It's Time for 300mm Prime

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think it. apply it.™

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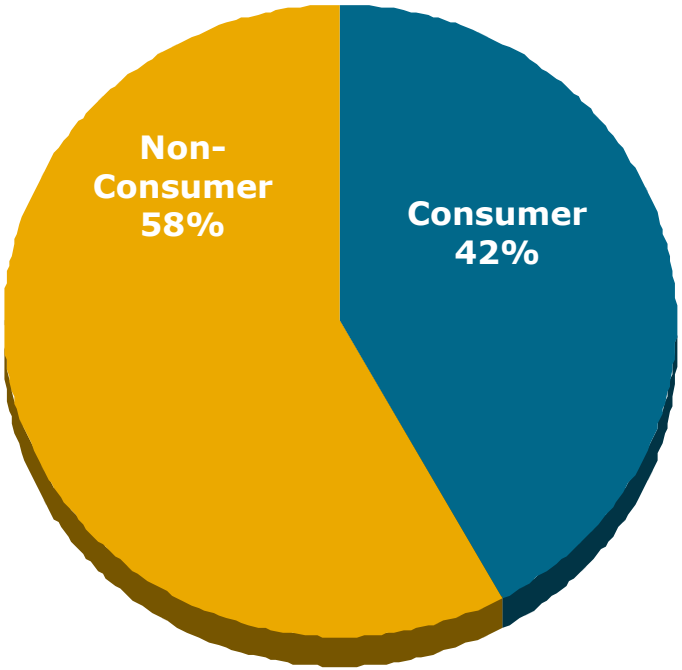
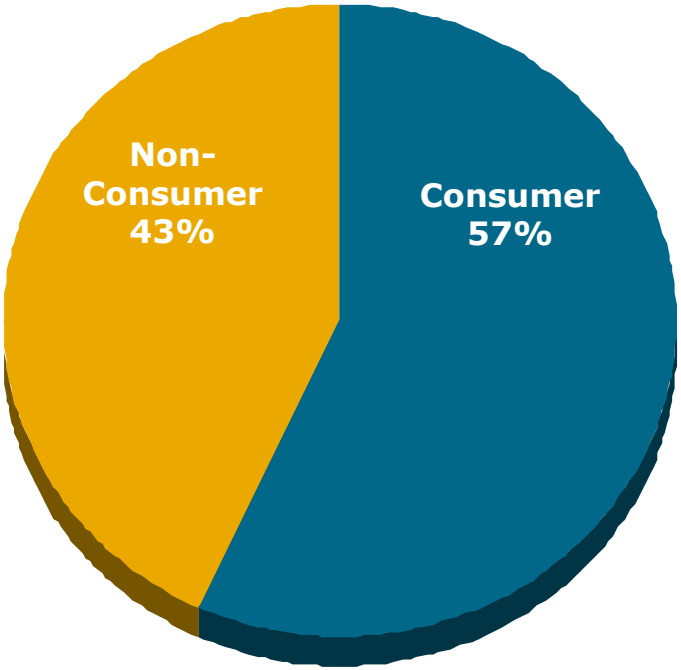
Consumerization of Semiconductors



2000

$223B



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$326B

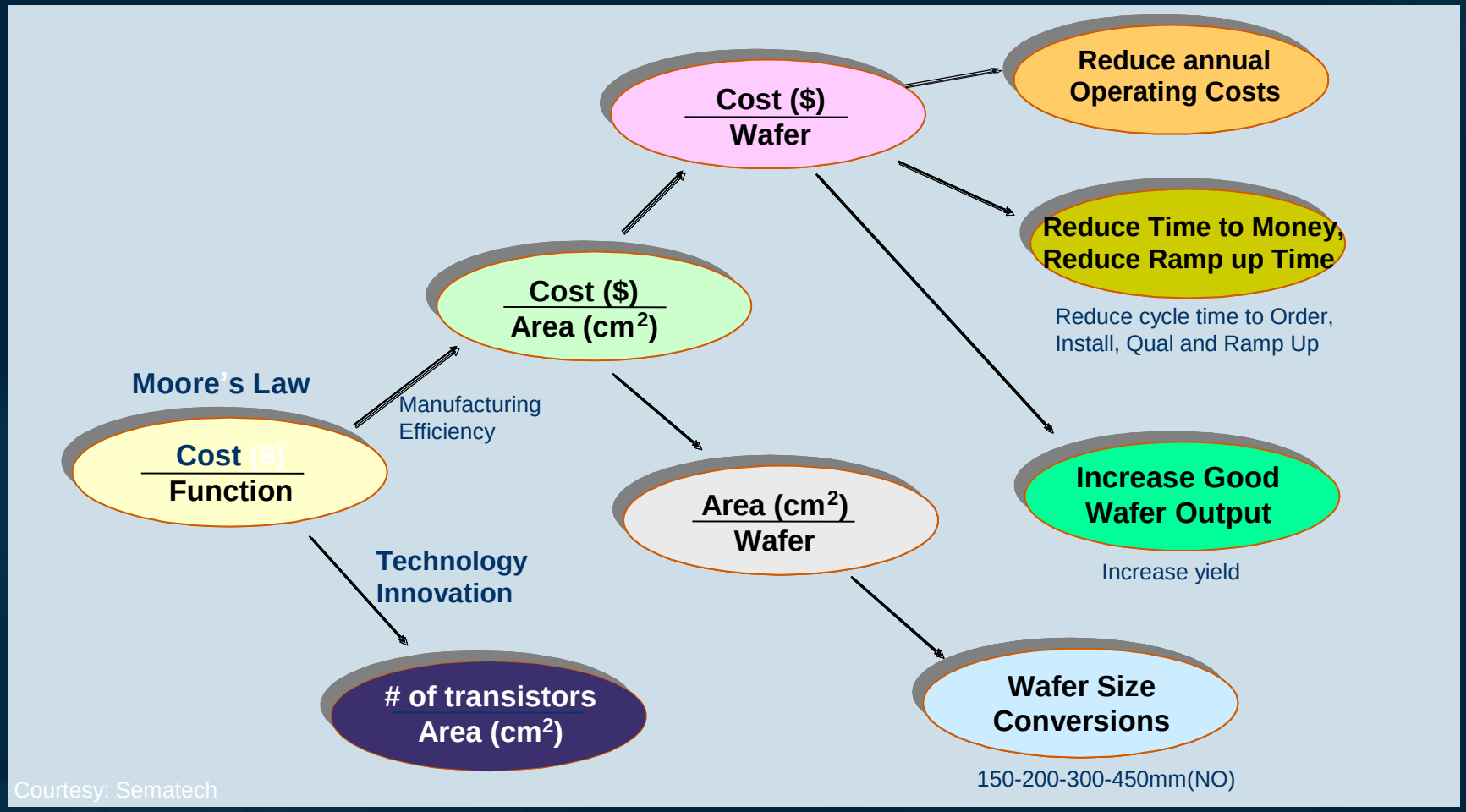
Source: Gartner Dataquest

Consumerization of the Industry Changes Everything

- Push for advanced technology created fab challenges:
  - High variability in tool operational performance (defects, MTBF, MTBI, MTTR)
  - Fabs incur high costs to contain and control variability
  - Fabs sacrifice cycle time to maintain operational efficiency
- This is NO LONGER ACCEPTABLE in the consumer era:
  - Cycle time / agility requirements
  - Cost
- Consumer era also severely curtails available funding across the semiconductor food chain

No more Business As Usual

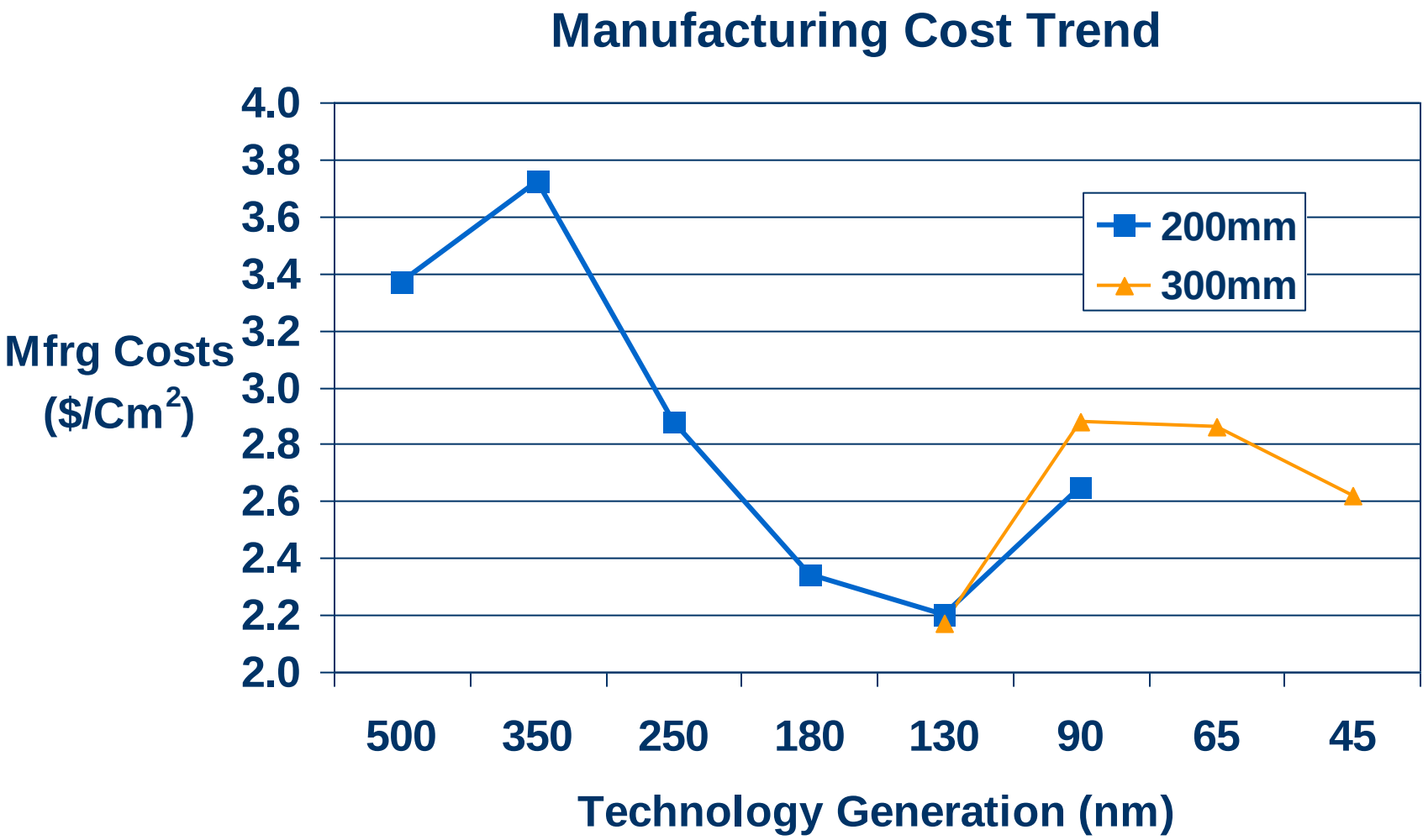
Fulfilling Moore's Law



Moore's Law Requires Continual Improvement in Cost/Function which Is Driven by Technology Innovations and Manufacturing

Ref: 2003 ITRS

Economic Impact of Wafer Size Transition

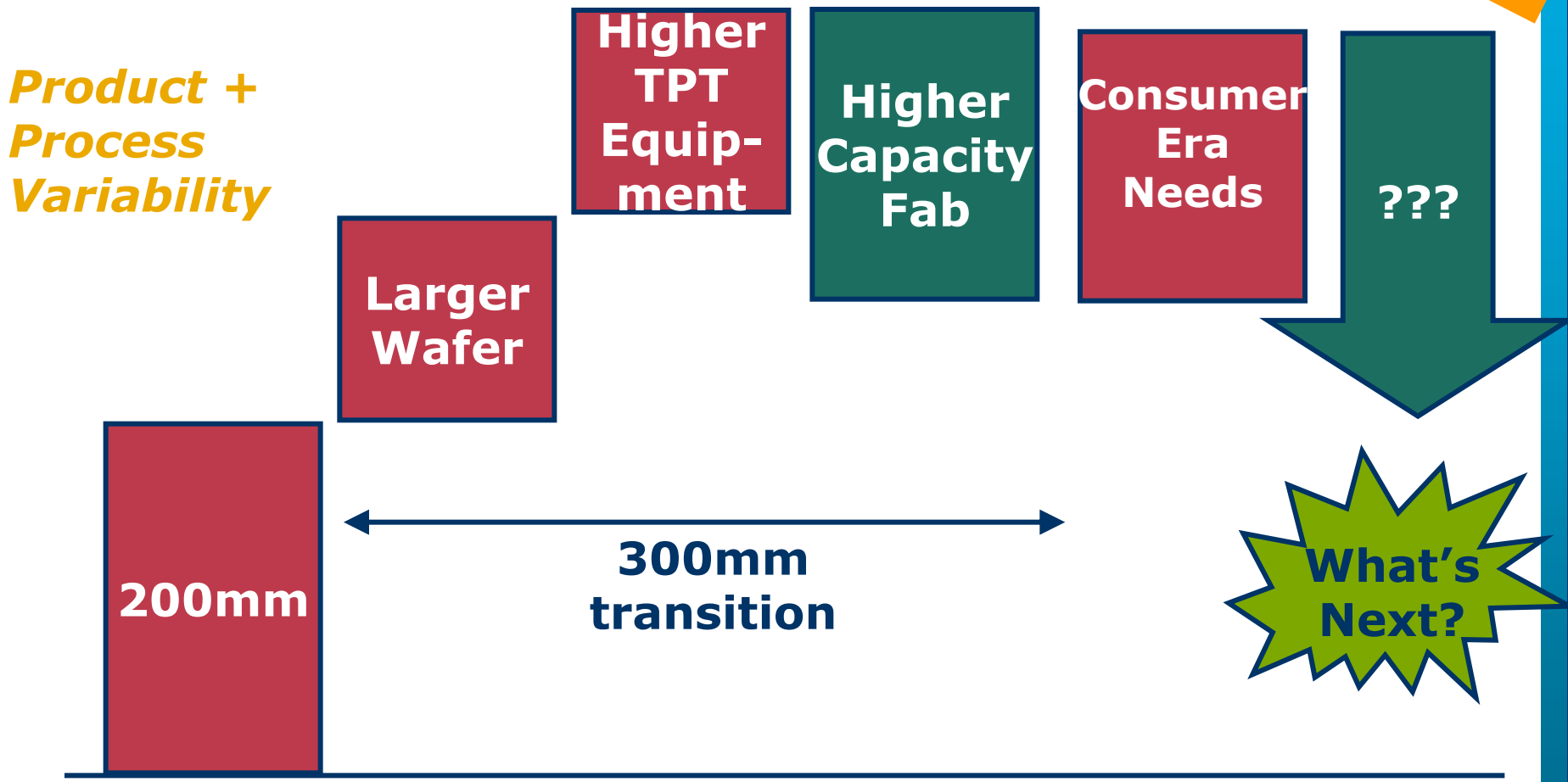


Note: Year 3 of production, Leading Edge Memory

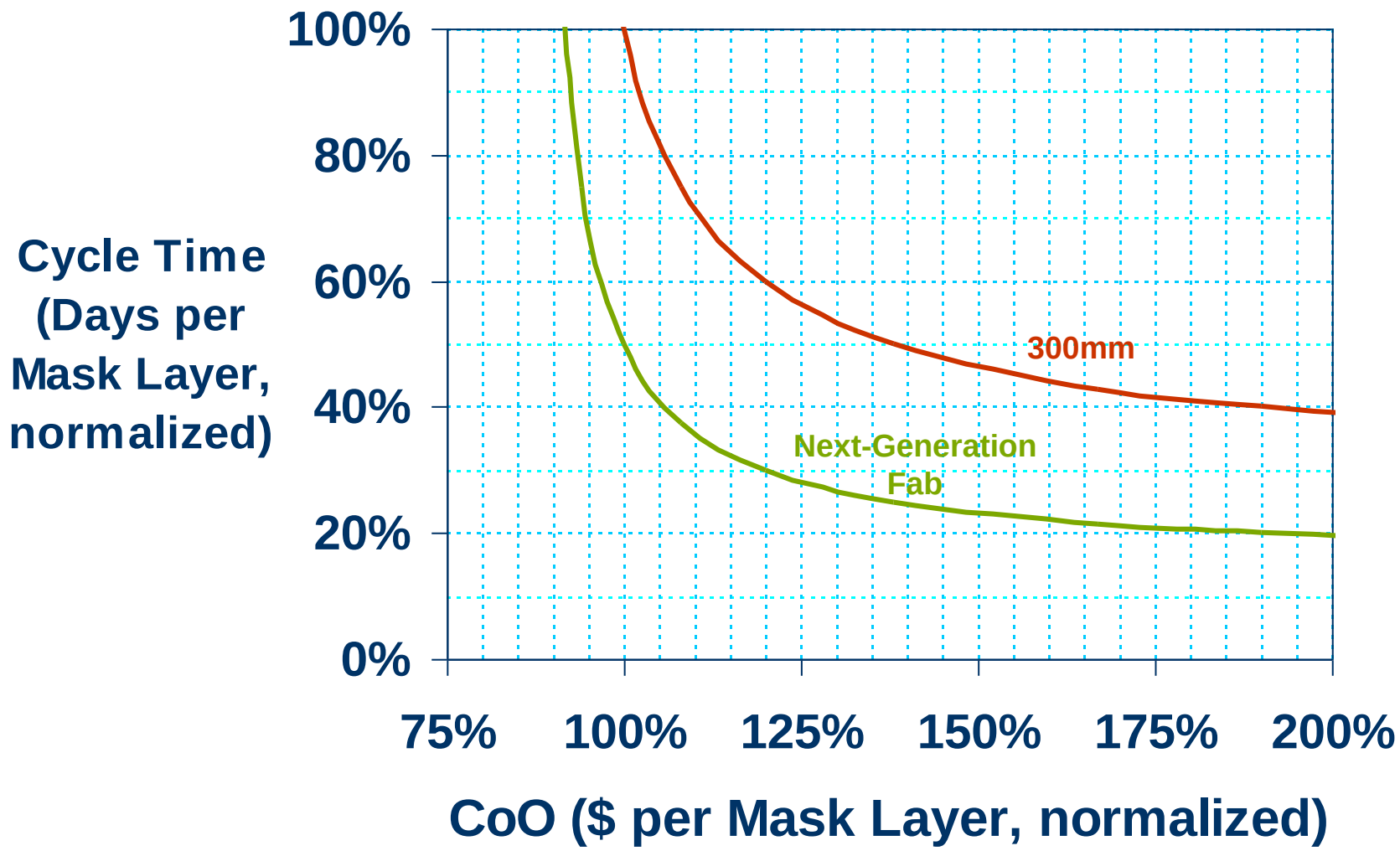
Source: Applied analysis of ISMI's Economic Model

Managing Variability

Conceptual

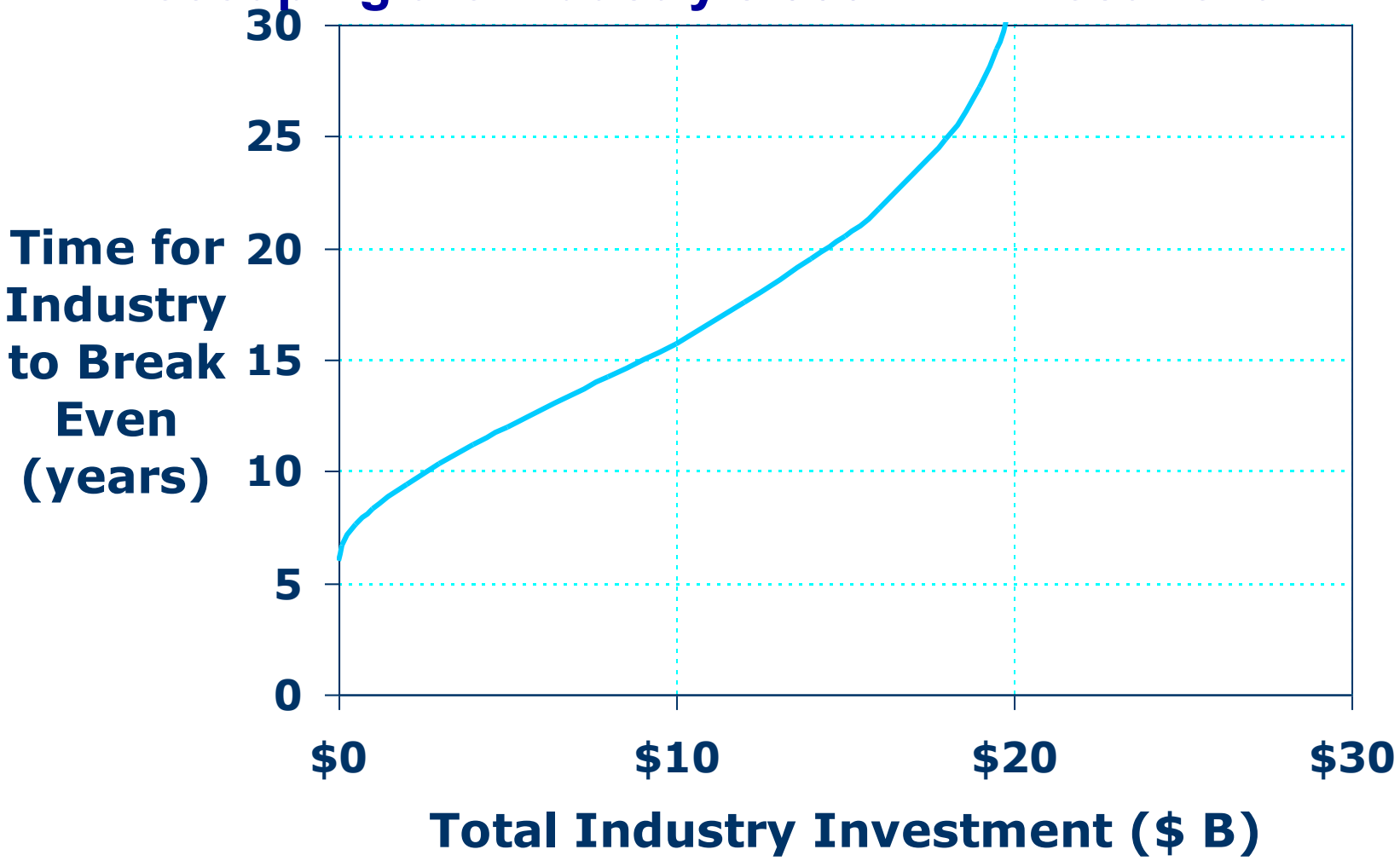


Productivity Space



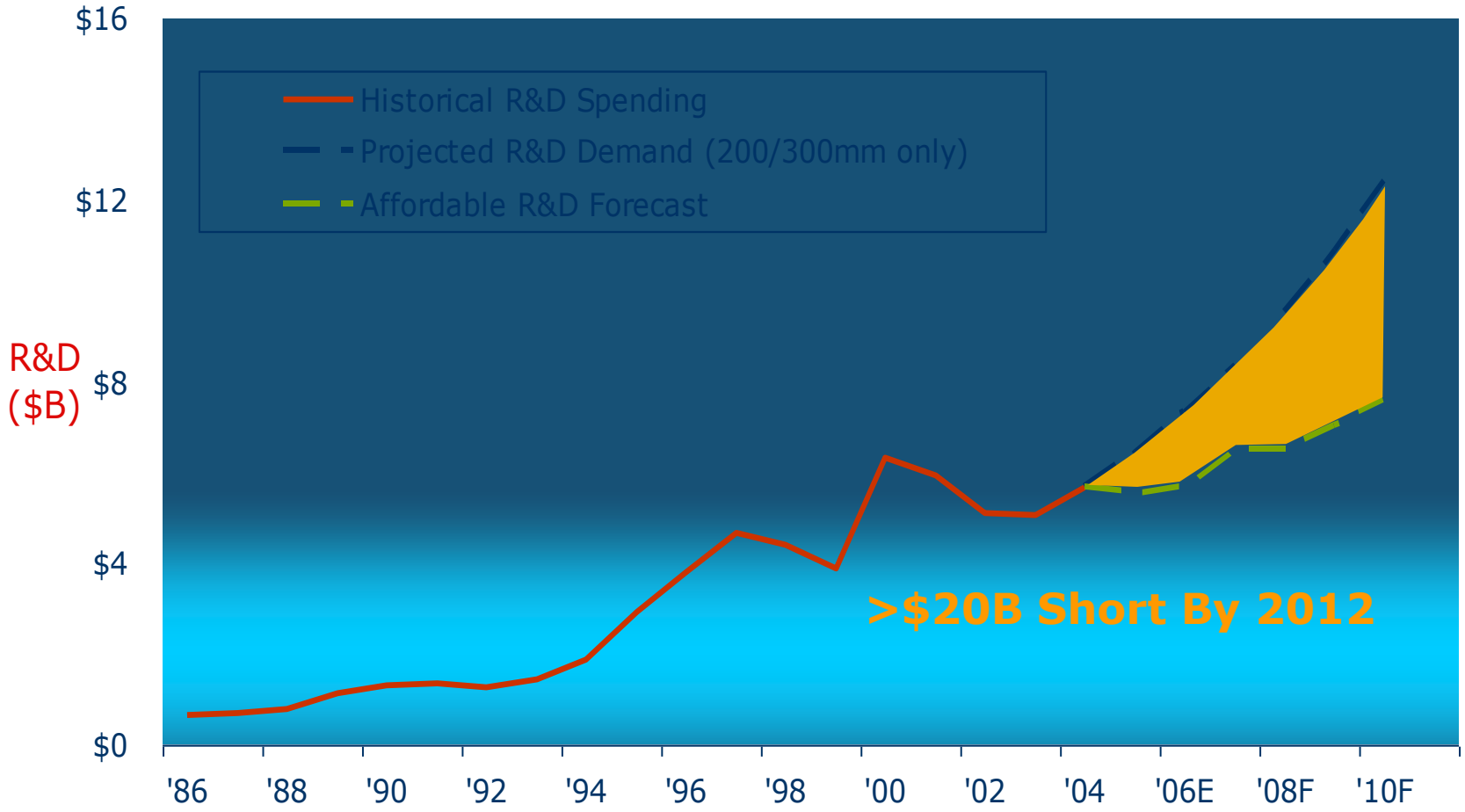
300mm Investment May NEVER Be Repaid

Recouping the Industry's 300mm Investment



Assumptions: Semiconductor industry trending from about $200B at 8% p.a.; 300mm follows a 30-year life cycle, peaking at 50% of silicon area processed (implicitly assuming larger wafer generations); semiconductor companies enjoy 45% gross margin; 55% of semiconductor costs are in wafer fabrication; 30% of die costs can be reduced via 300mm adoption; initial investment is distributed evenly over a six-year period; cost of capital is 20%

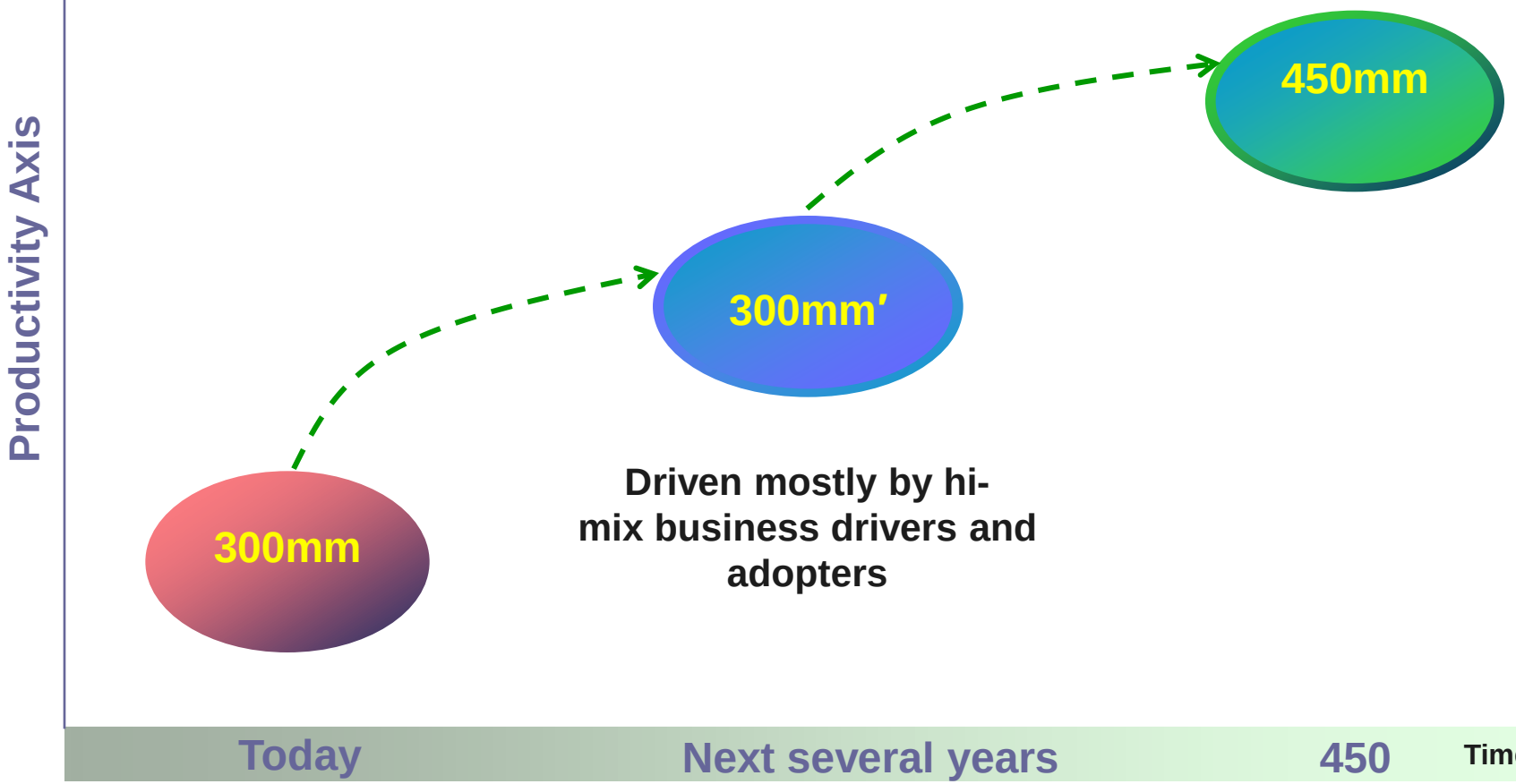
Equipment R&D Gap



Note: Affordable R/D forecast assumes 14% of equipment industry revenues
Sources: S&P, SIA, SEMI, Infrastructure Advisors

ISMI's Vision

300mm Prime:
an evolutionary transition to 450 mm concept



300mm Prime - strongly influenced by new/emerging business models (high-mix, smaller order sizes, shorter product life cycles …)

ISMI's Vision

300mm Prime – What is it?

Any 300mm design that has the likelihood of being used in a 450mm environment

Examples: lot buffering strategy, carrier design, factory recipe management system, predictive maintenance strategy, etc.

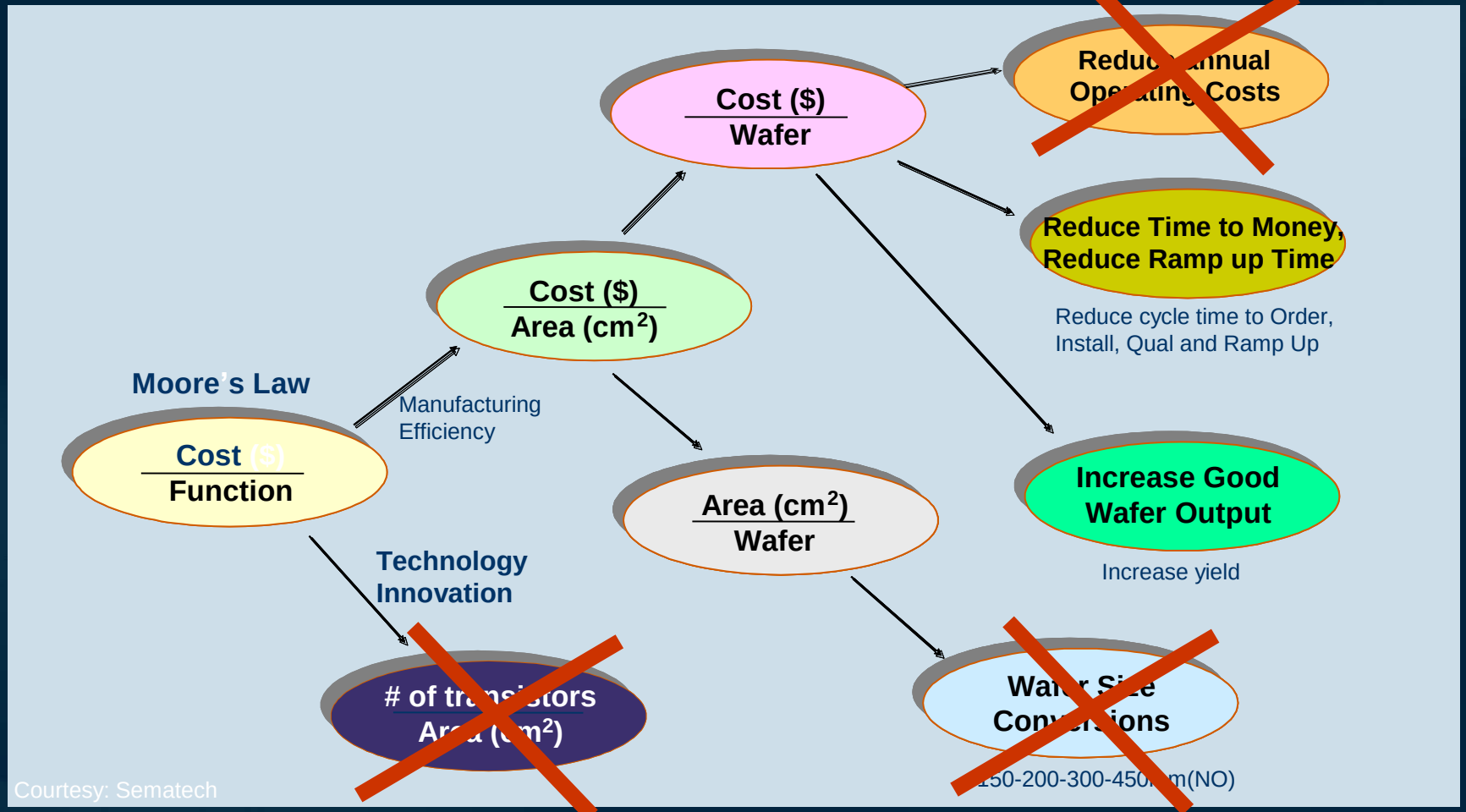
ISMI Next Generation Factory Vision

- ISMI member company inputs: 50% reduction in cycle time and 30% cost per area reduction
  - Tool utilization, availability, and output remain high, continuing lower cost of tool ownership
  - Target: 50% reduction from today's cycle time values to offset continuing growth in number of mask layers and to reduce product delivery time to customers
    - Example: Today: 2 days → Future: 1 day per mask layer
  - One aggressive goal that has been stated is 0.7 days /mask layer
- Shorter cycle time enablers:
  - More reliable process equipment
  - Elimination of batching delays
  - Reduced lot sizes
  - Reduced raw process time
- Several factors must come together to realize substantially shorter cycle time
  - One of these factors is AMHS design
  - Likely smaller lot sizes and shorter cycle time will drive higher AMHS transport performance and storage requirements/strategies

Source: ISMI, Scott Kramer, 11/6/2006

INTERNATIONAL SEMATECH ISMI MANUFACTURING INITIATIVE

Fulfilling Moore's Law *Via 300mm Prime*



Moore's Law Requires Continual Improvement in Cost/Function which Is Driven by Technology Innovations and Manufacturing

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APPLIED MATERIALS

Maximizing the Return on Fab Investment

Optimize fab operations

Build foundation of rapid, differentiated, technology solutions

- Extend Litho
- Enable transistor performance
- Scale interconnect RC
- Scale memory density (strain)
- Resolve nano defects

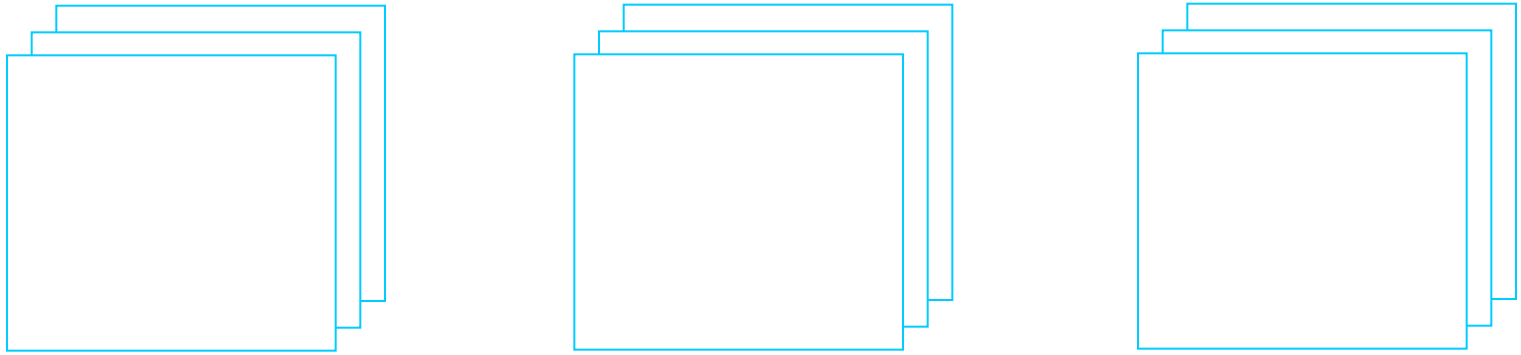
300mm Prime :
Maximizing the Return on 300mm Investment

- Definition:
  - The 300 mm Prime program seeks to implement **discontinuous improvements** in fab productivity of the type historically coinciding with wafer size transitions…
  - **…** **without** incurring the costs and risks associated with a scale-up of tool sets
- Scope: primary focus will be increased fab **agility** and **reduced cycle time**, as a complement to **continuous improvements** in the productivity of the 300mm tool set
- Key levers:
  - High-capacity, high-reliability material delivery system ➔ small-lot manufacturing
  - "Intelligent" tools (high predictability)
  - Universal single-wafer processing

Mapping 300mm Prime

Needs/Benefits/Levers		Possible Technological Implementations (Example)			
		Small Carrier Size	Single Wafer Processing	Wafer Level Tracking	…
First Wafer Effect	Average setup time				
	time to start processing 1st wafer				
Tool Variability	% of down time that is unscheduled				
	Variability of time between down time				
	Variability of repair time				
Transport & Storage	Wafer wait time at tool inside carrier				
	Variability of carrier delivery time				
	Variability (distribution) of WIP awaiting tool				

System Products ***Service Products*** ***Software Products***



300mm Prime Architecture

Processing Platforms	**Automation Platforms**	**Software Platforms**
Universal Single-Wafer Processing	***Small-Lot Handling***	***Embedded Intelligence/ Reduced Variability***

Consumerization of the Industry Changes Everything

- "Business as Usual…"
  - Sacrificing fab agility
  - Suboptimal (low-ROI) investment decisions
- … is NO LONGER ACCEPTABLE in the consumer era
  - Cycle time / agility requirements
  - Resource limitations
- Fabs need to match the economics of the consumer era
  - Reconfigure tools to enable short cycle time manufacturing and short lead time
  - Small lot size
  - Frequent recipe change

think it. apply it.™

APPLIED MATERIALS®