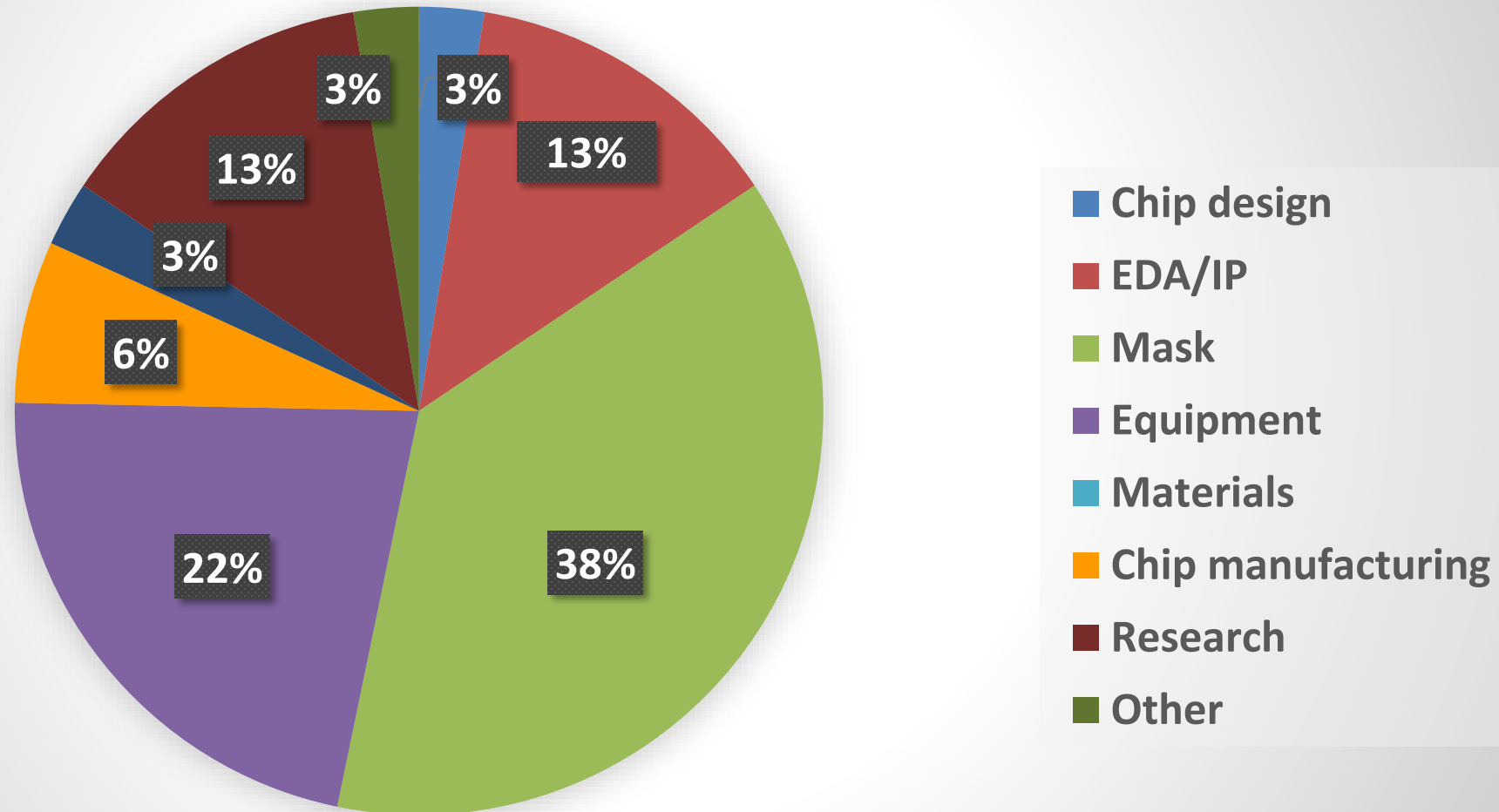


# Thank you for Our 9<sup>th</sup> Annual Survey of Luminaries

## 77 luminaries across 42 different companies in July 2020



What part of the semiconductor ecosystem is your focus?

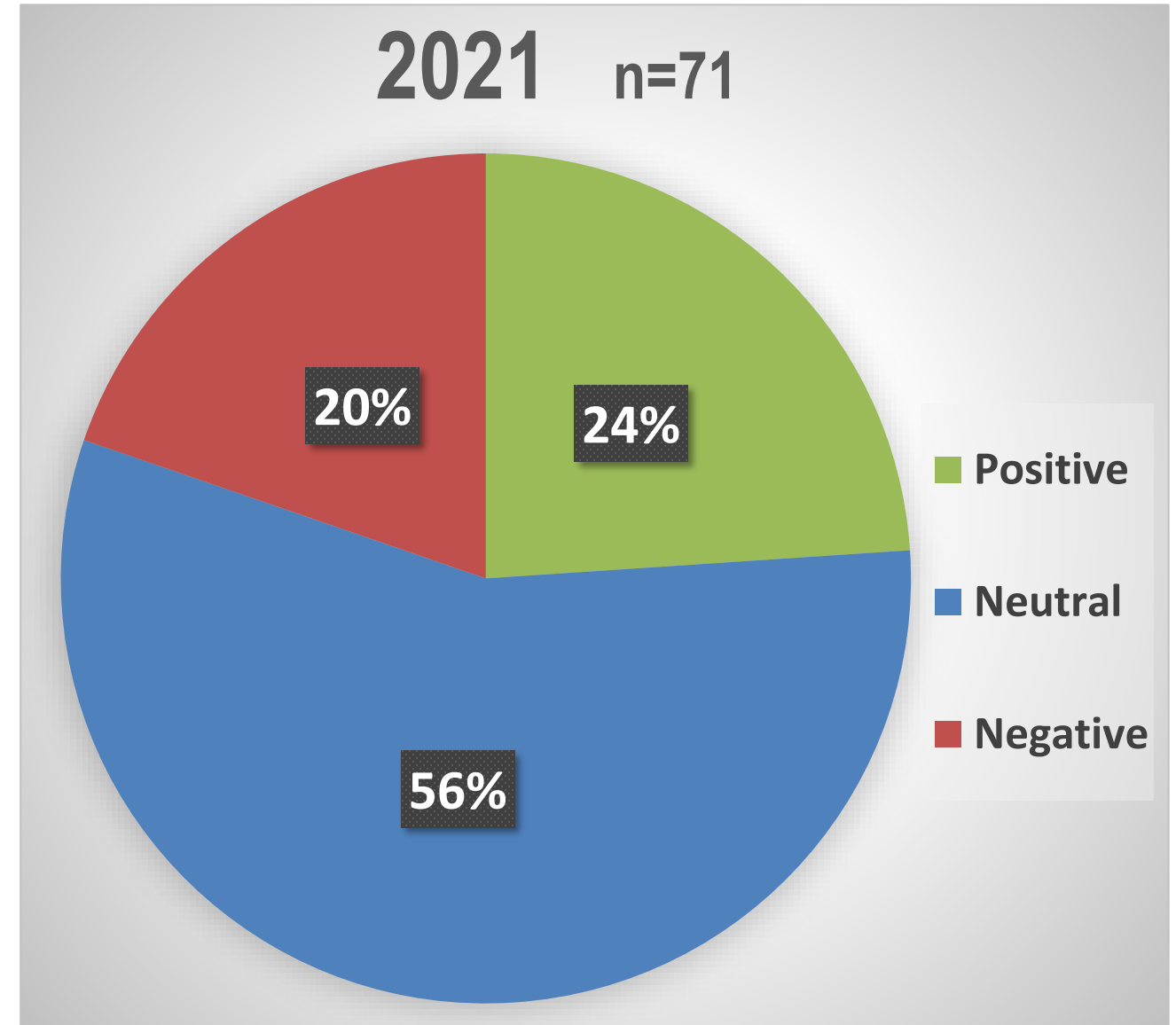
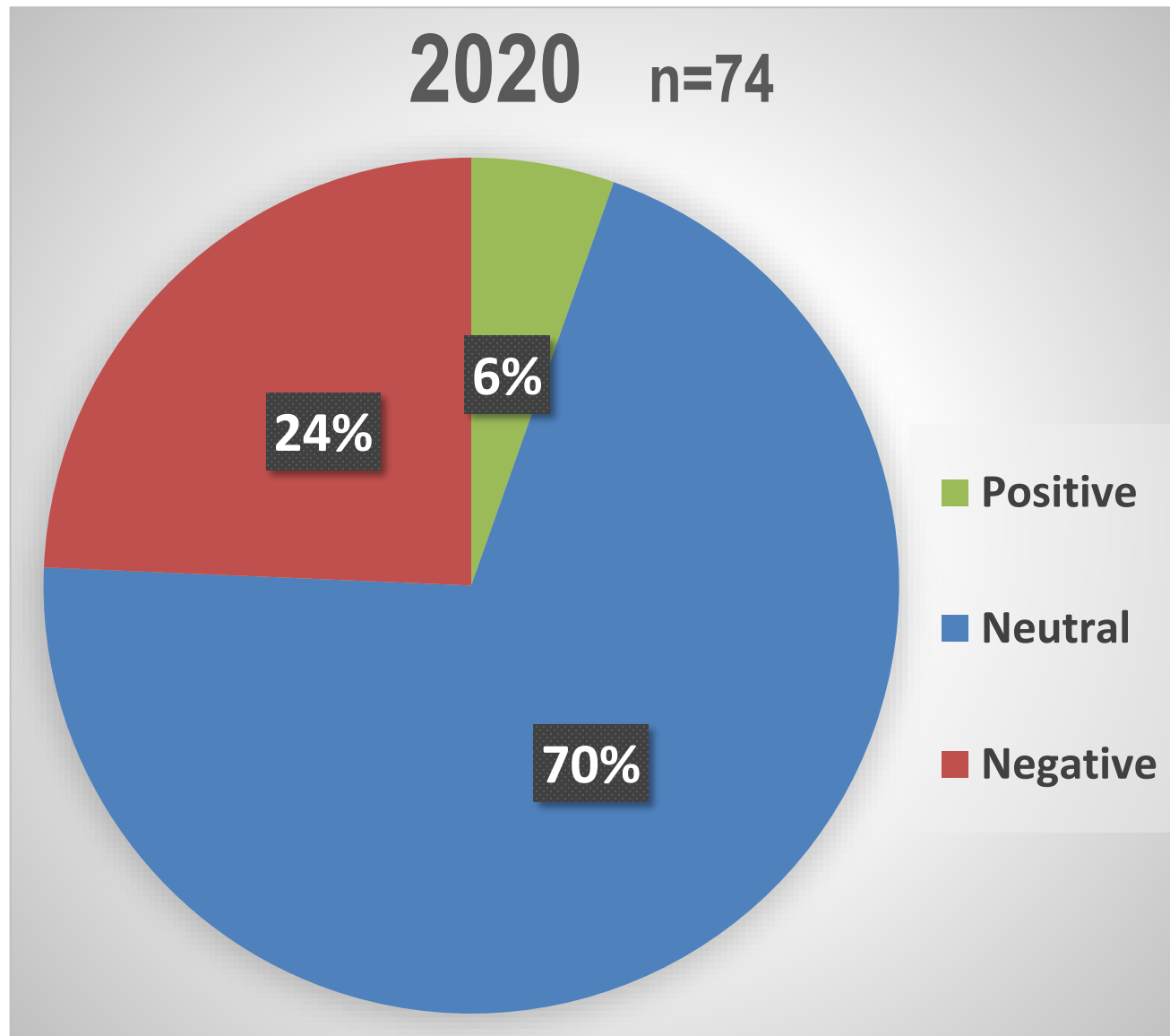


# Survey Says Net Neutral COVID-19 Business Impact

By 2021, 24% positive vs 20% negative predictions

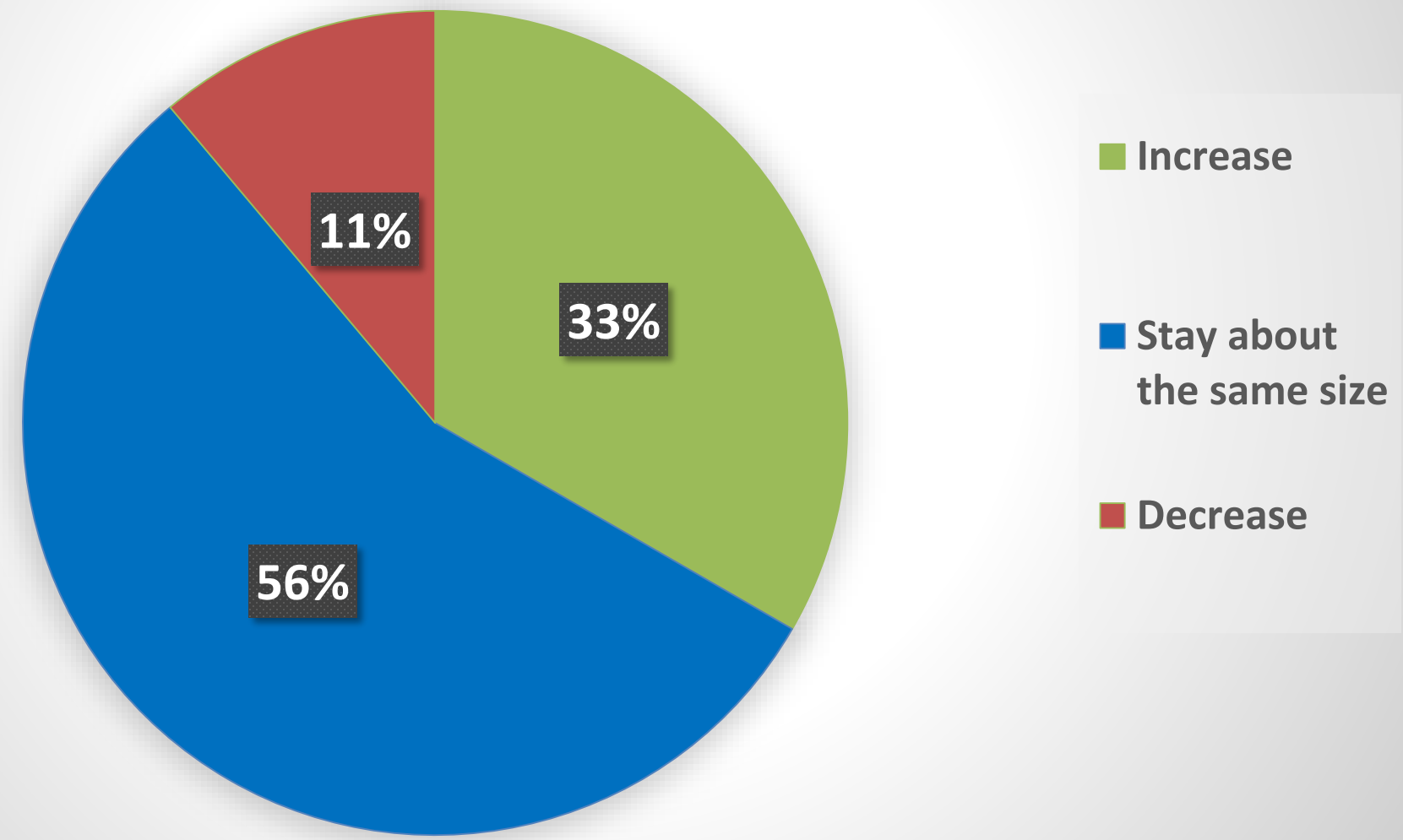


What business impact do you think COVID-19 will have on (2020, 2021) total mask revenues?



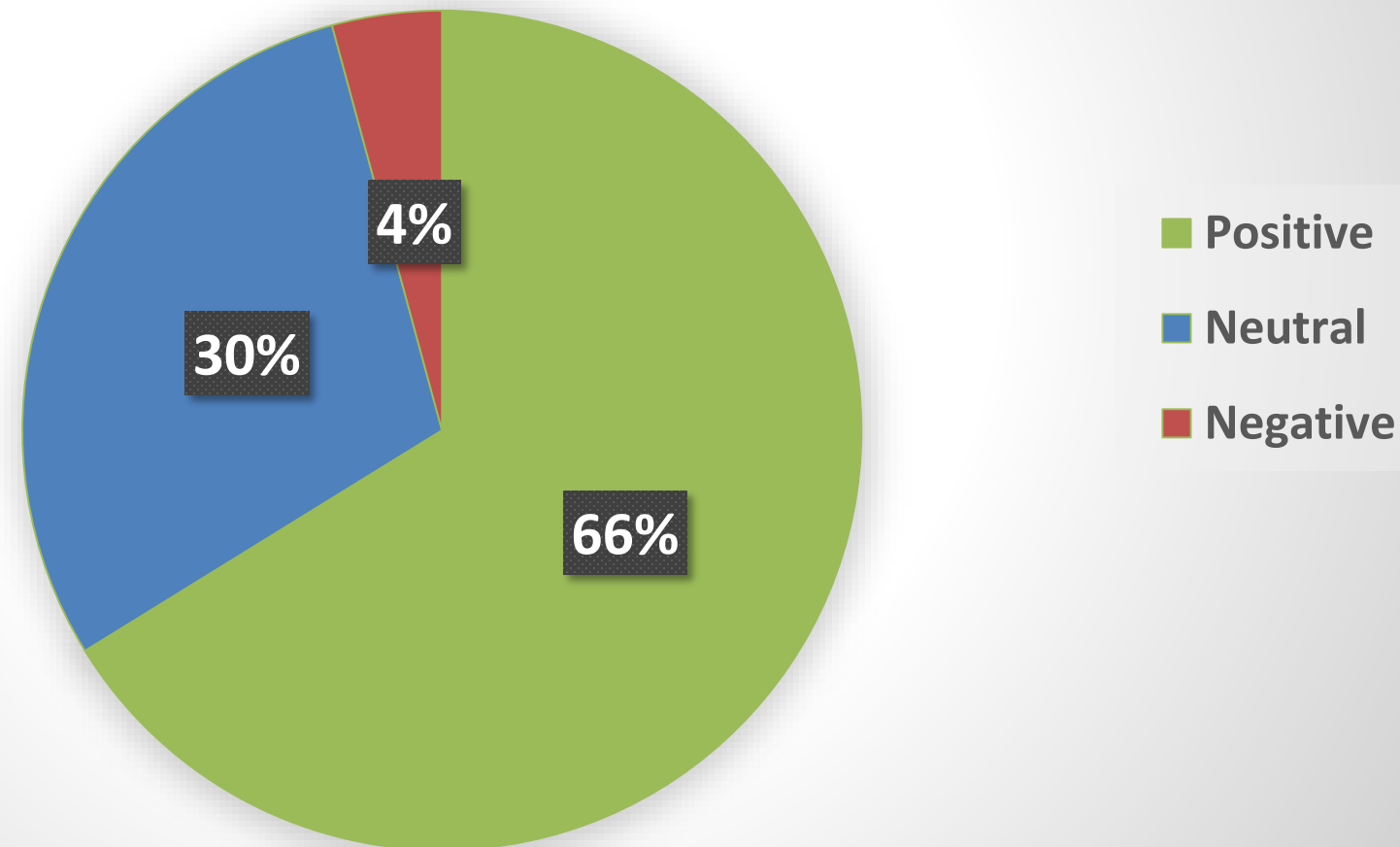
# 89% Neutral or Positive About 2020 Mask Revenues Despite COVID-19

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



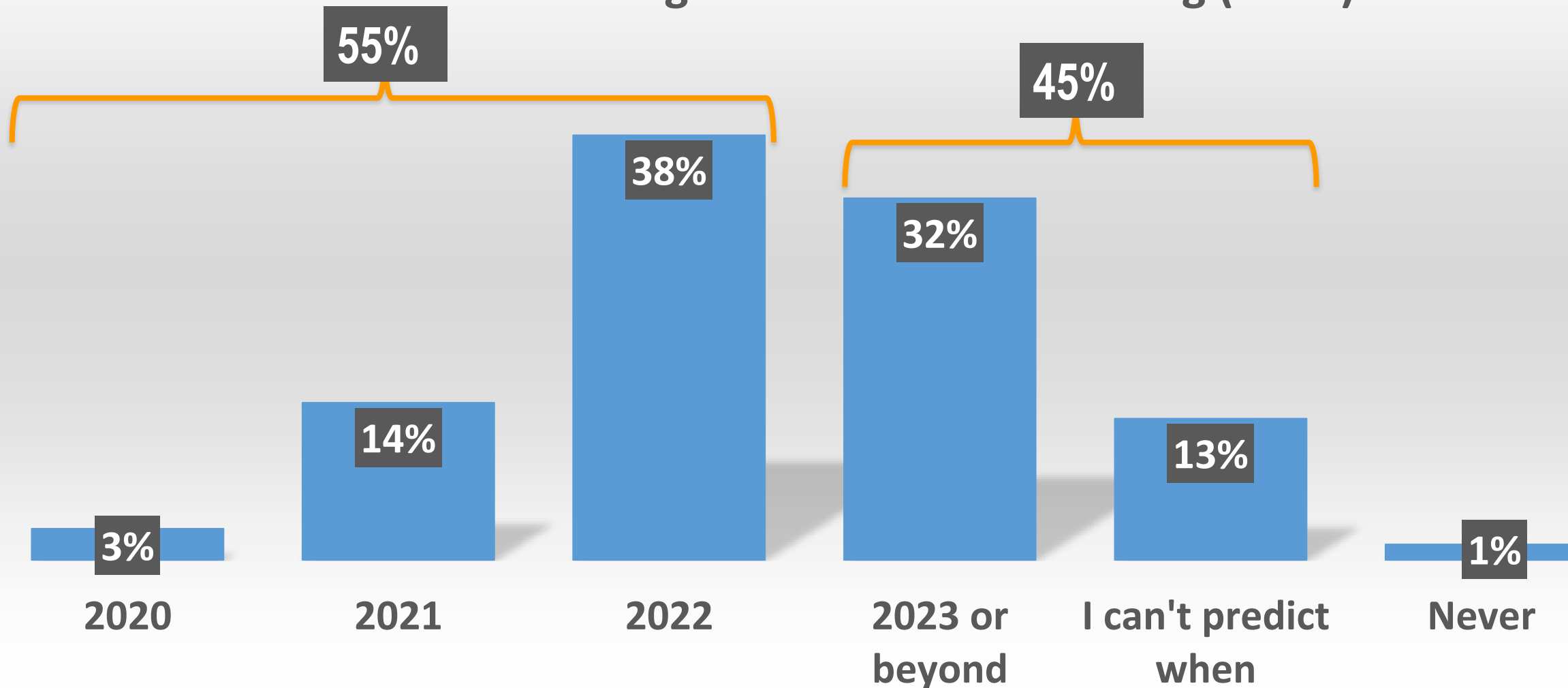
# 66% Say EUV Positive for 2020 Mask Revenues

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



# 55% Say EUV Pellicles for HVM by End of 2022

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 (HVM)? n=72



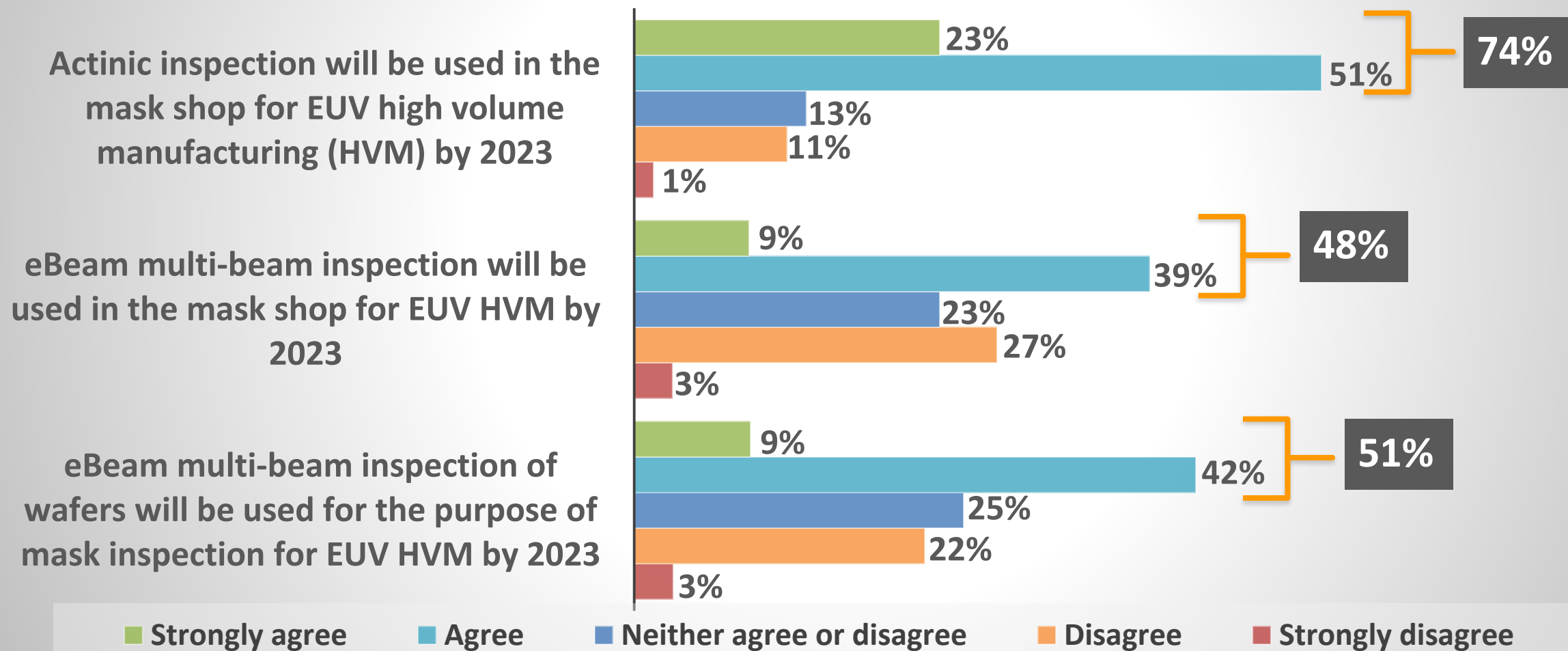
# 74% Agree Actinic Inspection for EUV HVM by 2023

48% eBeam multi-beam mask inspection, 51% eBeam multi-beam wafer inspection



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

n=69

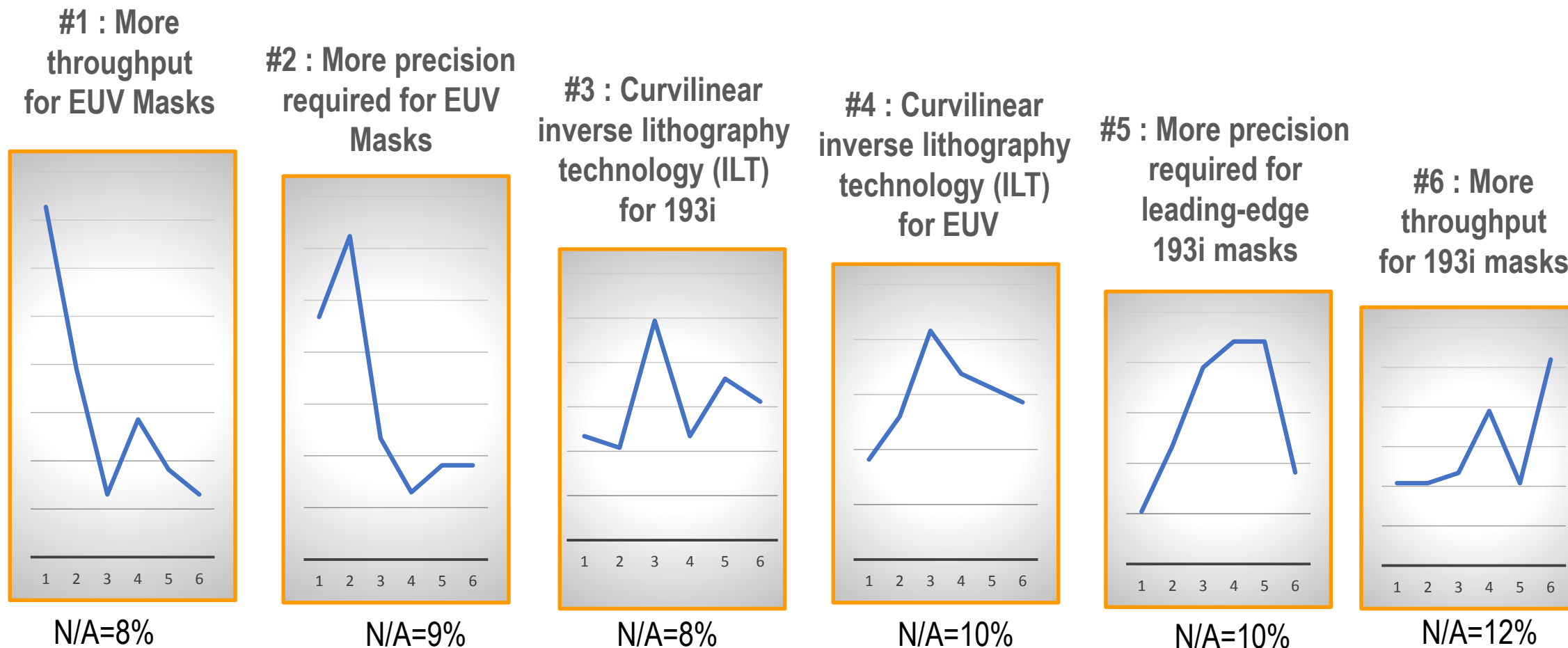


# EUV is Driving Multi-Beam Writer Purchases

## Survey participants ranked six reasons



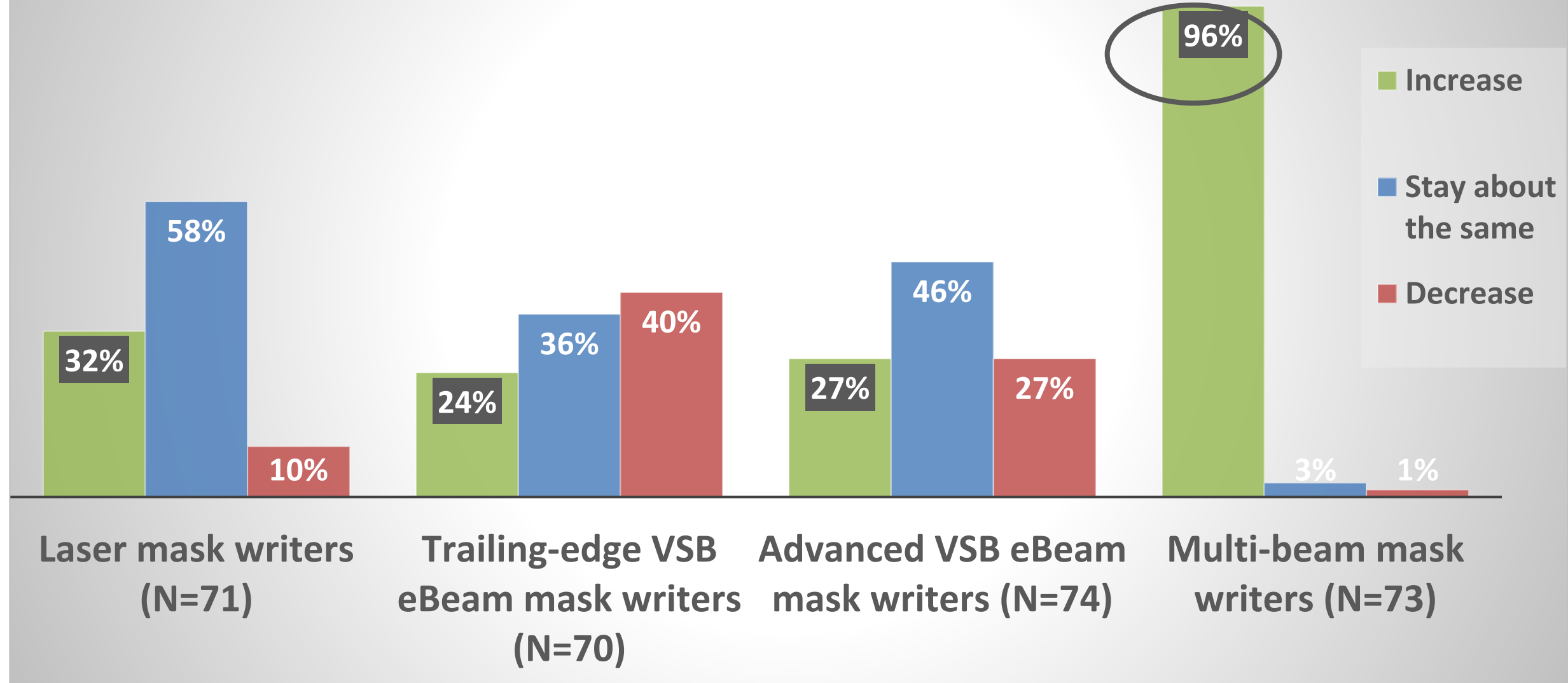
Q: Please rank the primary reasons for purchasing multi-beam mask writers. Note in the answers below, precision refers to CD uniformity as well as placement accuracy. n=77



Note: 1-6 on X-axis indicate % of respondents that ranked that question as that ordinal number

# 96% Predict Growth for Multi-Beam Mask Writers

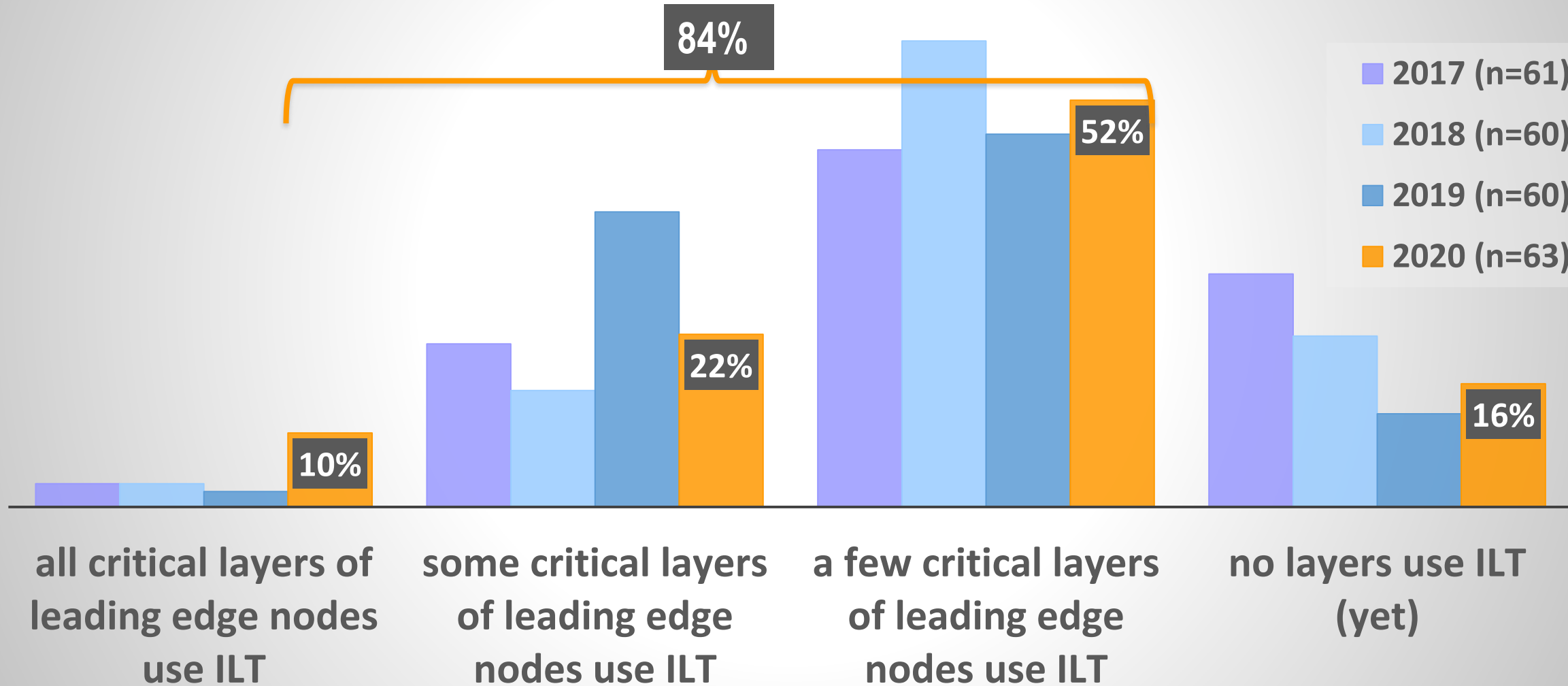
What do you predict will happen to unit purchases of new mask writers by type over the next 3 years?





# 84% Say ILT in Use Today

How broadly is inverse lithography (ILT) used for production chips today (2020)? (use includes for hot spots only)

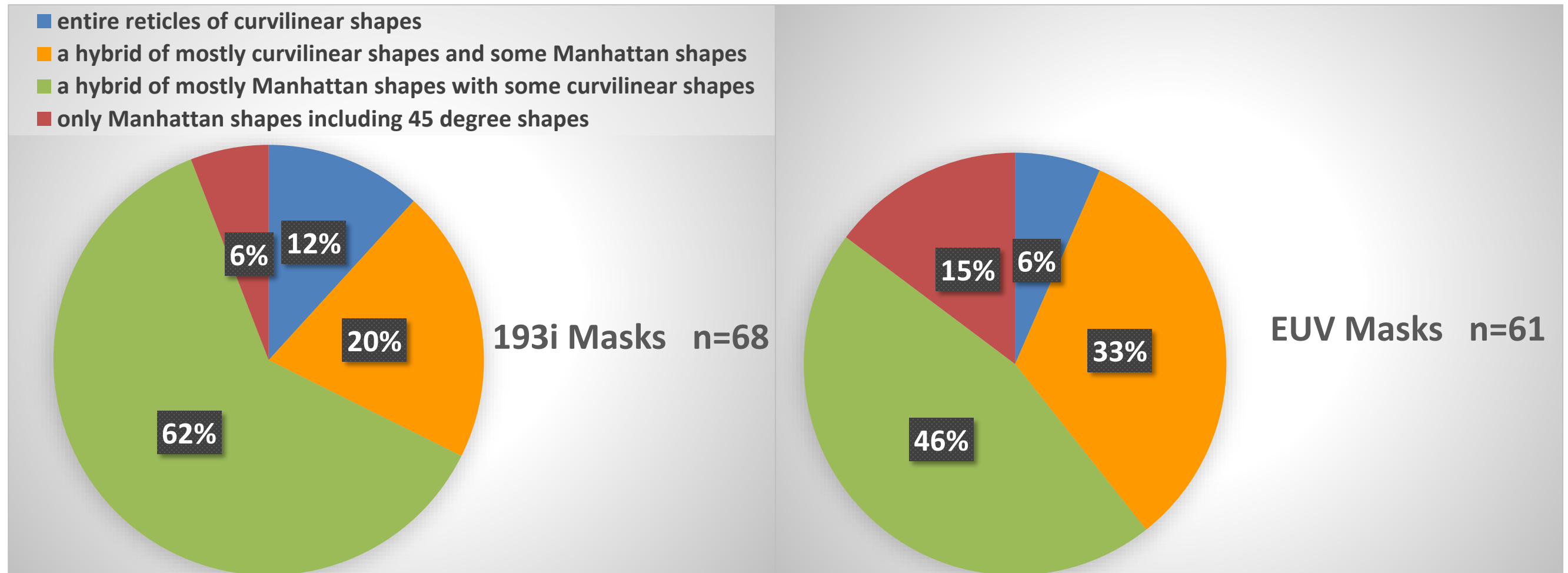


# Curvilinear Shapes to be Pervasive by 2023

## 94% of 193i, 85% of EUV masks with some curvilinear shapes



Manufacturing of curvilinear masks is enabled by multi-beam mask writers. How extensively will curvilinear shapes be used for leading-edge (EUV, 193i) masks intended for high volume manufacturing (HVM) by 2023?

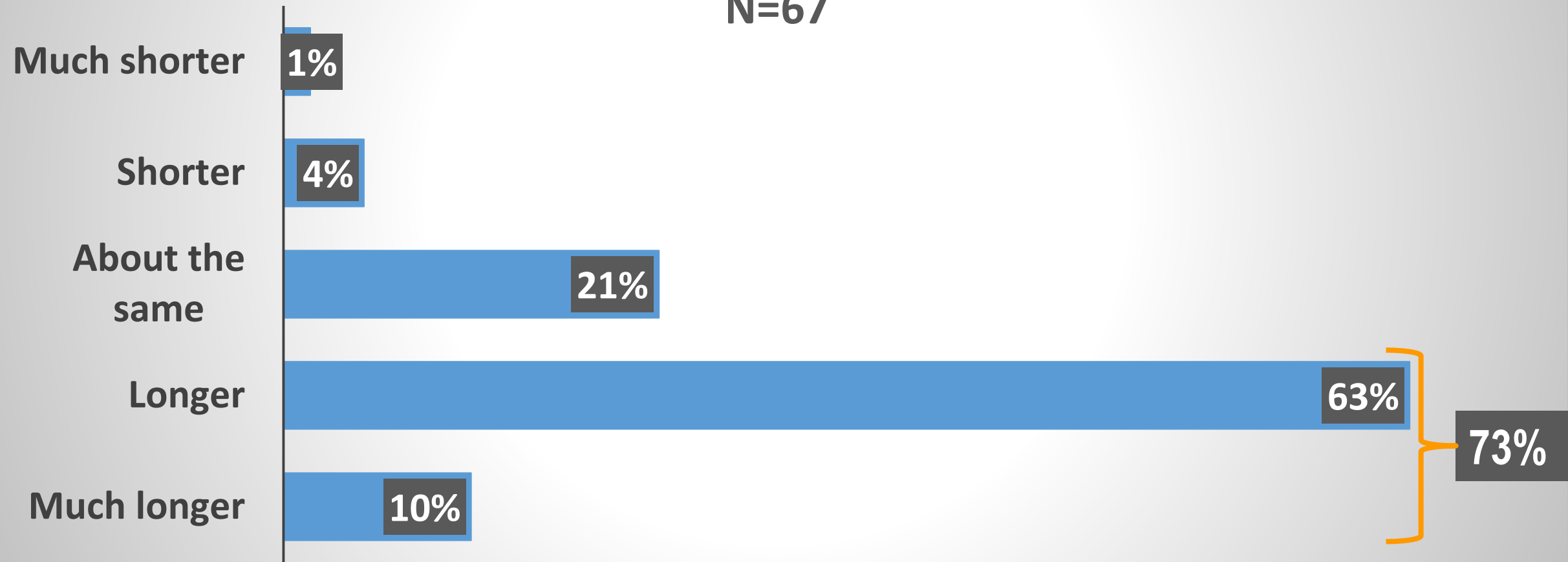


# 73% Say Longer EUV TAT in 2023 vs 193i Today

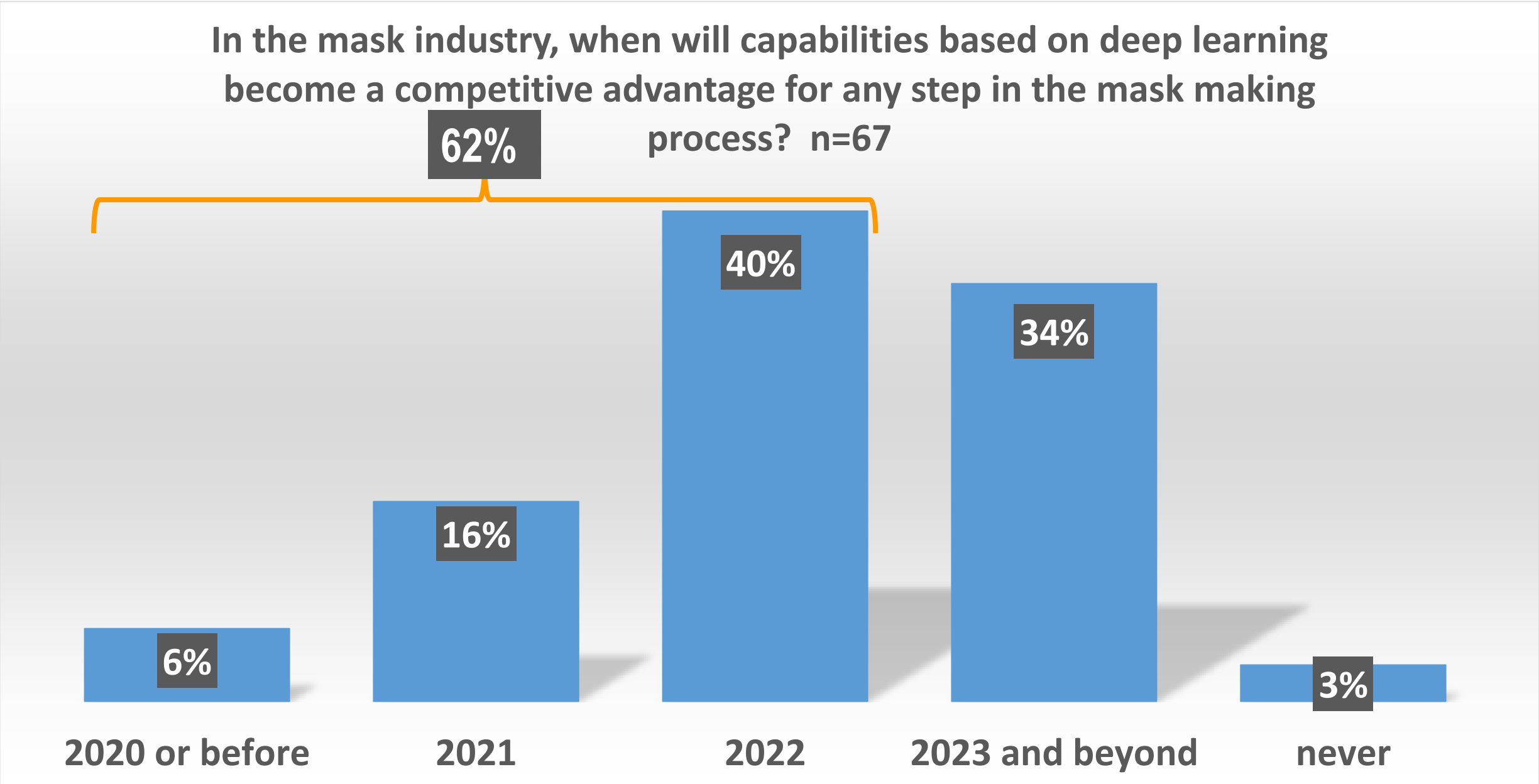


Turnaround time is critical to the mask business. How will EUV mask turnaround times in 2023 compare to leading-edge 193i mask turnaround times of today?

N=67



# 62% Predict Deep Learning an Advantage by 2022



# Upbeat Mask Market Outlook for 2020, 2021



- **Net neutral business impact of COVID-19 by 2021**
  - 89% predict mask revenues to stay the same or increase in 2020, despite COVID-19
- **EUV to drive business growth for masks and equipment**
  - 66% predict EUV to have positive impact on mask revenues in 2020
  - EUV is driving multi-beam mask writer purchasing decisions
  - 96% predict multi-beam mask writer purchases to increase over the next 3 years
- **Curvilinear shapes on mask to be pervasive by 2023**
  - 96% say 193i masks will have some or more curvilinear shapes by 2023
  - 85% say EUV masks will have some or more curvilinear shapes by 2023

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

**Luminaries and Mask Makers survey results available on  
[www.ebeam.org](http://www.ebeam.org)**