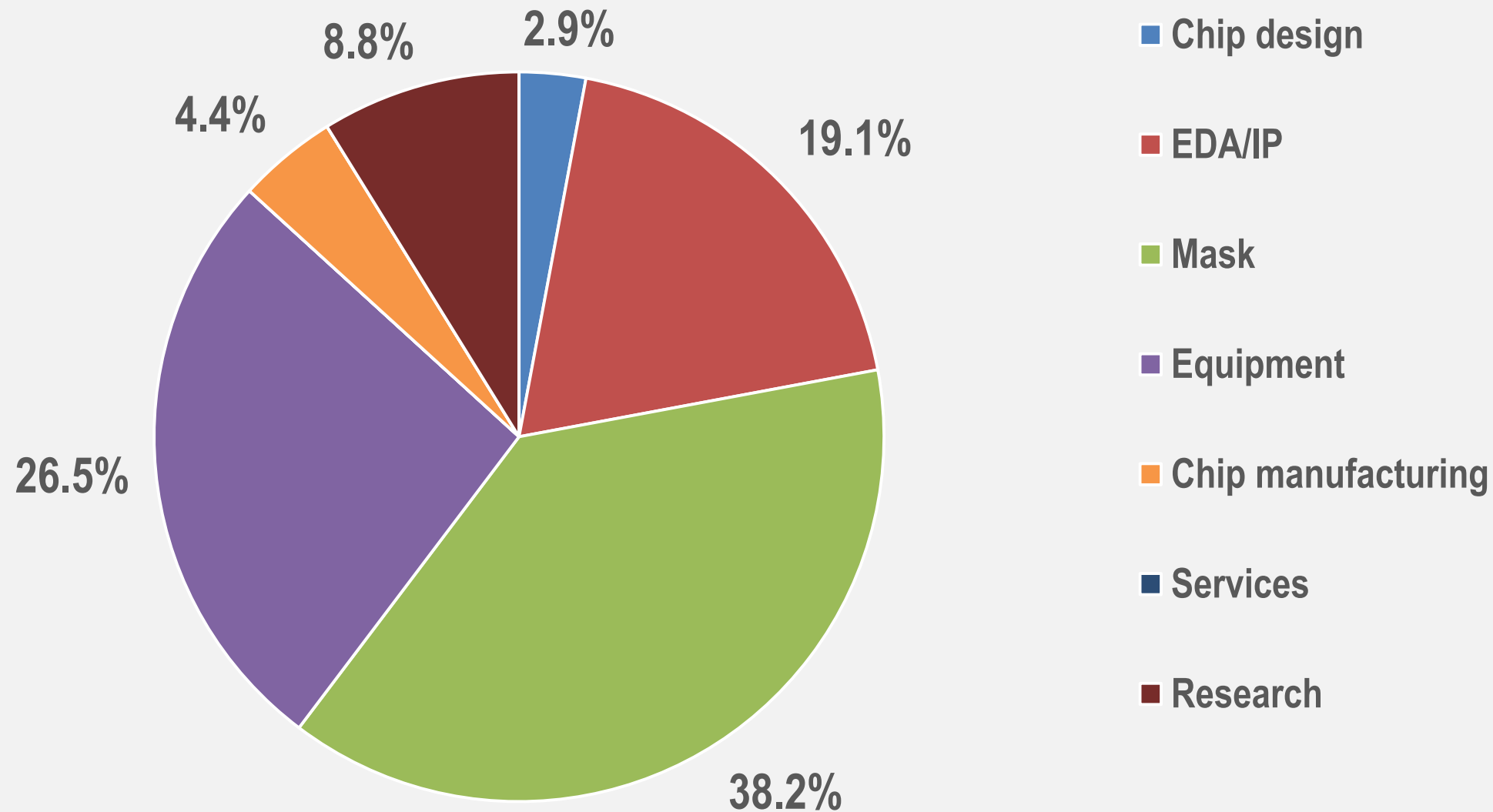


Our 8th Annual Perceptions Survey – 2019 (July)

Thank you to the 68 luminaries across 42 different companies



What part of the semiconductor ecosystem is your primary focus?

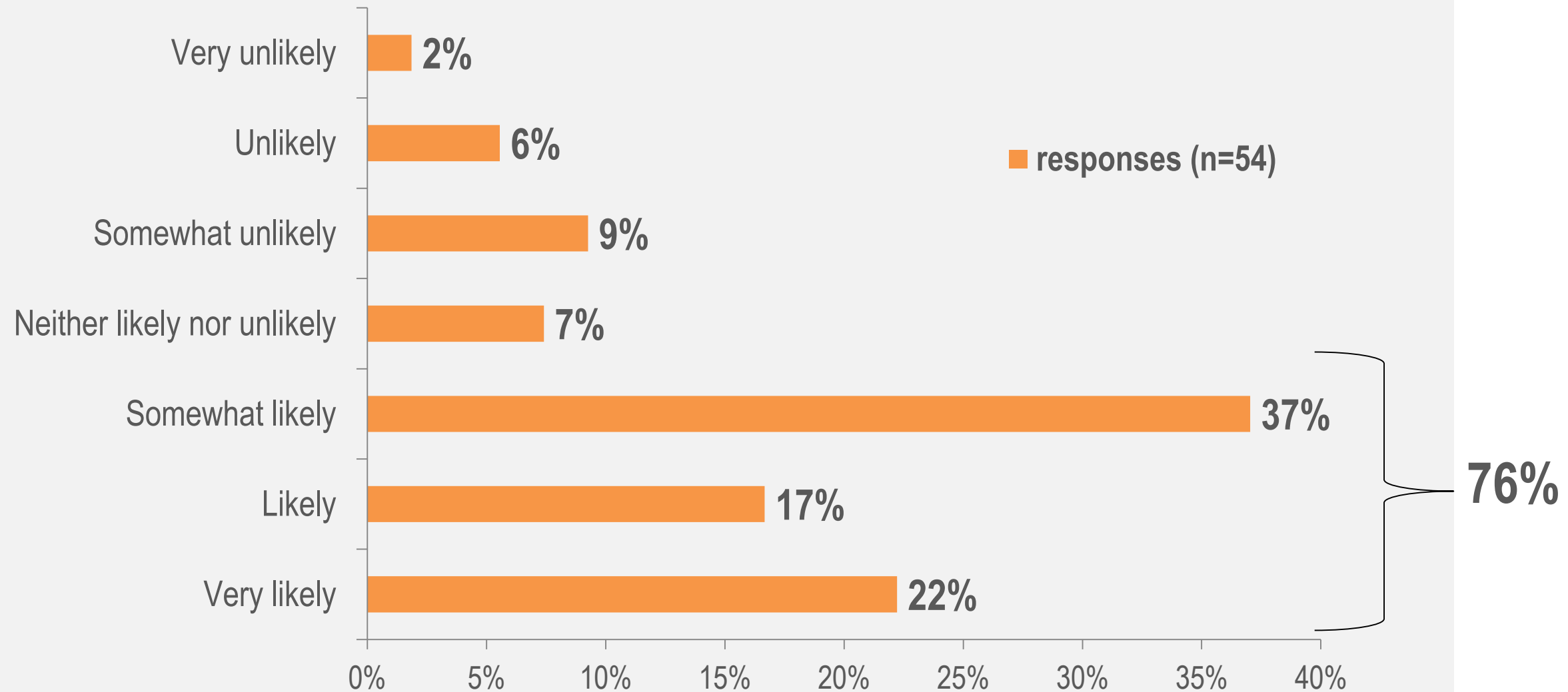


Deep Learning Impact Predicted by 2020

76% say it's somewhat to very likely to be a purchase criterion



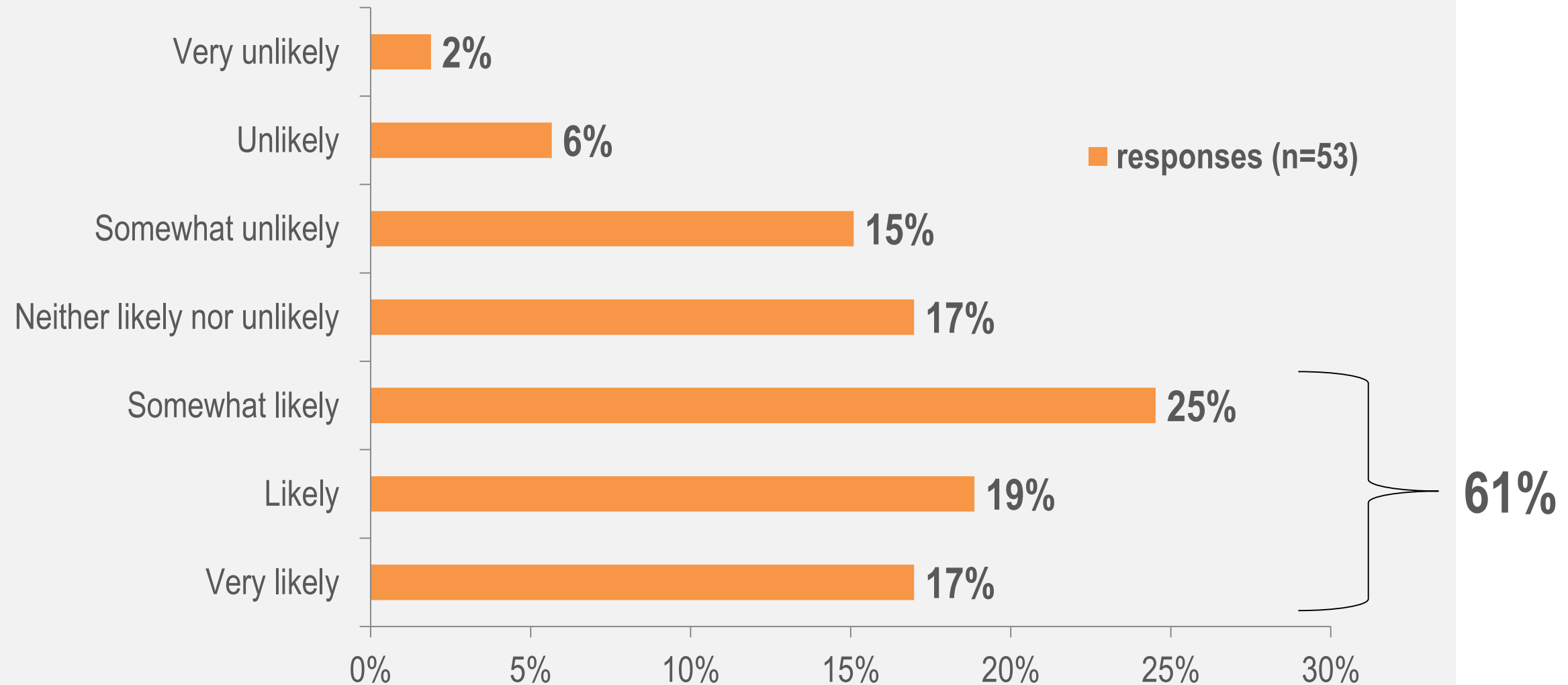
New Q: In your company's semiconductor operations, how likely are your customers to purchase products or services based on its deep learning content by the end of 2020?



Deep Learning Impact Predicted by 2020

61% say it's somewhat to very likely an internal buying criterion

New Q: In your company's semiconductor operations, how likely are you to purchase products or services based on its deep learning content by the end of 2020?

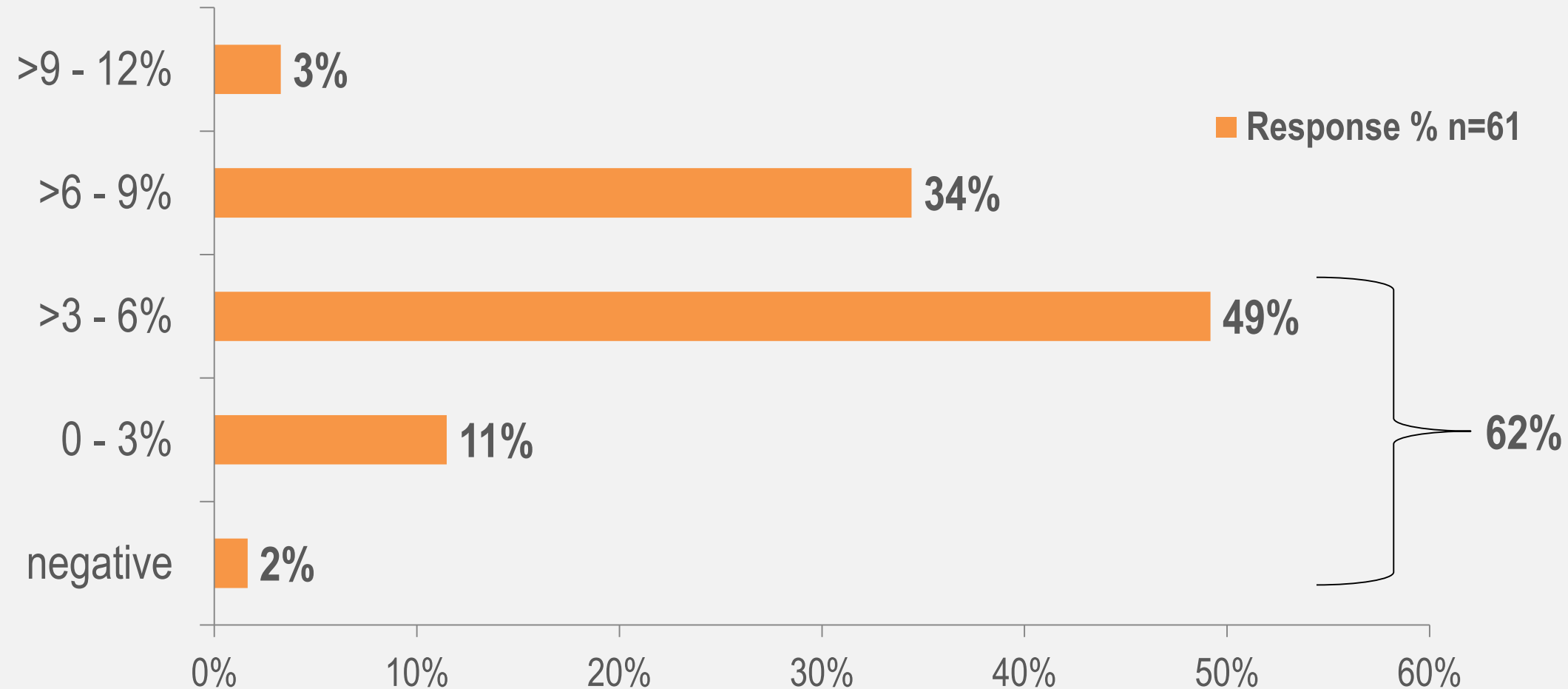


Mask Market Growth Perceived to be Slowing

62% predict “6% or lower” 3 yr CAGR for 2019

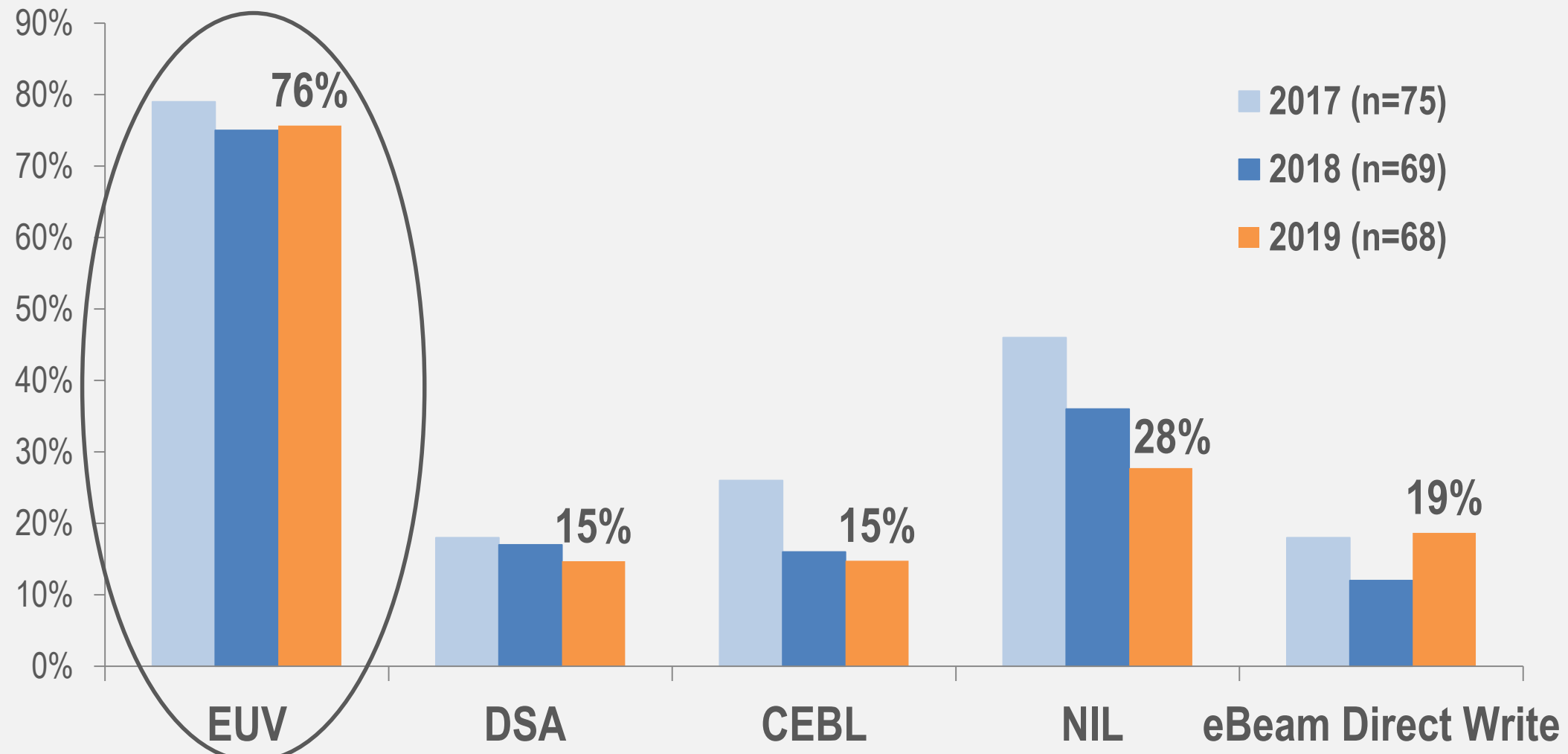


New Q: SEMI reported that the overall mask market increased to \$4.04B in 2018 which is a 7.34% compounded annual growth rate (CAGR) over 3 years ending in 2018. What is your best estimate of the 3 year CAGR for the overall mask market at the end of 2019?



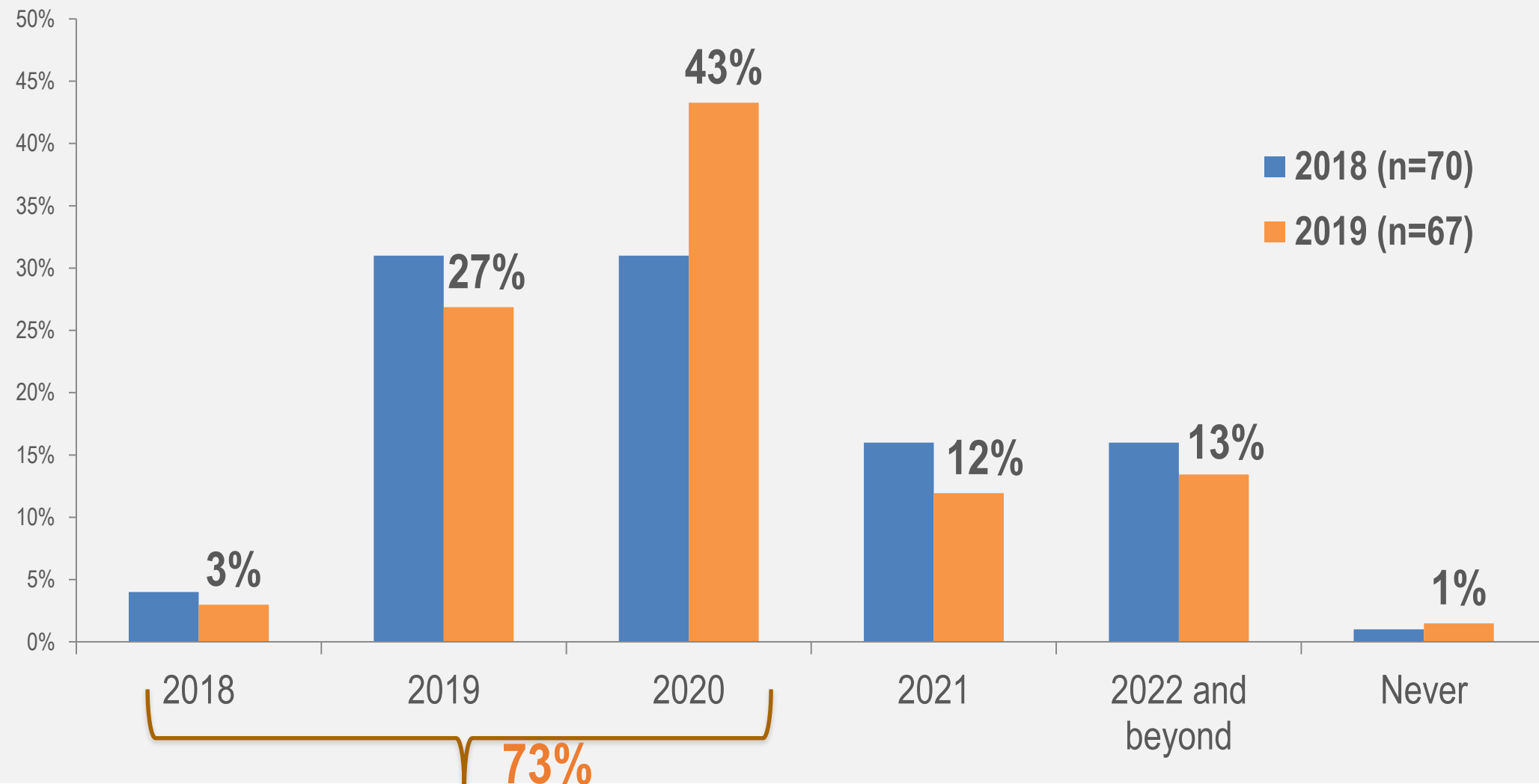
EUV Confidence Remains High

Please rate your confidence that the following lithography solutions are used for at least one manufacturing step of at least one production chip being manufactured in the world by the end of 2021:



73% Predict EUV in HVM by End of 2020

By the end of which year do you predict EUV will be used in high volume manufacturing? Please choose one.

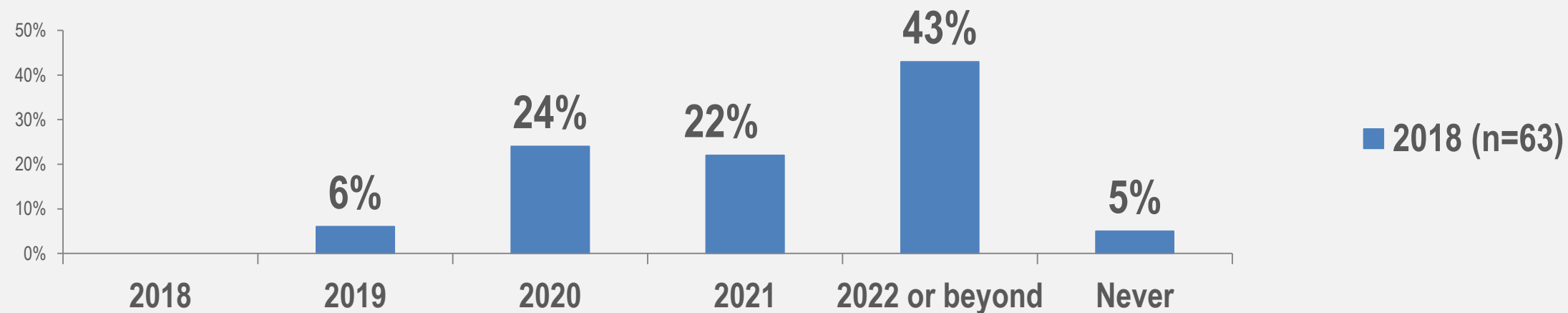


Outlook Remains Positive for Actinic Inspection

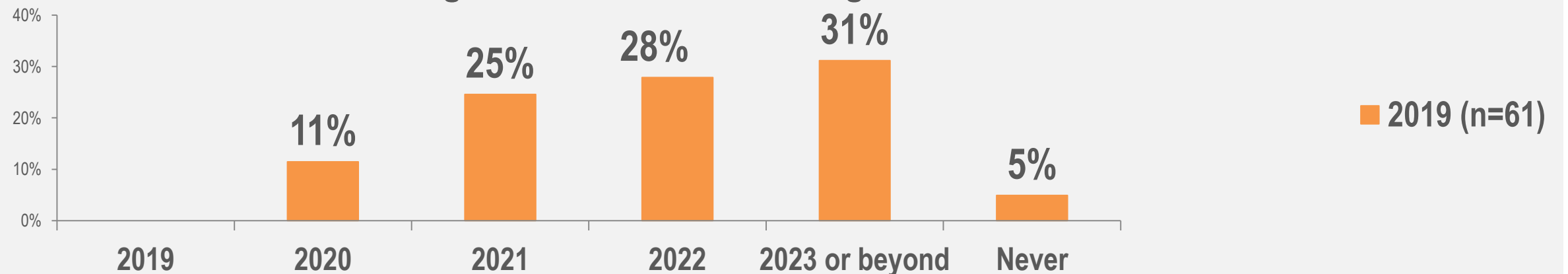
Only 5% predict “Never” in 2018 and again in 2019



By the end of which year do you predict actinic mask inspection for EUV will be used in high volume manufacturing? Please choose one.

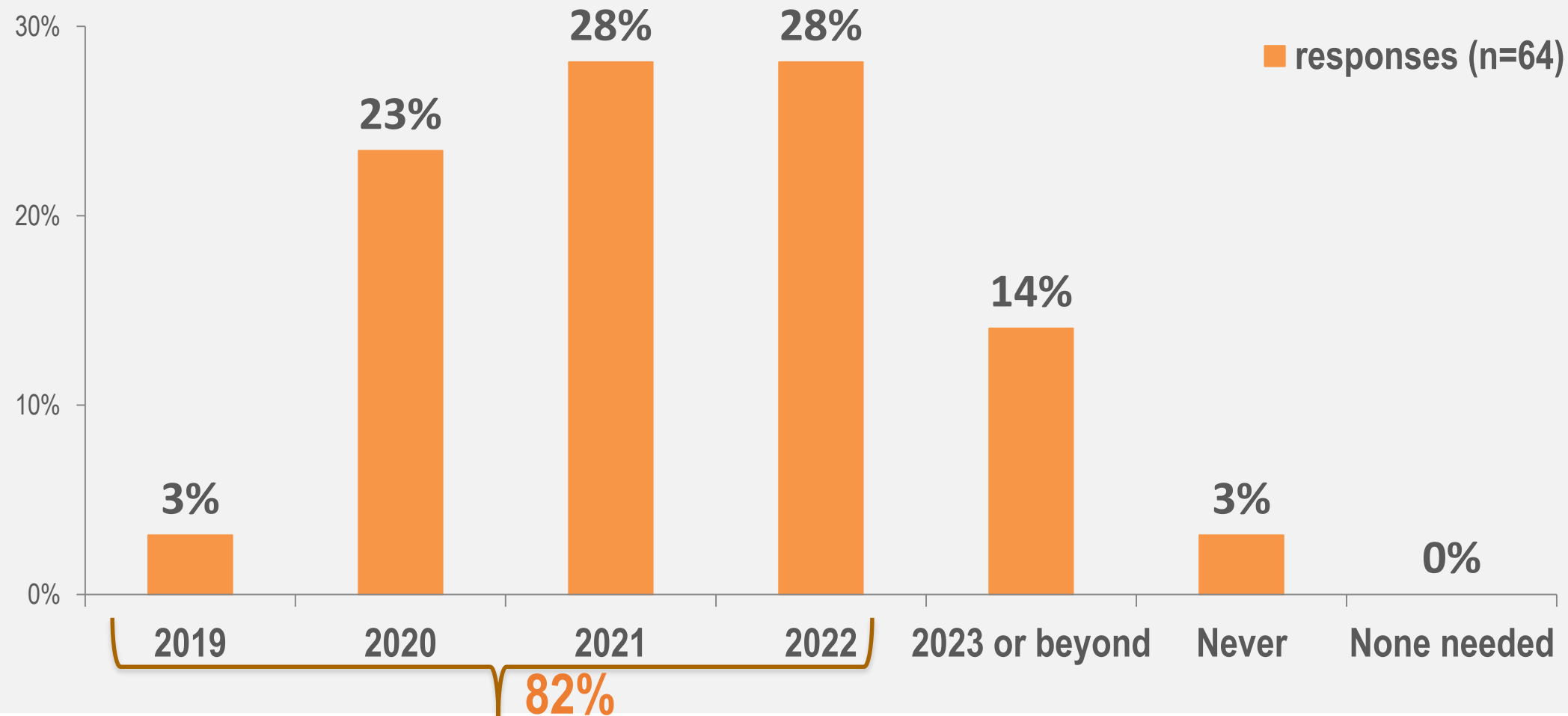


By the end of which year do you predict actinic mask inspection for EUV will be used in high volume manufacturing? Please choose one.



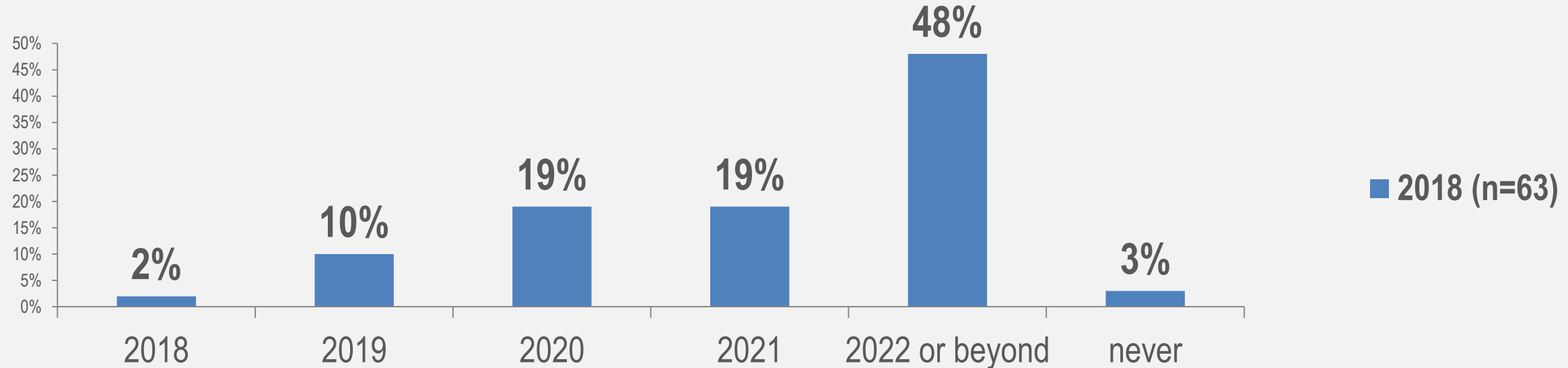
82% Predict EUV Pellicle in HVM by 2022

New Q: By the end of which year do you predict a pellicle will be available for EUV high volume manufacturing? Please choose one.

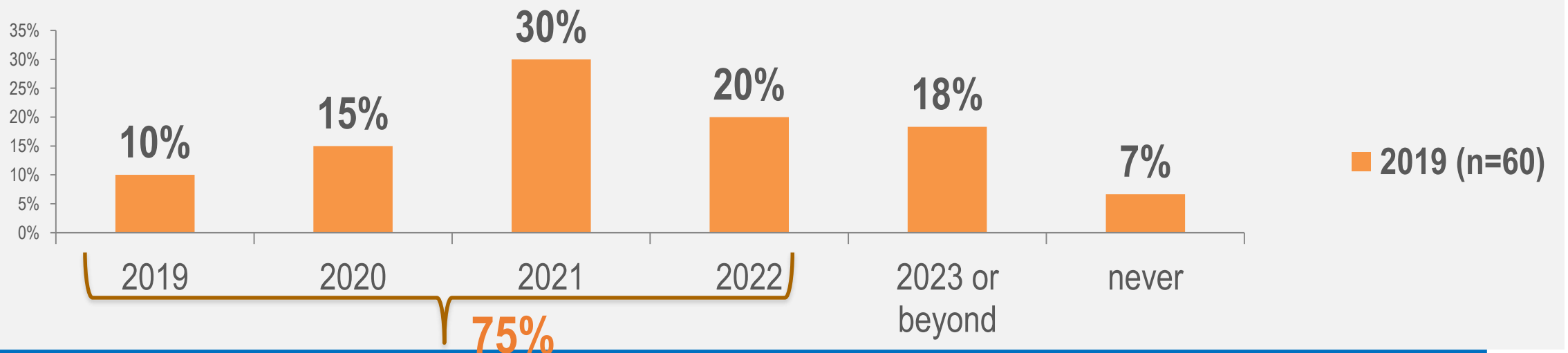


75% Say ILT + EUV Usage by 2022

There will be at least one layer of a high volume production chip that will use ILT for EUV lithography by what year? Select one answer.



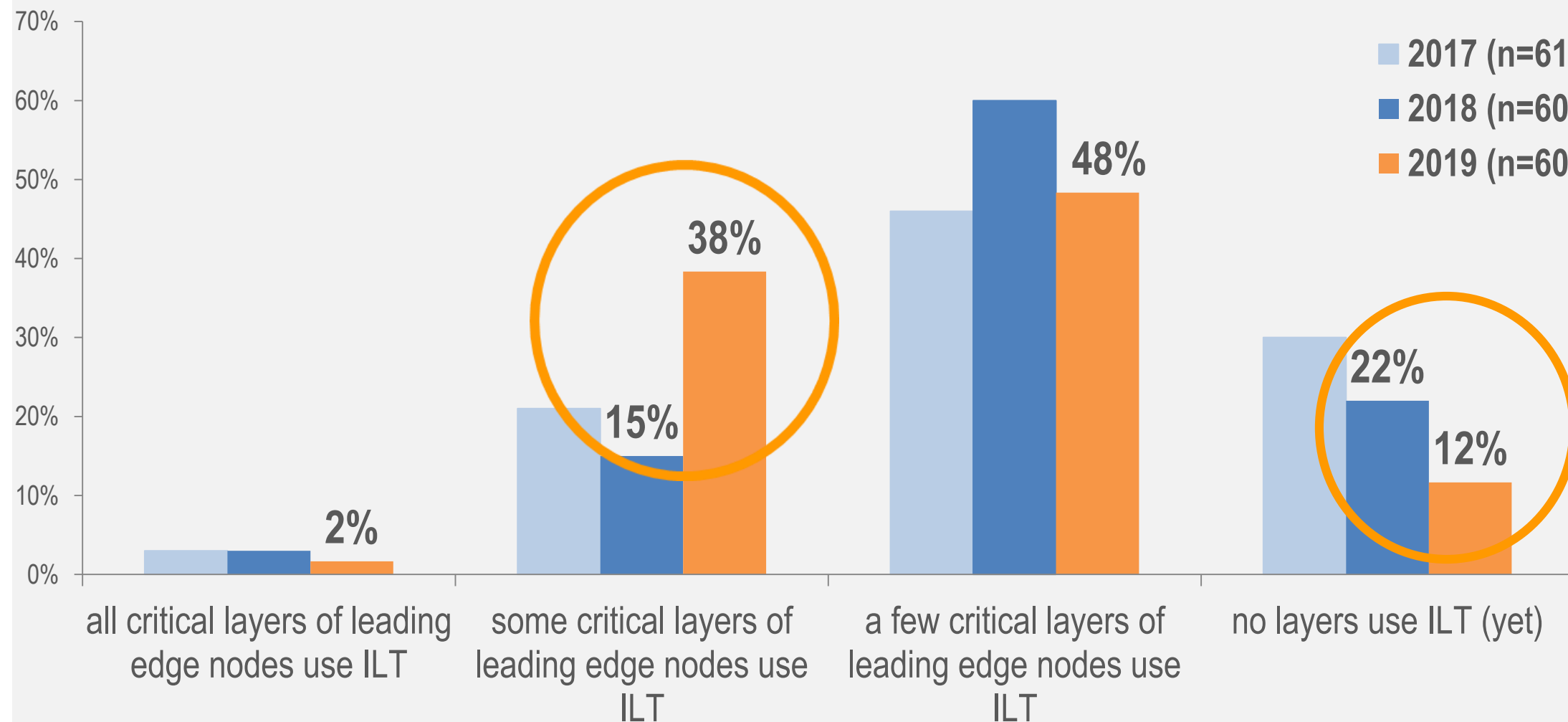
There will be at least one layer of a high volume production chip that will use ILT for EUV lithography by what year? Select one answer.



Usage of ILT Perceived to Have Increased

12% vs 22% last year said “no layers use ILT”

How broadly is inverse lithography technology (ILT) used for production chips today (2019)? (use includes for hot spots only) Select one answer.

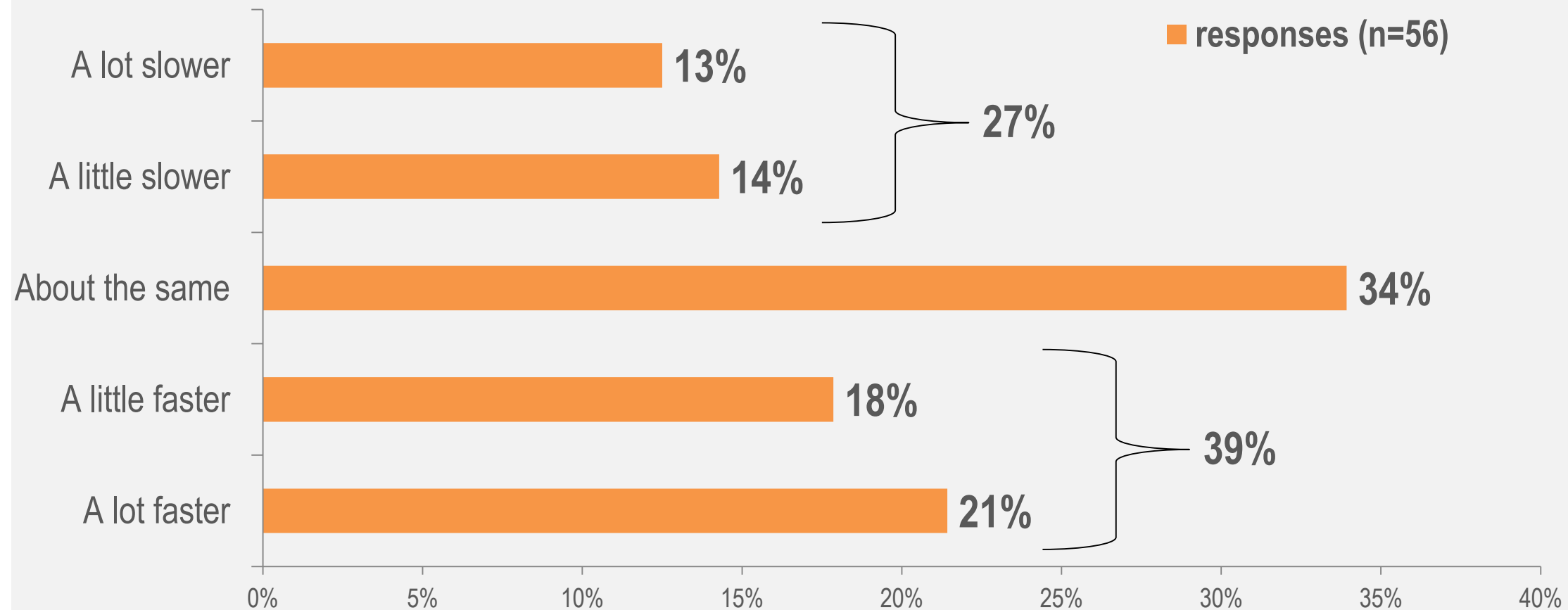


Differing Views Remain on TAT for EUV OPC/ILT



27% say “slower”, 34% the “same”, 39% “faster”

Revised Q: For leading-edge production wafers at year-end 2024, how will the total turnaround time compare for EUV vs 193i to execute all OPC/ILT functions processing one mask layer (retargeting, OPC, flare, etc)? EUV will be....

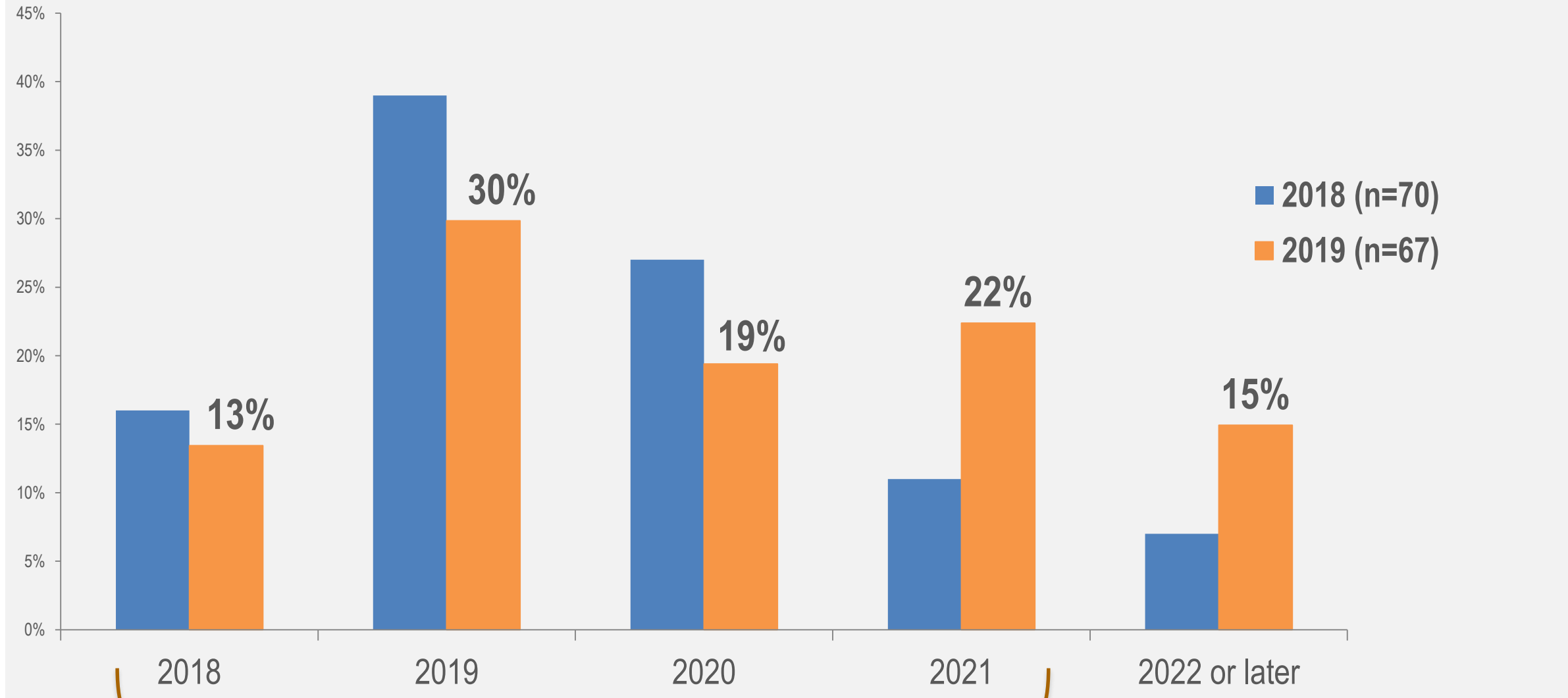


Multi-beam Mask Writers Being Adopted

Consistent with Mask Makers' Survey



By the end of which year do you believe that multi-beam technology will be used for mask writing for high volume manufacturing? Select one answer.



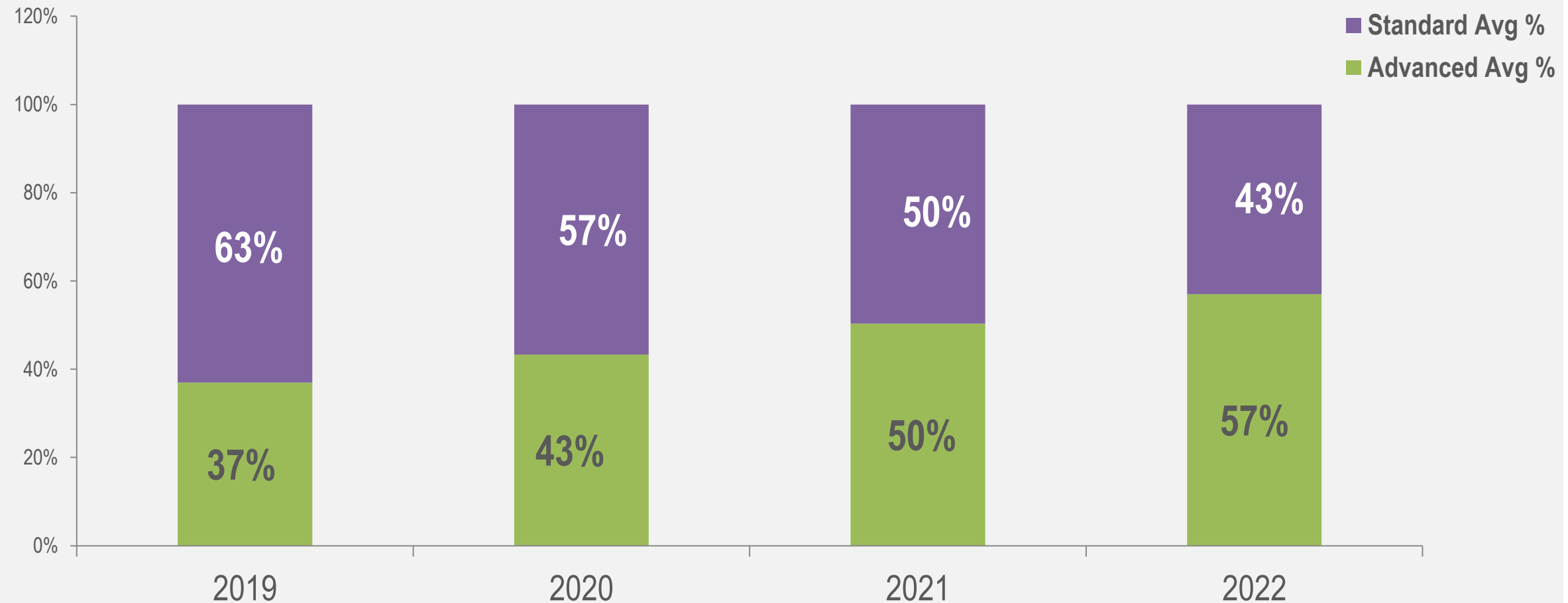
84%

Spectrum of New eBeam Writers Needed

50/50 Adv vs Std split predicted in 2021

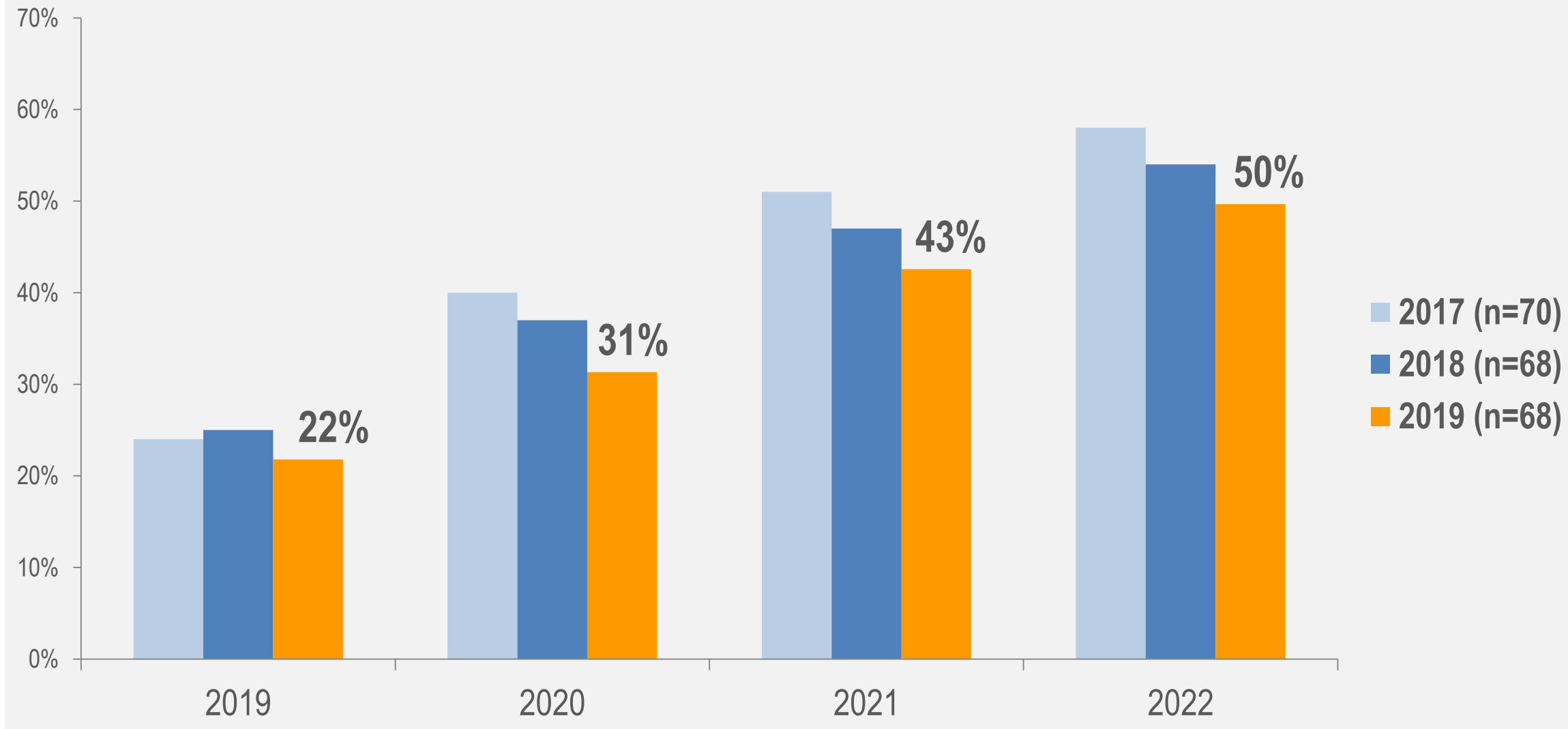


New Q: What will be the split (by units) in purchases of new eBeam mask writers worldwide between Advanced vs Standard? (where "Advanced" means multi-beam eBeam or the most advanced VSB mask writer)



Multi-beam eBeam Writer Purchases Ramp Up

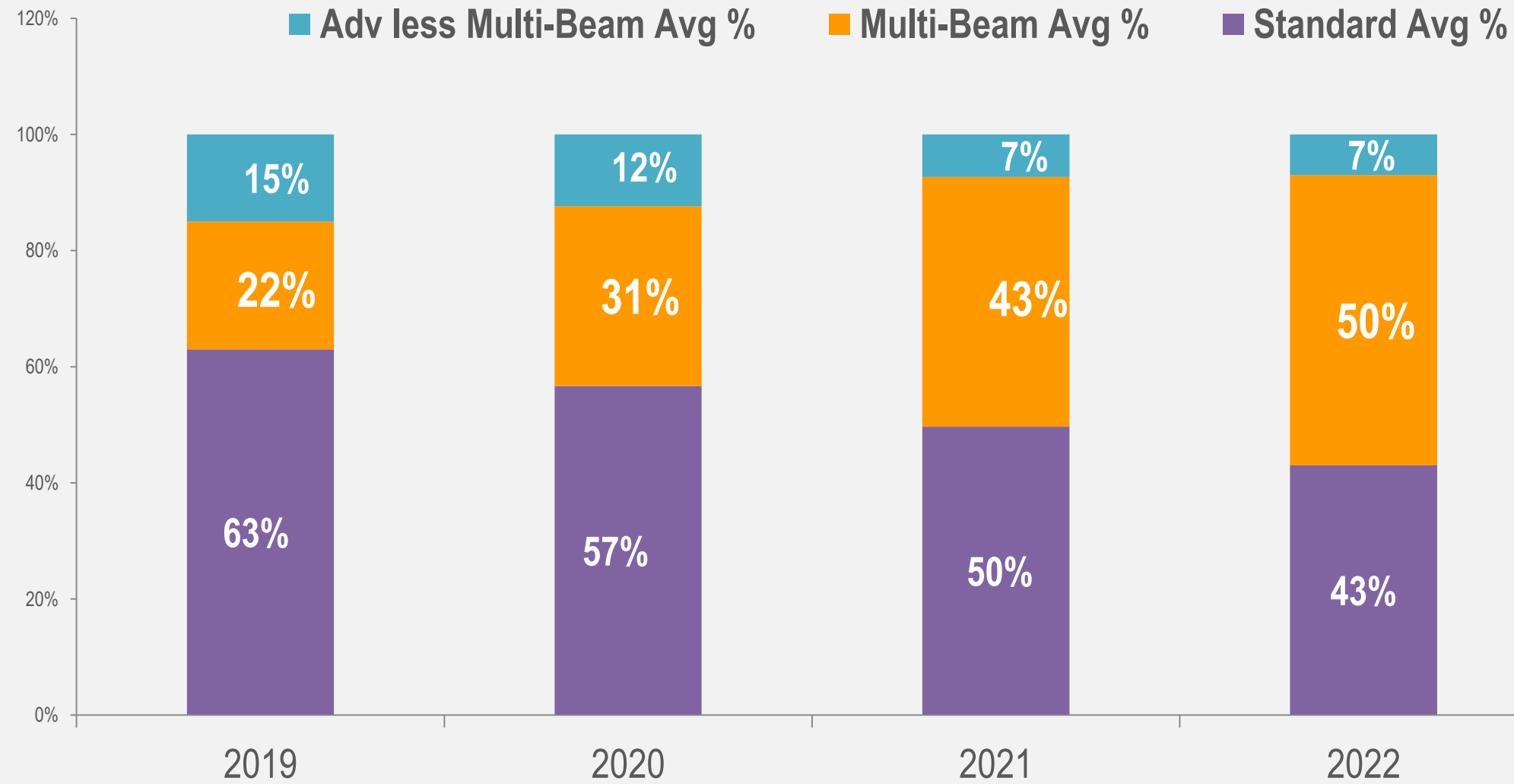
What percentage of new eBeam mask writers purchased worldwide will be multi-beam eBeam writers? Please answer for each year.



Multi-beam is 50% of Purchases by 2022



Breakdown of New eBeam Writers to be Purchased



Deep Learning and EUV to Impact 2020



- **Deep Learning Likely to be a Purchasing Criterion Soon**
 - For our customers: 76% predict it will impact decisions by the end of 2020
 - For ourselves: 61% predict it will impact internal decisions by the end of 2020
 - **Confidence in EUV Remains High**
 - 73% predict HVM by end of 2020
 - Outlook is positive for actinic inspection and pellicle
 - **Multi-beam Mask Writers Being Adopted**
 - Consistent with Mask Makers' Survey
 - Predicted to ramp up to 50% of all new eBeam writers purchased by end of 2022
-

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

**Perceptions and Mask Makers' survey results available on
www.ebeam.org**