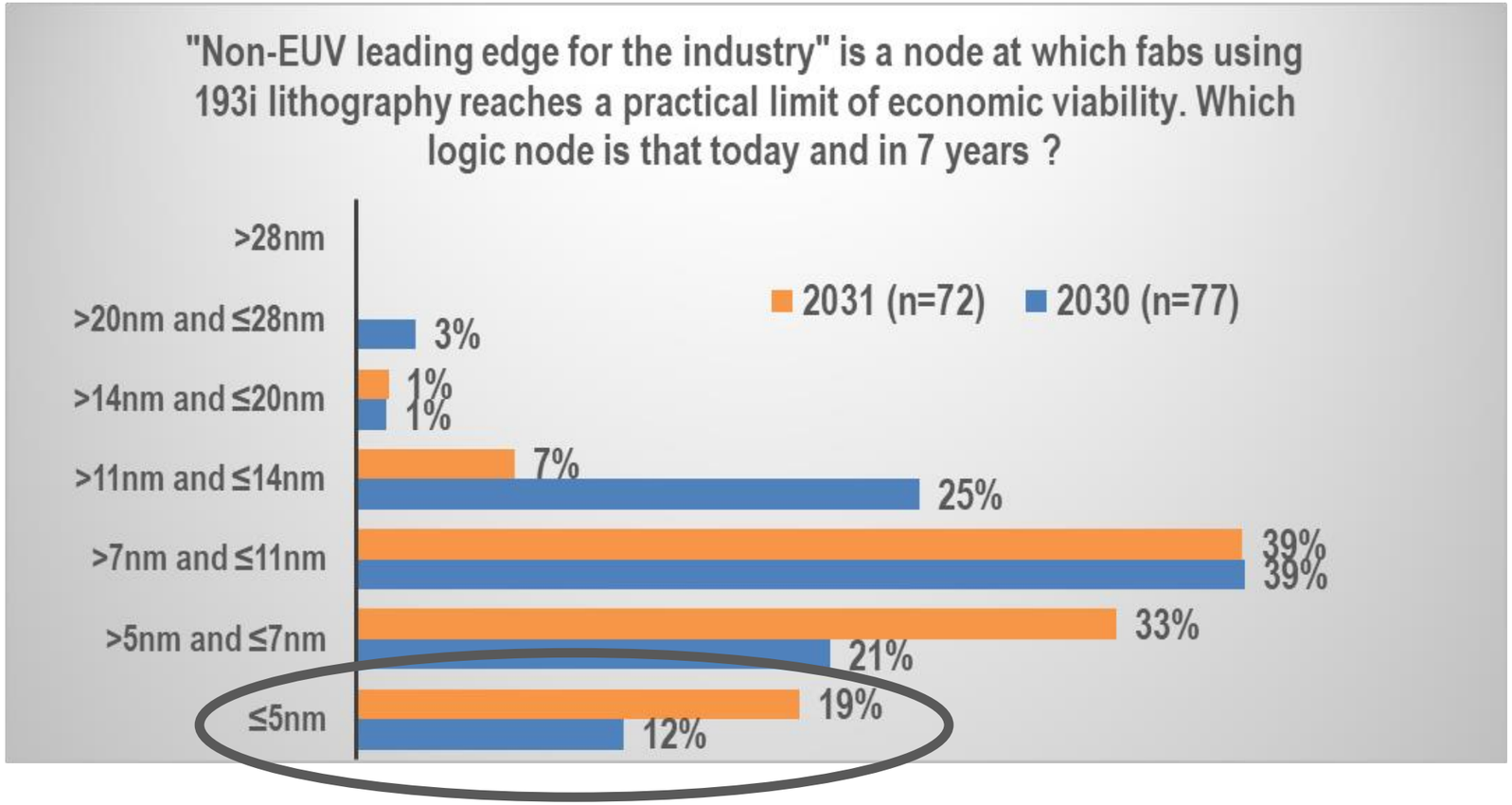
Confidence Increased: Fabs w/o EUV Can Reach ≤ 5nm in 7 Years

19% say ≤ 5nm vs 12% who said that last year

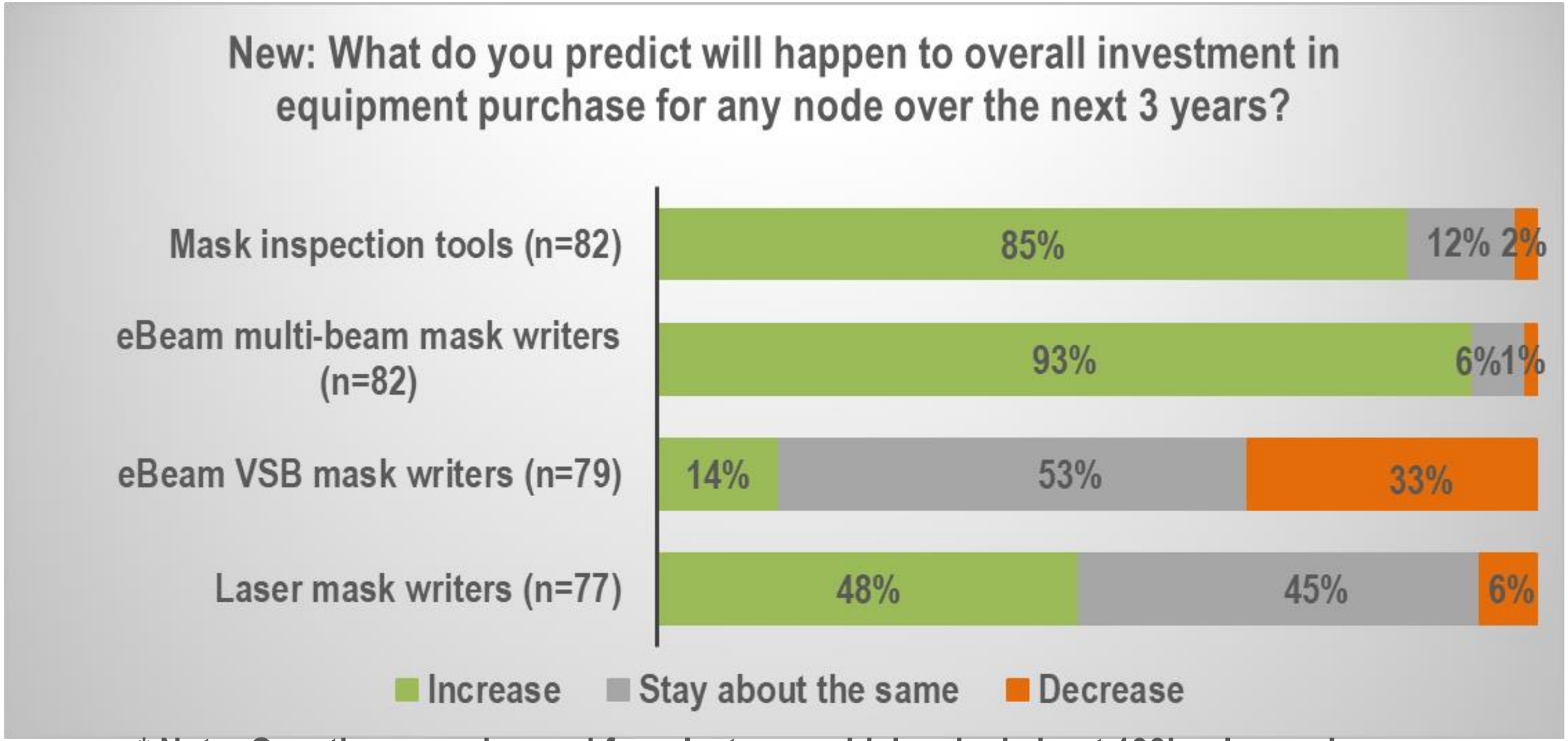
“Today”



“In 7 Years”



Mask Inspection, Multi-beam and Laser Mask Writers: Positive Outlook for Purchasing New Equipment for Any Node*

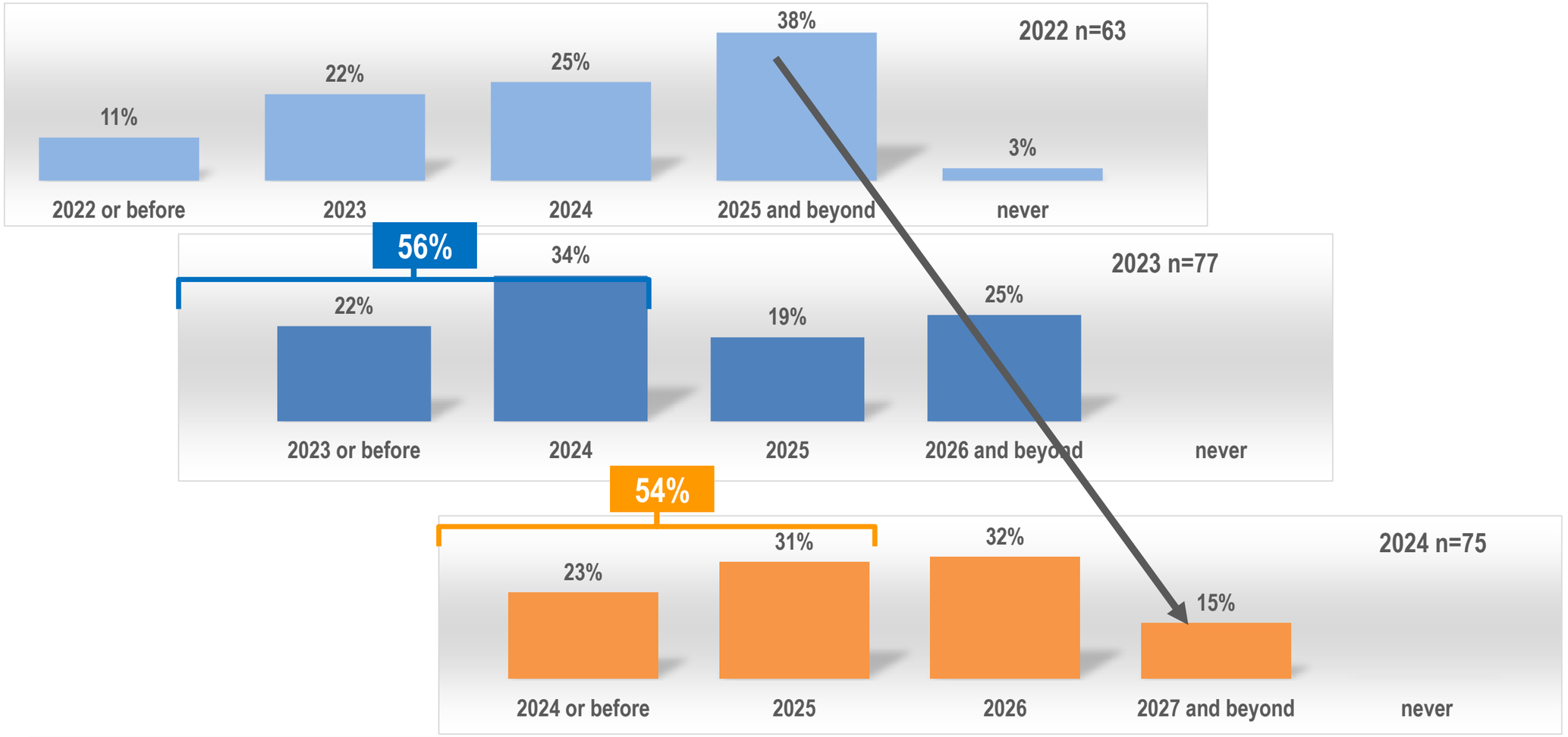


* Note: Question was changed from last year which asked about 193i only purchases

Predictions of Deep Learning Adoption Slip A Year

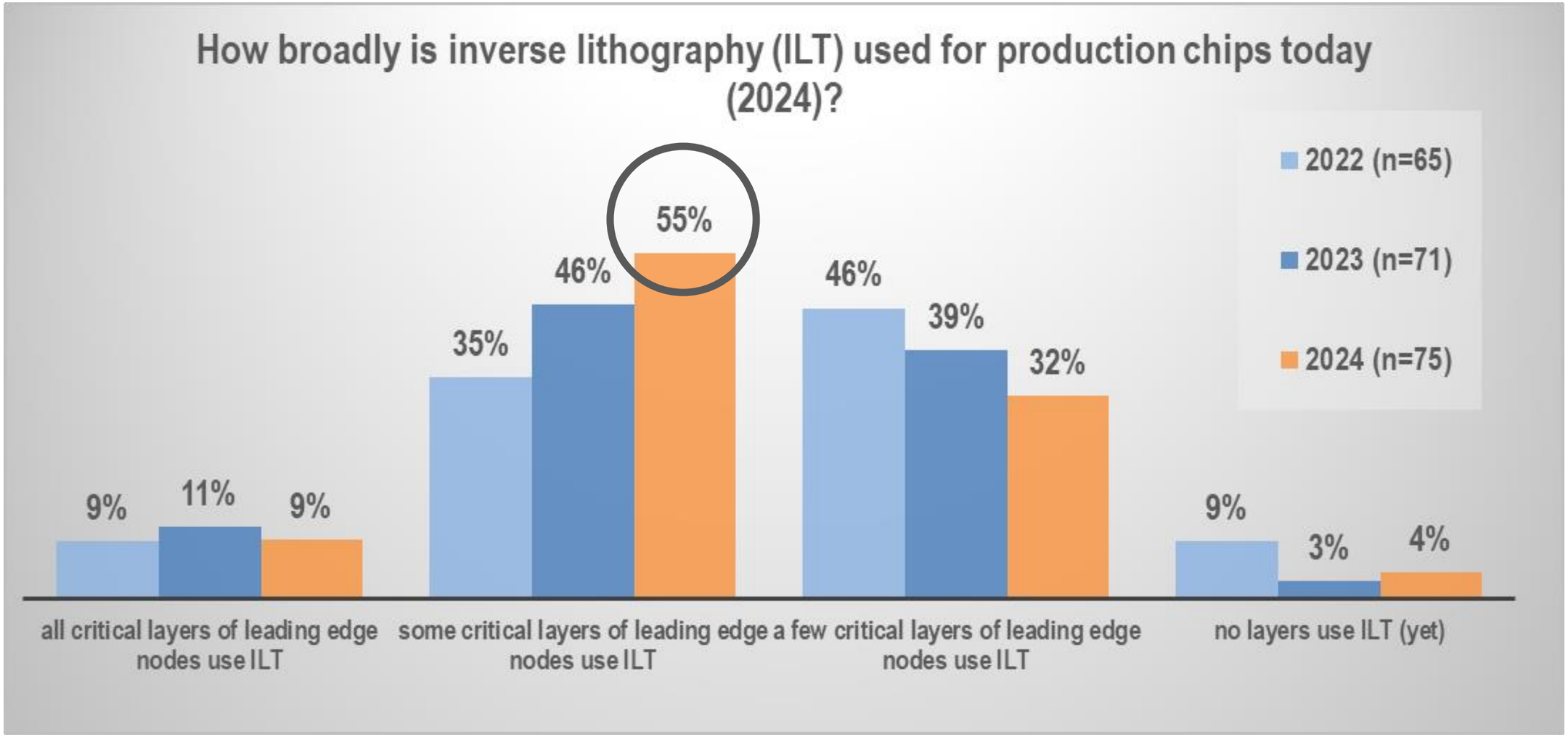
However, “three years from now” trend has decreased from 38% to 15%

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



Survey Results Point to More Critical Layers Using ILT

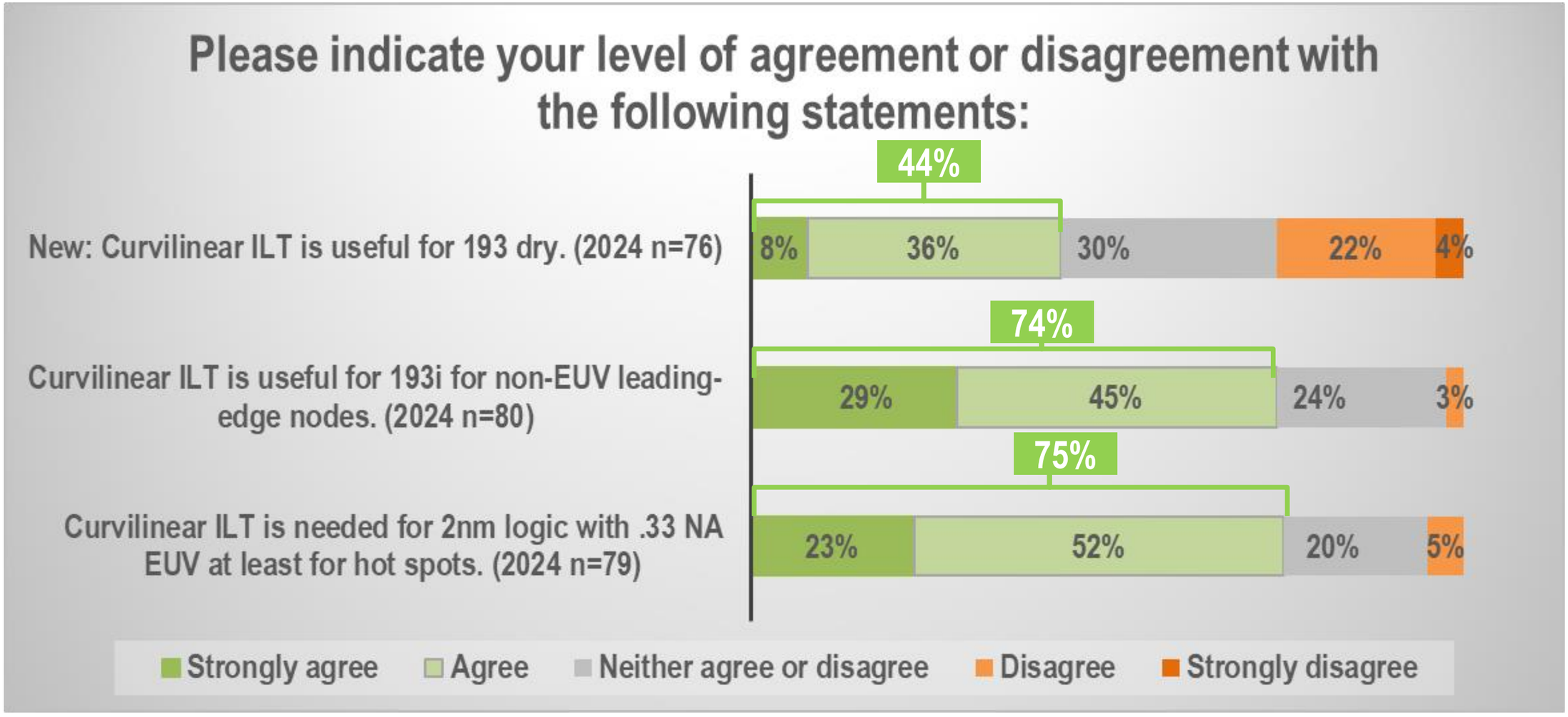
55% say “some critical layers” in 2024 vs 46% in 2023



Note: Repeat question since 2017 but only showing most recent 3 years in this chart

New Question: 44% Agree Curvilinear ILT Useful for 193 Dry

74% “agree” useful for 193i, “strongly agree” up 5% to 29%; EUV is similar to 2023



Mask Shop Software Infrastructure Top Curvilinear Concern

Difference in opinions on mask inspection, access to MBMW, mask repair

Please rank your biggest concerns in producing masks with curvilinear* shapes. n≥73

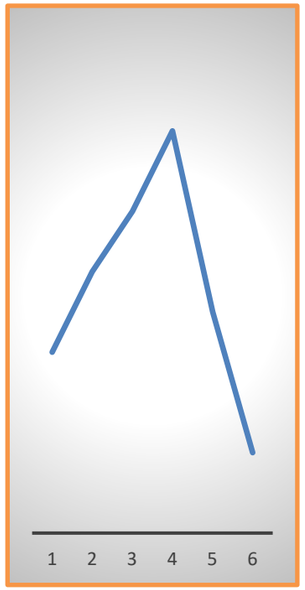
#1: Mask shop software infrastructure

N/A=10%

#2: Mask Inspection

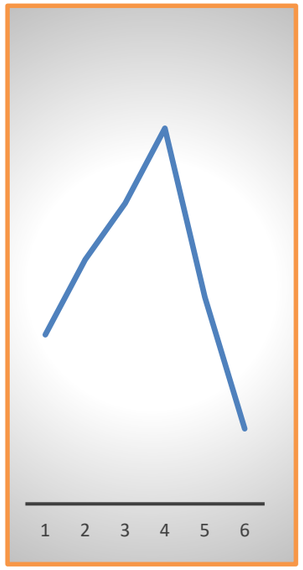
N/A=10%

#3: ILT software



N/A=13%

#4: Mask Metrology



N/A=10%

#5: Access to Multi-beam Mask Writers

N/A=13%

#6: Mask Repair

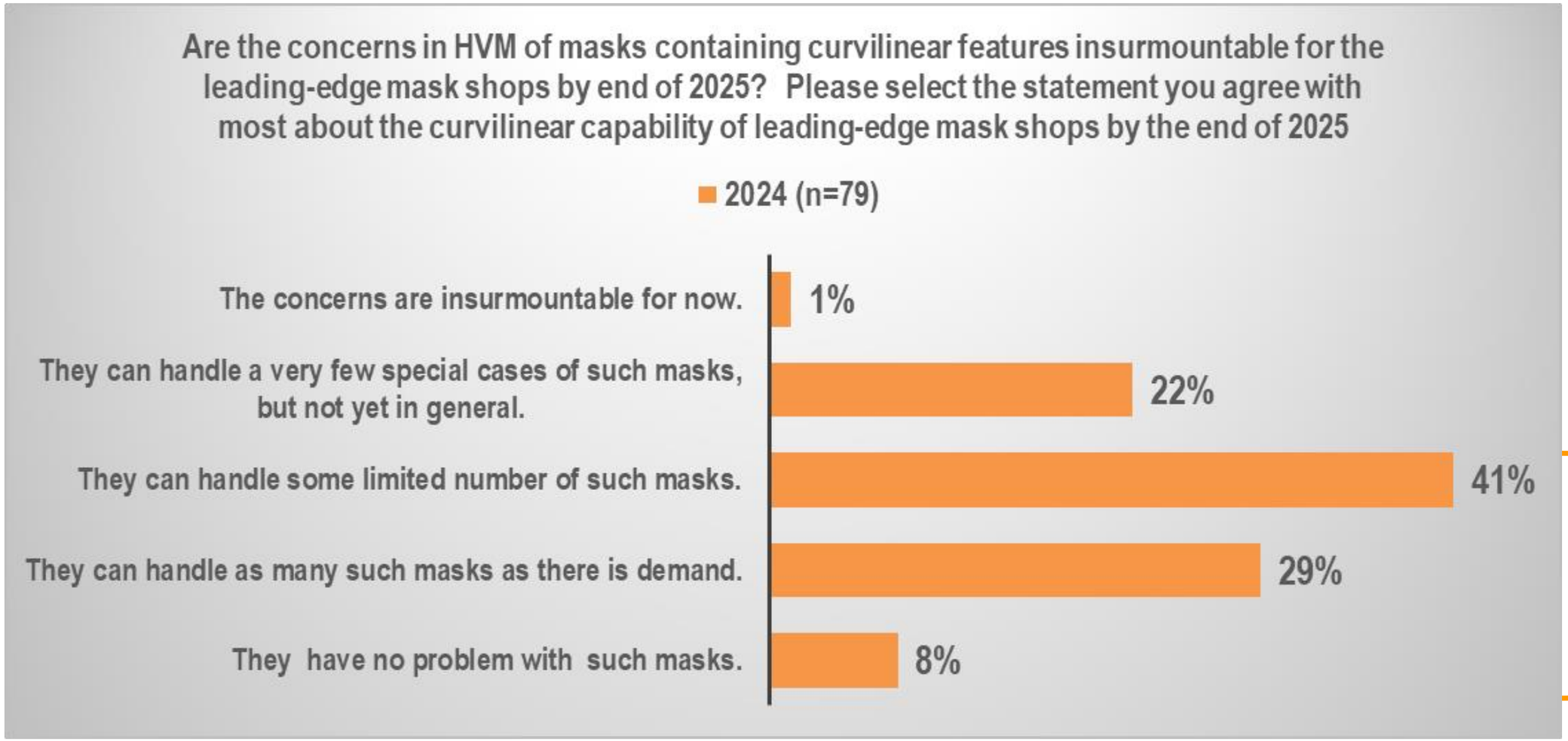
N/A=11%

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

* 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."

78% Say Mask Shops Can Handle Curvilinear Masks by 2025

Versus 87% who said that last year for the end of 2023



eBeam Initiative Luminaries Predict 2024 Mask Market Growth

13th Annual Luminaries Survey - July 2024

- 100% of Luminaries say **2024 mask revenues will increase (74%) or stay the same (26%) over 2023** revenues of $5.4B reported by SEMI.

- **Positive outlook for purchasing new equipment** in the next 3 years with increases predicted for multi-beam mask writers (93%), mask inspection (85%) and laser mask writers (48%).

- Confidence increased that **fabs without EUV can reach 5nm in next 7 years** with 19% who say that this year compared to 12% last year.

- 81% of Luminaries surveyed think that stitching for high-NA EUV masks will require **designers to be aware of the stitching boundaries during design.**

Thank you to those who participated in the survey!

Luminaries survey results available on www.ebeam.org