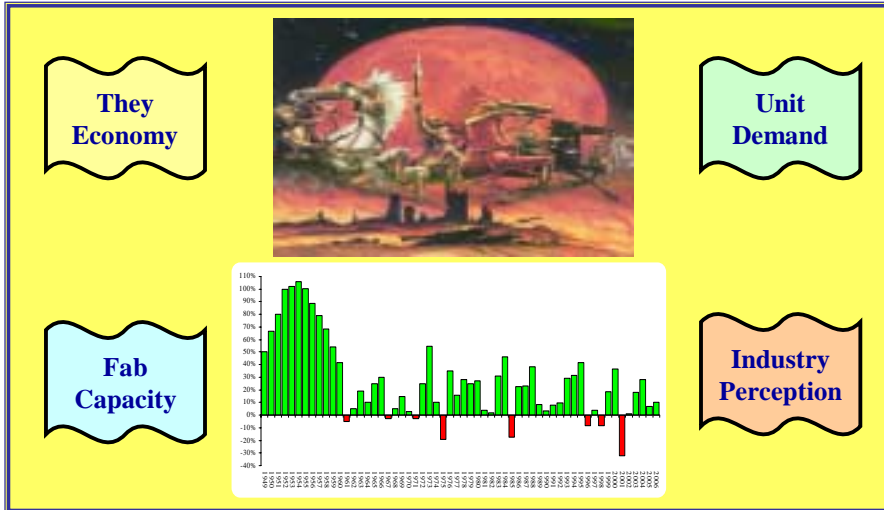


## Outlook & Issues For The Global SC Market



**Malcolm Penn, Chairman & CEO, Future Horizons**



1

The Global Semiconductor Industry Analysts

## Agenda

**Current Industry Status & Outlook**

**Key Market Drivers**

**Industry Issues**

**Summary & Conclusions**



2

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## Future Horizons Research Methodology

- Focus On The Basic Fundamentals
- Look For Changes In Industry Characteristics
- Analyse Deviations From Long-Term Trends
- Analyse Cause Of Cycles, Not 'Best Historical Fit'
- Sales Value = Units Sold x Price Sold For
- Markets Don't Buy Chips - Only Customers
- All Markets Are Finite - They Eventually Saturate
- Over Capacity => Meltdown => Revenue Downturn
- Look For The Facts Not Hype, Fashion Or Denial
- Past Industry Cycles Poor Indicator Of The Future
- Good Old-Fashioned Common Sense & Experience  
(Slide Rule Sanity Check Mentality)



## Future Horizons Forecast Track Record

(What We Said In January vs What Actually Happened)

**IFS2002 - FH Analysis "No Chance For Recovery":**  
Forecast 1.4% (Consensus: 'Double Digit' Bounce Back) Actual 2.0%

**IFS2003 - FH Analysis "Weak 1H With Strong 2H Recovery"**  
Forecast 18.0% (Consensus: Single-Digit Growth) Actual 18.8%

**IFS2004 - FH Analysis "Continuing Strong Recovery"**  
Forecast 32.0% (Consensus: Low Double-Digit Growth) Actual 28.0%

**IFS2005 - FH Analysis "Pause Not Recession, 2003 Re-Run"**  
Forecast 15.0% (Consensus: Negative To Low Growth) Actual 6.8%  
(2H Rebound Delayed By 1-2 Months. IC Unit Growth 11%)

**IFS2006 - FH Analysis "Continuing Strong Recovery, 2004 Re-Run"**  
Forecast 20.0% (Consensus Single Digit Growth) Actual 8.9%  
(130nm Impact/Memory-MPU Price Wars Derailed ASPs. IC Unit Growth 18%)

**IFS2007 - FH Analysis "Continuing Strong Recovery, 2004 Re-Run"**  
Forecast 12.0% (Consensus Low Double Digit Growth) Actual 3.2%  
(8% Lost Due To Continuing Memory-MPU Price Wars. Unit Growth 10%)

**We Got The Underlying Market Trends Right Six Years In A Row  
50-50 On Guessing The Right Number**



## 2007 In Perspective

- Disastrously Bad Start (1H-07 IC Sales Down 6.4% vs. 2H-06)
- Market Finally Changed Momentum In Q3-07 (Normal Seasonality)
- 'Too Little Too Late' To Rescue The Year As A Whole
- Third Successive Year Of Single Digit Growth (cf 1989-1992?)
- Declining ASPs To Blame (IC Units Grew 10.0 Percent)
- Unit Growth Lower Than 2006's 18.1% (But In Line With LT Trend)
- Memory & Micro Price Wars Cost 8-9 Percentage Points Of Growth
- Underlying Problems Structural Not Recession (Key Distinction)
- Market Can Bounce Back Fast From A Correction (Less So A Recession)

**What Then For 2008? ... 4<sup>th</sup> Year Of Single Digit Growth (1991-92)  
Or Long Awaited Bounce Back (1992-93 / 1998-99 / 2002-03)?**

***"The Triumph Of Hope (10-12%) Over Experience (2-4%)"***



## Squaring Up To The 2008 Semiconductor Challenge

### More Questions Than Answers

- Will The 2008 Chip Market Recover Or Be Single Digit (Negative) Growth?
- Is Cap Ex & Capacity Expansion Too High, Too Low Or Just About Right?
- Are the NAND Flash & DRAM Markets Out of Control?
- Are IDMs The New Dinosaurs Verging On Extinction?
- Are There Real Risks With An Asset-Lite Strategy?
- How Will IDM/Fabless Firms Differentiate With The Same Blocks/Process?
- What Is The Impact Of Fab Consolidation On Cap Ex & Utilisation?
- Will The Foundries Move From IP Providers Into Chip Design?
- Are Foundries The New IDM Business Model In Prospect?
- Why Is The (Established) Industry So Cautious & Risk Adverse?  
(‘Focus On The Numbers & Compliance’ vs ‘Make Lunch Or Be Lunch’)
- “It’s Different This Time ... The Industry’s Matured & The Cycles Tamed”



## Back To Industry Basics – Dr Gordon Moore

*“Semiconductors are a peculiar business; the only sane strategy is to bet the company regularly”*

- ❑ This industry tends to have cycles; for the device suppliers these are generally price not volume driven
- ❑ If you plot the volume of devices, you see very, very few dips and very mild ones; you plot the dollars and you see very wide fluctuations. This causes fairly abrupt dislocations; the price never comes back up
- ❑ You never get well on the old products; you only get the increased revenue by moving on to the next generation of products. So it's very important you continue R&D investment across the bottom of the cycles
- ❑ This is something that tends to be counterintuitive to people used to operating in other industries where you cut your cost, which means often cutting development, during the recessionary periods and build them up again during the others
- ❑ In semiconductors you can't do that; you have to keep developing the new stuff all the time. In fact, you even need to accelerate the development of new stuff across these negative periods. You always have to have something new coming out the other end



## Back To Industry Basics – Dr Tsuyoshi Kawanishi

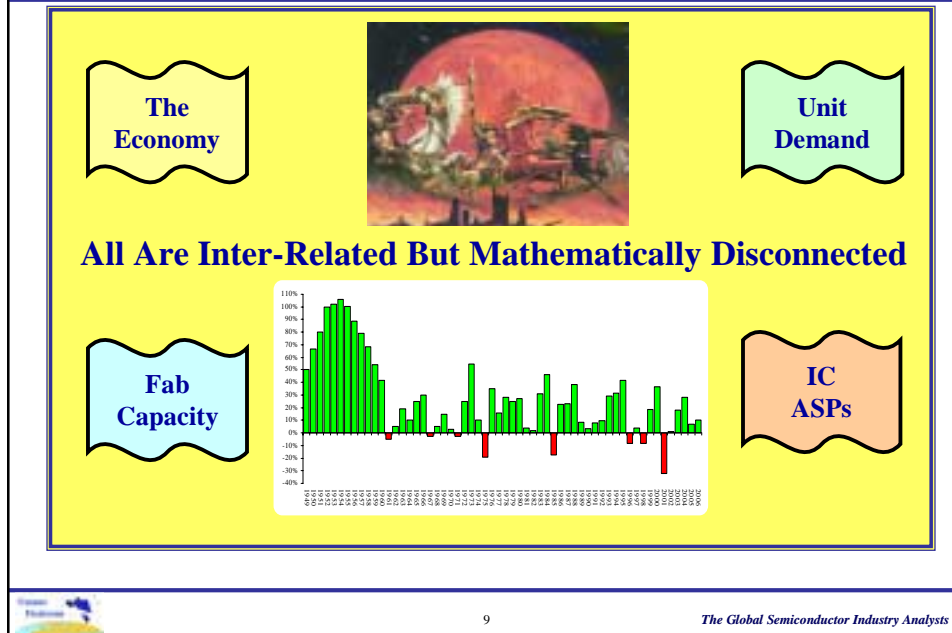
### Ten Symptoms Of Big Company Disease

1. An increase in the number of meetings
2. Meetings do not come to any conclusion
3. No longer able to rise to a challenge and slow in responding
4. Slow in responding to information from customers
5. Put emphasis on forecasting
6. Tend to emphasise consensus at the expense of professional insight
7. Try to fit the business to the budget rather than the needs of the customer
8. Ignore figures and forget other business fundamentals
9. Talk about past glories increases, at the expense of future dreams
10. Authority is replaced by power

**This Is What Creates Dinosaurs ...  
Not What The Individual Business Strategy Is**



## Current Industry Status & Outlook

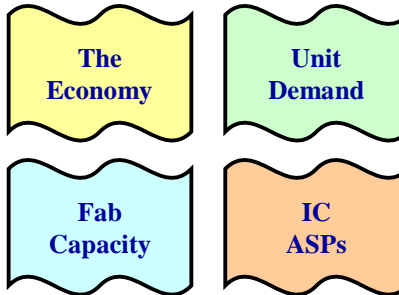


## An Industry In Deep Trauma

- Current Industry Status ... Confused & Uncertain
- Short-Term Issues Are Dominating The Agenda
- Longer-Term Structural Trends Are Unclear
- Traditional IDMs Going Through A Mid-Life  
‘New Business Model’ Identity Crisis
- Start-Ups Are Struggling To Reach Critical Mass
- All This Amidst Intense Economic Uncertainty

**Now Is The Time For Strong Nerves & Determination**  
**The Underlying Industry Fundamentals Are Sound**  
**No Change To The ‘Make Lunch Or Be Lunch’ Ethos**

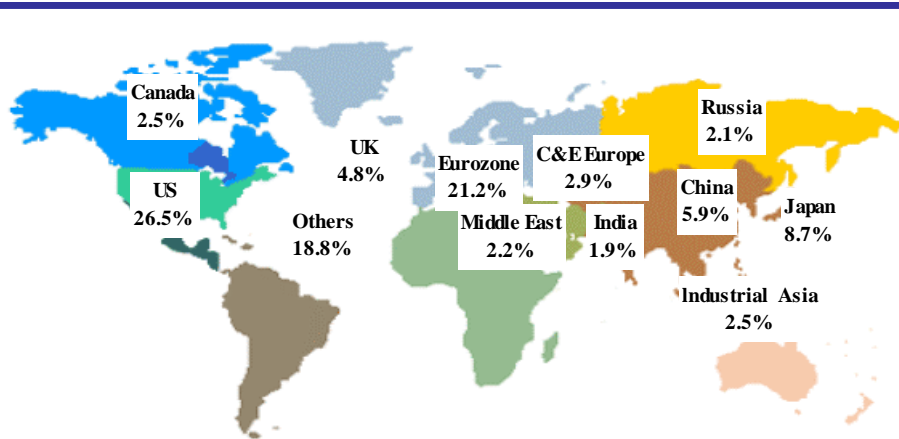
## #1 – The Economy



*Forensic Analysis Of The Data, Cycles & Trends*



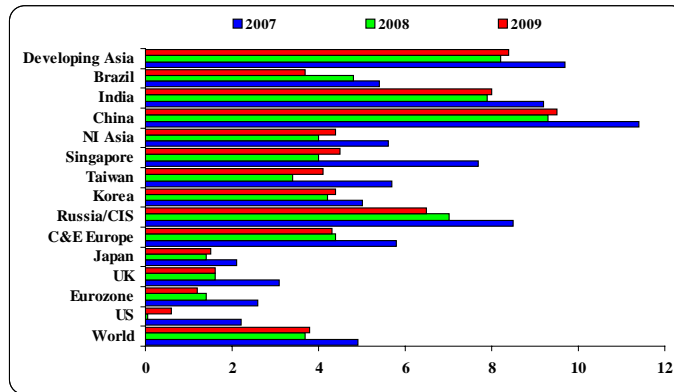
## 2007 World GDP In Perspective



**2007 World Output = US\$50.8 Trillion**



## World GDP Growth Trends



- ❑ 2008 IMF Forecast Now 3.7% (vs 4.8% Oct 2007)
- ❑ 2009 Growth Expected At 3.8%
- ❑ Mild Recession For USA In 2008 - Recovery Starting In 2009
- ❑ Western Europe Growth Decelerated - Activity In Japan More Resilient
- ❑ Emerging Economies Less Affected By Financial Market Turbulence

Source: IMF/Future Horizons

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## World GDP Growth Rates By Region

GDP Growth Rate	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
China	7.6	8.4	8.3	9.1	10.0	10.1	10.4	11.1	11.4	9.3	9.5
India	6.9	5.4	3.9	4.6	6.9	7.9	9.1	9.7	9.2	7.9	8.0
Russia/CIS	5.2	9.1	6.1	5.2	7.8	8.2	6.5	8.2	8.5	7.0	6.5
Singapore	7.2	10.1	-2.4	4.2	3.5	9.0	7.3	8.2	7.7	4.0	4.5
C&E Europe	0.5	4.9	0.4	4.2	4.8	6.9	6.1	6.6	5.8	4.4	4.3
Korea	9.5	8.5	3.8	7.0	3.1	4.7	4.2	5.1	5.0	4.2	4.4
NI Asia	7.5	7.7	1.2	5.5	3.2	5.9	4.8	5.6	5.6	4.0	4.4
Brazil	0.3	4.3	1.3	2.7	1.1	5.7	3.2	3.8	5.4	4.8	3.7
Taiwan	5.7	5.8	-2.2	4.6	3.5	6.2	4.2	4.9	5.7	3.4	4.1
UK	3.0	3.8	2.4	2.1	2.8	3.3	1.8	2.9	3.1	1.6	1.6
Eurozone	3.0	3.8	1.9	0.9	0.8	2.1	1.6	2.8	2.6	1.4	1.2
US	4.4	3.7	0.8	1.6	2.5	3.6	3.1	2.9	2.2	0.1	0.6
Japan	-0.1	2.9	0.2	0.3	1.4	2.7	1.9	2.4	2.1	1.4	1.5
World	3.8	4.7	2.2	2.8	3.6	4.9	4.4	5.0	4.9	3.7	3.8

### Emerging & Developing Economies Shifting Global Growth Dynamic

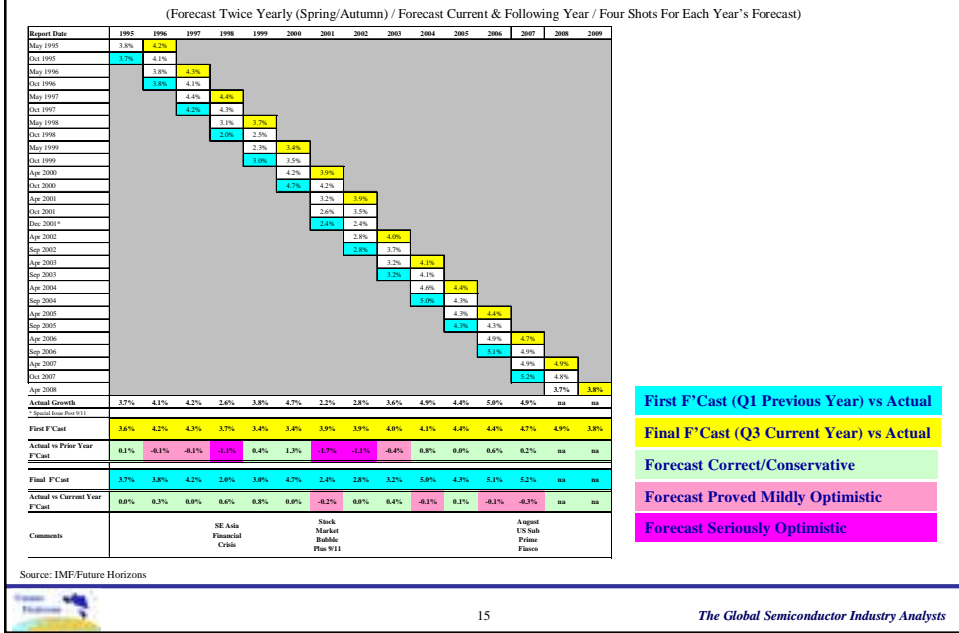
- ❑ China Now Accounts For One-Quarter Of Global Growth
- ❑ Resource Intensive, Increasing Demand For Key Commodities (Oil, Metal & Foodstuffs) (E&DE Growth Accounts For 90% Of Key Commodities Consumption Rise)
- ❑ Pattern Of Trade Has Changed – Now Much Less Dependent On Advanced Economies (Increasing Inter-Regional Trade Embracing Exports To Other Emerging Economies)

Source: IMF/Future Horizons

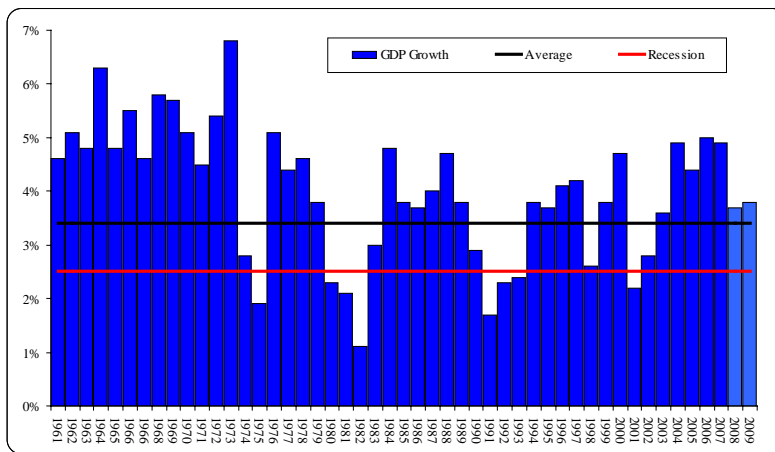
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## So ... Just How Good Are The IMF GDP Forecasts?



## World GDP Growth Rate Trends



**Question: Will The Current Economic Boom Turn To Dust?**  
**(In Other Words ... Just How Fragile Is The Global Financial Infrastructure)**  
**IMF Not Yet Forecasting A Global Recession ... Just A Return To 'Normaly'**

Source: IMF/Future Horizons

## **But ... The 2008 World Economy Has Wobbled**

### **Greed ... The Dark Side Of Capitalism**

*“Never Mind The World Economy ... Think Of My Commission”*  
(Especially If You Don't Have To Pay It Back When The Deal Goes Sour)

- Collateralised Debt Obligations (CDOs)     Sub-Prime Mortgages (aka Dodgy Loans)
- Structured Investment Vehicles (SIVs)     Conduits ... What On Earth Are They?

Who Makes This Stuff Up??? It's All Emperor's New Clothes & Snake Oil  
Back To Basics & Plain Talking ... The Devil Make Work For Greedy Bankers?

**End Now In Sight To The Financial Market Crash**  
**The Worst Would Definitely Seem To Be Over**  
(Except For The 'Debt Is Good & Free' Lingering Hangover)

**Total Losses Now Estimated By IMF At US\$ 1 Trillion**  
**How On Earth Could You Keep All These Billions 'Off Balance Sheet'?**



## **Forecast Health Warning #1**

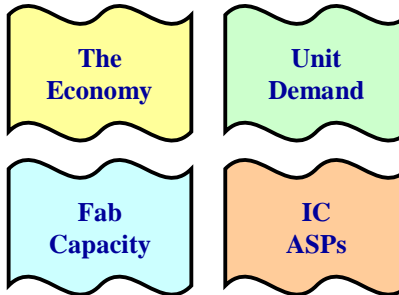
**IF The GLOBAL Economy Collapses It WILL Take  
The Chip Market With It. If That Happens:**

- 2008 Growth Will Be Negative ... (Lack Of) Demand**  
(How Negative Depends On Unit Growth & ASP Impact)
- 2008 Cap Ex Will Be Cut Back Even More Strongly**  
(More Than The 10% Cut Back Already Planned)
- But 2009 Should Bounce Back Quite Strongly**  
(Given The Other Chip Fundamentals Are In Good Shape)

**If There Is Going To Be A Global Economic Recession,  
The Chip Industry (But Not All Companies) Is In The  
Best Shape Possible To Weather The Ensuing Storm**



## #2 – Unit Demand



*Forensic Analysis Of The Data, Cycles & Trends*



## IC Unit Demand

(The Chip Market Equivalent Of Heisenberg's Uncertainty Principle)

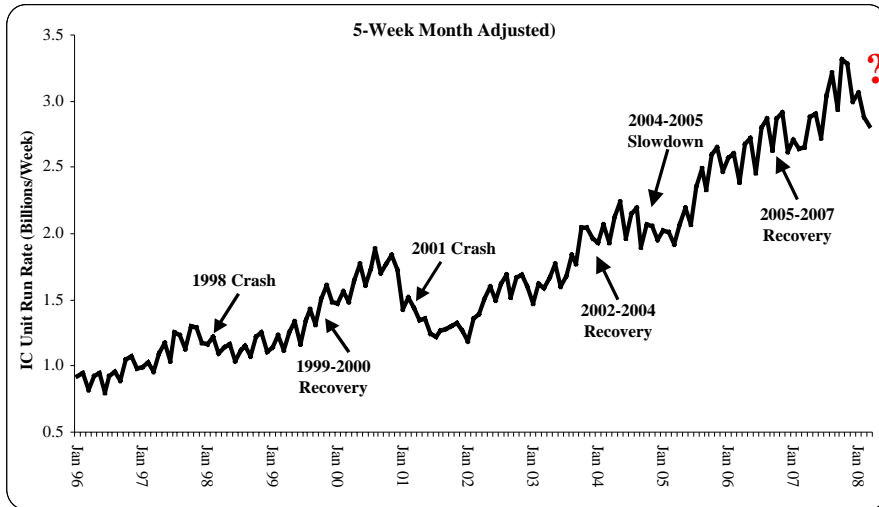


**In Theory It's Easy**

- Production Demand = BOM x Quantity To Be Built ... Except**
- Units Bought = Production Demand  $\pm$  Inventory Adjust**
- No Real End Market Demand/Supply Chain Visibility**
- Demand Changes In Days ... Supply Takes Several Months**



## Monthly IC Unit Shipments - Mega Trends

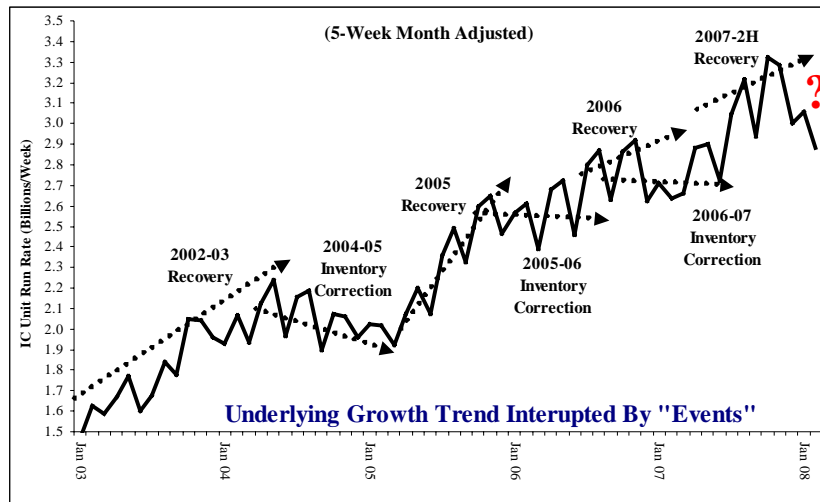


Source: WSTS/Future Horizons

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## Monthly IC Unit Shipments - Medium Term Modulations

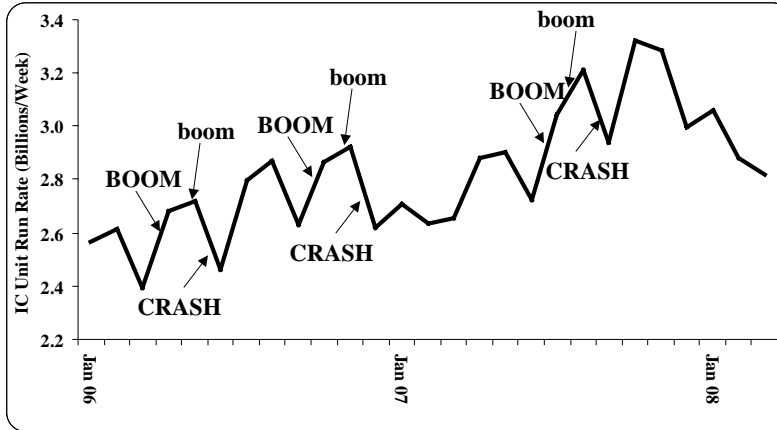


Source: WSTS/Future Horizons

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## Monthly Shipment Trends - Quarterly Sub-Pattern



- Unit Run Rate Trend Nowhere Near Linear (Whereas Capacity Is)
- Run Rate Varies Dramatically (Repeatable) Within The Quarter
- Plus The First Quarter Bust Following Fourth Quarter Boom

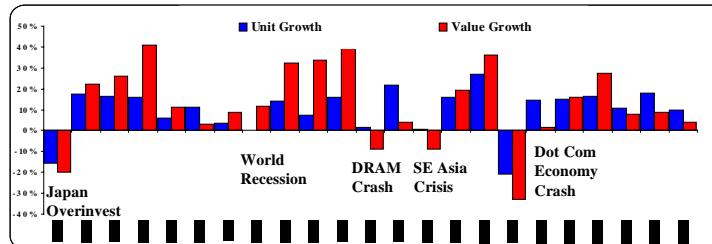
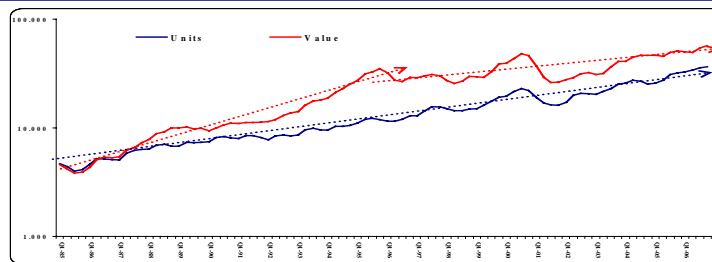
Source: WSTS/Future Horizons



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## Underlying IC Unit Growth Trends



**Units Are A More Realistic Growth Indicator ... It's Also What We Make!**

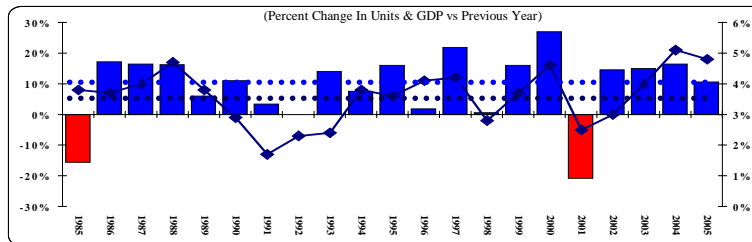
Source: WSTS/Future Horizons



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## Qu: What Is The *Real* IC Unit Market Outlook?



If 3.4% GDP Growth 'Supports' 10% IC Unit Growth ... What About 5.2% / 4.3% / 2.0%?

- Impossible To Balance Supply & Demand (Both Ways)
  - Demand Changes Are Measured In Days
  - Production Changes Take Months
  - It's A Classic 'Cobweb/Corn-Hog Cycle' Dynamic
- No-one Knows Which End Product Version Will Sell
  - Customer (Producer) &/Or Model Variant
- Visibility Made Worse By Batch vs Production Line Builds
- Inventory Dynamics Sit On Top Of This Uncertainty

Source: IMF/WSTS/Future Horizons

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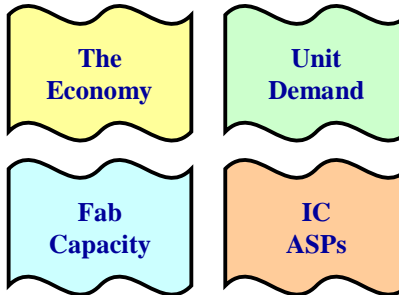
## Forecast Health Warning #2

- Impossible To Balance Supply & Demand
  - Product Life Cycle Of Some ICs Now 9 Months
  - Some 1H-08 Seasonal Mix/Line Balancing Inevitable
  - Overall Inventory Levels Continue To Be Sound
  - '10%' Unit Growth Forecast Still Looking Good  
( & In Line With Sustainable Long-Term Trends)
  - Stop Agonising The Detail & Get On With The Biz
- BUT ... Even If The Global Economy Holds Up, Need To Keep A Constant Eye On Inventory & Product Mix**
- Inventory Purges Take 4 Quarters To Clear
  - Economic / Capacity Recessions A Lot, Lot Longer

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### #3 – Fab Capacity



*Forensic Analysis Of The Data, Cycles & Trends*



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### Manufacturing Basics

- ❑ Total Equipment Cap Ex = 85% Of The Total Cap Ex
- ❑ Wafer Fab Cap Ex = 70% Total Equipment Cap Ex
- ❑ Order Today = Cap Ex One Quarter Later
- ❑ Wafer Fab Cap Ex = Additional Capacity Two Quarters Later
- ❑ Additional Capacity = IC Units Out One Quarter Later

**Kit Ordered Today Equals Units Out One Year Later**

(And That's If Everything Works Like A Dream)

**2008 Capacity Has Already Been Determined**

(By 2007's Capital Expenditure ... Up 6% Overall / 12% For Front End)

**2008 Cap Ex Will Determine 2009 Capacity**

Source: SICAS/WSTS/Future Horizons

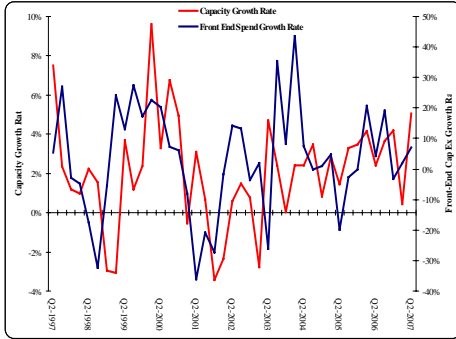


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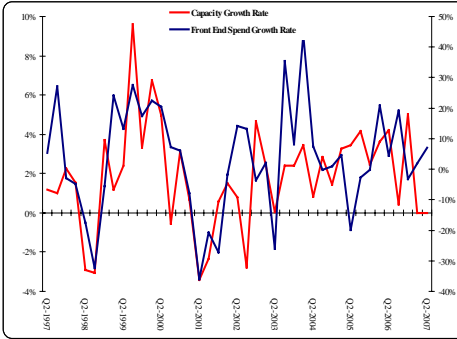
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## New Capacity vs Wafer Fab Cap Ex Spend

**Unadjusted**



**Slipped 2 Quarters**

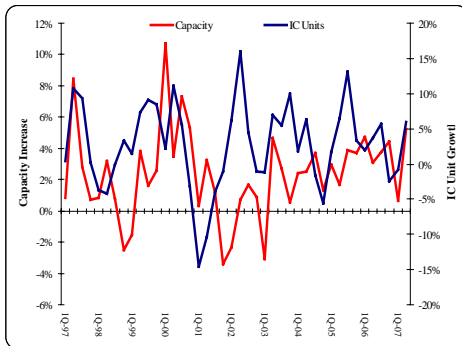


**Buy It Today Means Capacity On Line Two Quarters Later**

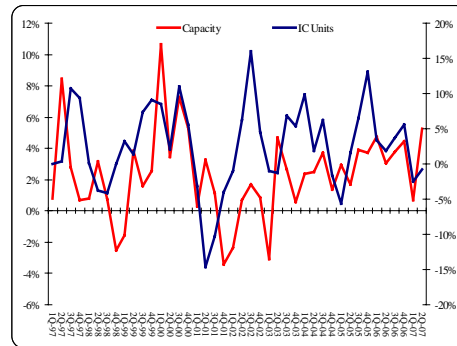
Source: SEMI/SICAS Future Horizons

## IC Units Out vs New Capacity

**Unadjusted**



**Slipped 1 Quarter**

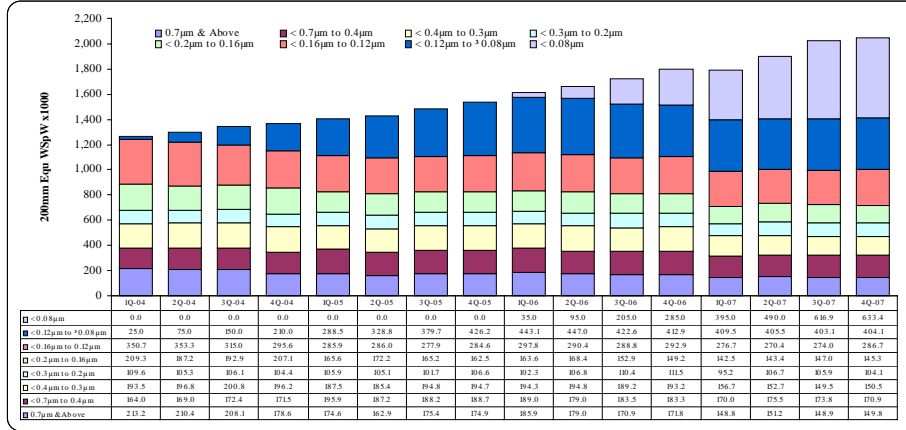


**New Capacity Today Means Units Out One Quarter Later**

Source: WSTS/SEMI Future Horizons

## Worldwide MOS Wafer Fab Capacity

200mm Equivalent Wafer Starts/Week (k)



Capacity Growth Q1-03 To Q4-07: 3.11% Per Quarter (13.0% CAGR)  
Unit Growth During Same Period: 3.61% Per Quarter (15.2% CAGR)

**New Capacity Comes On Stream Smoothly, But ... Timing Is Everything!**

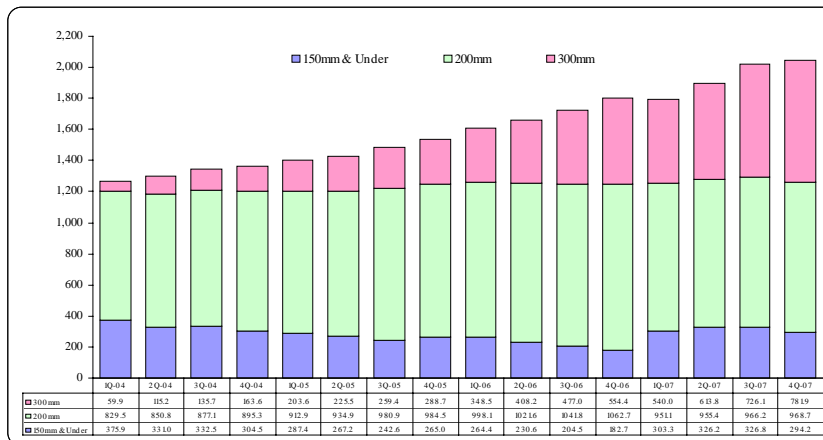
Source: SICAS/WST/Future Horizons

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## MOS Capacity By Wafer Size

200mm Equivalent Wafer Starts/Week (k)



**300mm = 38.2% Of Total (vs 30.8% One Year Ago)**

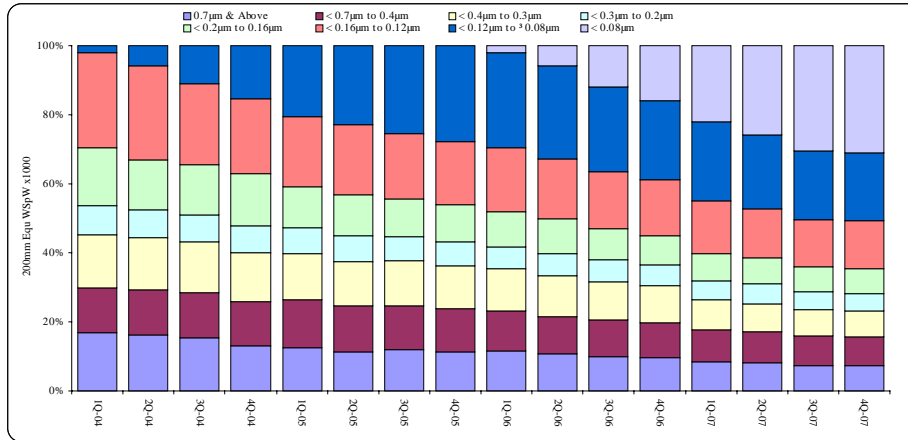
Source: SICAS/Future Horizons

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## MOS Capacity By Feature Size

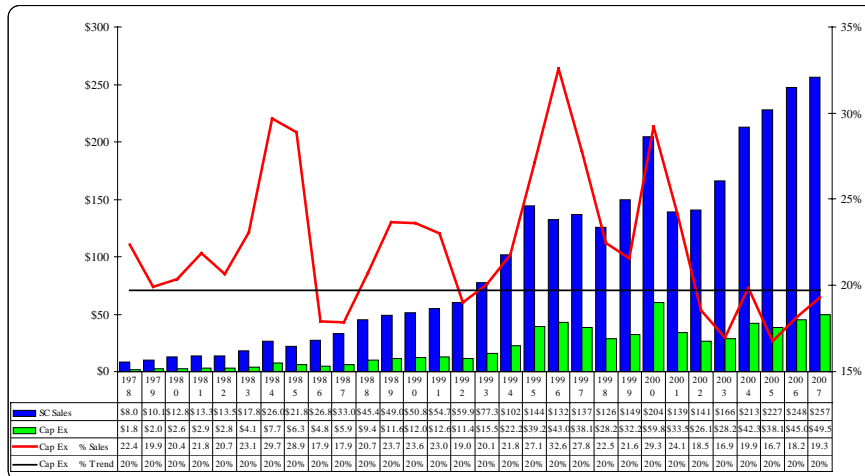
200mm Equivalent Wafer Starts/Week (k)



Source: SICAS/Future Horizons



## Capital Spend & SC Market Compared

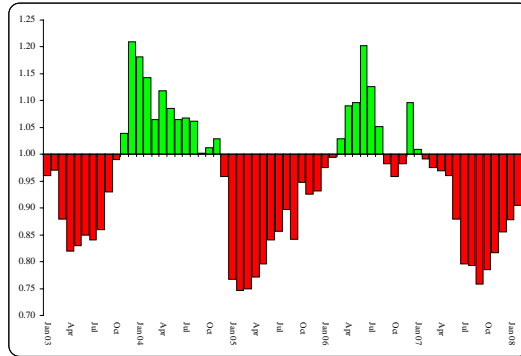


**Bouncing Under The Long-Term Trend Line (2008 Will Be Lower)**

Source: WSTS/Company Reports/Future Horizons



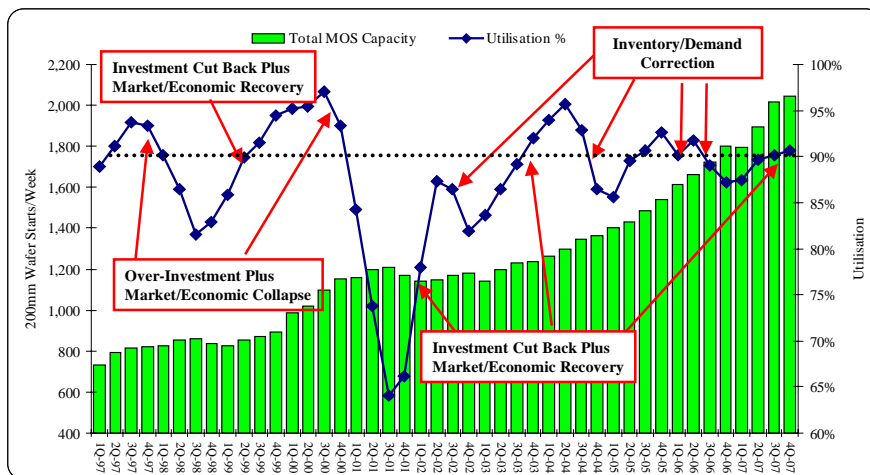
## Front End Book-To-Bill



- ❑ Equipment Orders Placed Today Equals New IC Sales 4 Quarters Later
- ❑ 2009's Capacity Expansion Already Fixed (Minimum 10% Down On 2008 Growth)
- ❑ 2008-2H Utilisation Rates Will Continue To Climb (Provided Unit Growth Holds)
- ❑ Cap Ex Expansion Unlikely Before Mid-2008 (i.e. Mid-2009 Capacity)

Source: SEMI Future Horizons

## Supply/Demand Balance

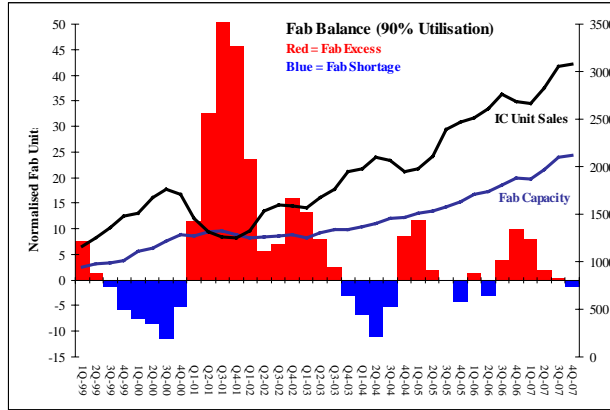


**Impossible To Balance But Utilisation Rates Are Recovering  
Most Notably ...Utilisation Rates Increased In Q4 (Q1's Units)**

Source: WSTS/SICAS Future Horizons

## Wafer Fab Supply & Demand

“Full” Capacity = 90% Utilisation Rate



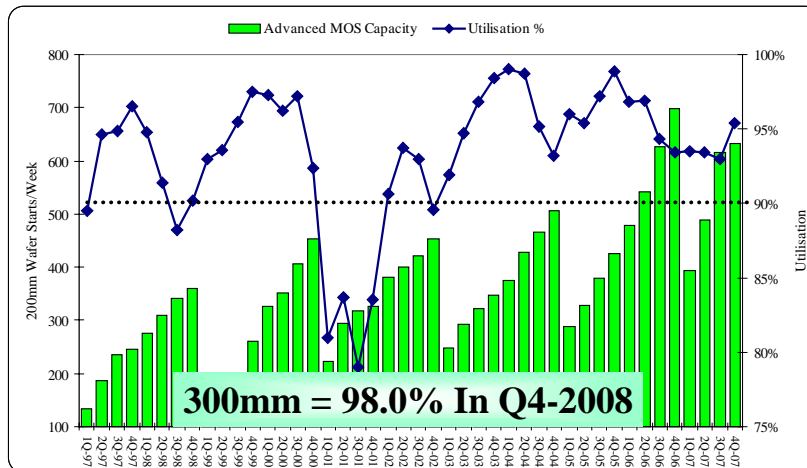
**2006/07 Over Capacity Will Dissipate 1H-2008  
 2008 (09) New Capacity Outlook Looking Tight**

Source: SICAS/WSTS/Future Horizons

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## Advanced Wafer Fab Utilisation Rates High



**Sold Out ... Need To Keep Them Loaded ... & They Are  
 (These Fabs Carry The Highest Depreciation)**

Source: WSTS/SICAS/Future Horizons

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### Forecast Health Warning #3

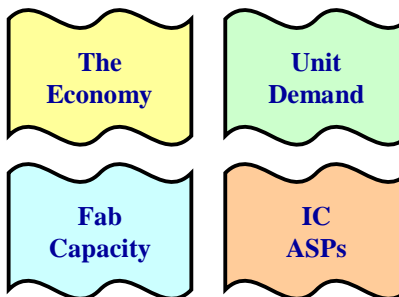
**2006 Cap Ex (2007 Capacity) Was On The High Side**  
**2007 Cap Ex (2008 Capacity) More In Line With Market**  
**2008 Cap Ex (2009 Capacity) Reduction Is Good News**  
(Unless You're A Supplier Of Cap Ex Equipment)

**Overall Capacity Expansion Is On The Side Of Caution**  
**But ... Always Keep A Watchful Eye On Cap Ex Trends**

- DRAM / Flash ... Que Sera Sera**
- Likewise Intel / AMD ... MPUs Only**
- Foundry & Logic Much More Crucial**
- Unless The Market Collapses ... Supply Will Be Tight**



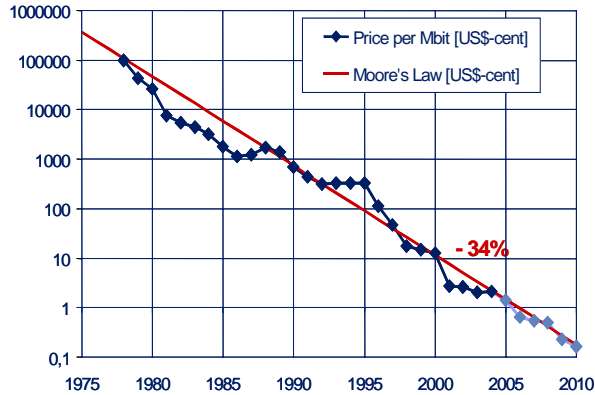
### #4 – IC ASPs



*Forensic Analysis Of The  
Data, Cycles & Trends*



## Transistor Learning Curve



**Transistor Prices Decrease '30% Per Year' – ASPs Do Not**  
 (Bonding Pads, Interconnect, Package, Supply/Demand, Complexity/Mix Impact)

Source: WSTS/Future Horizons

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## Price Wars Ride On Top

32-Bit MPUs	Units	ASP	Dollars	Lost Revenue
2004	277.3	\$109.5	\$30,368	
2005	326.7	\$106.9	\$34,927	
2006	360.8	\$91.8	\$33,120	\$5b
2007	325.8	\$85.5	\$27,861	\$6b
				Zero Elasticity

Total DRAM	Units	ASP	Dollars	Lost Revenue
2004	6,182	\$4.34	\$26,849	
2005	7,105	\$3.60	\$25,596	
2006	8,041	\$4.20	\$33,787	
2007	11,920	\$2.64	\$31,460	\$12b
				Call It \$6b For Elasticity

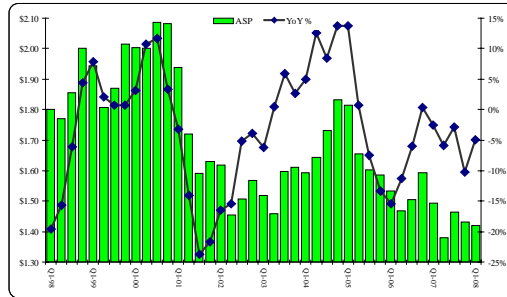
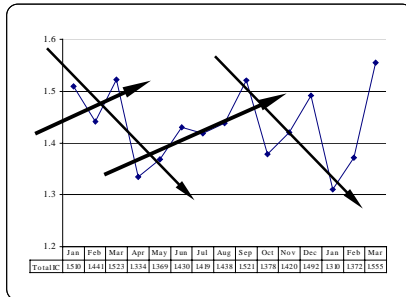
**The 2007 DRAM & MPU Price Wars Cost**  
**The Market 6-8 Percentage Points Of Growth**  
 (& Derailed Our 12% 2007 Forecast)

Source: WSTS/Future Horizons

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## An Enigma Wrapped Up In Riddle



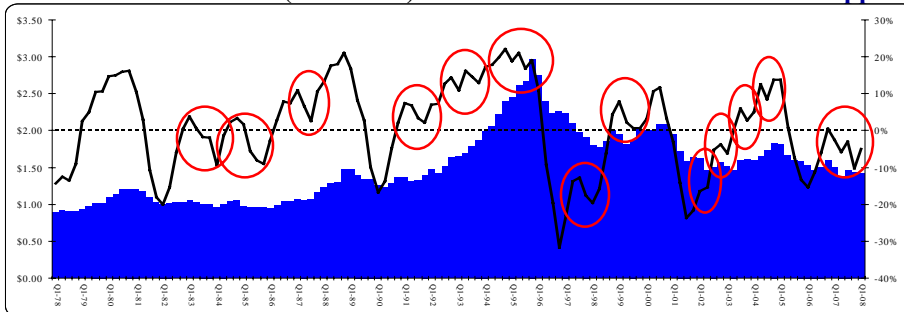
- ❑ ASPs Are The Perennial (& Least Understood) Industry Wild Card
- ❑ Individual IC Prices Decline (30% Transistor Learning Curve Effect)
- ❑ ASPs Are Driven By New IC Designs ... That Takes Time (3-4 Years)
- ❑ Post-2001 Value Recovery Lost One Generation (130nm Impact)
- ❑ ASP Recovery 'Wobbled' In 2007 (Memory & MPU Price Wars)
- ❑ Barring A Recession ASPs Will Recover In 2008 (It's Already Started)

Source: WSTS/Future Horizons



## Still A Lot Of ASP Recovery Road In Prospect

The Course Of ASPs (Like Love) Never Runs Smooth ... "Wobbles Happen"



IC ASP Growth Rate Peaks & Troughs

Low	Gap	High	Gap
Q6:78	-	Q1:83	-
Q6:82	16	Q4:84	16
Q6:98	32	Q4:99	26
Q4:98	27	Q3:00	27
Q3:00	15	Q1:03	15
Q5:06	35	???	???
Range	4.8 Years	Range	4.7 Years

IC ASP Growth Rate Transitions

Low To High	Gap	High To Low	Gap	High To Low Trigger
Q1:79 to Q4:80	11	Q4:88 to Q1:92	3	Global Recession
Q1:82 to Q4:85	27	Q4:88 to Q1:99	3	Global Recession
Q1:90 to Q4:94	19	Q4:94 to Q4:96	3	DRAM Crash
Q4:96 to Q3:00	15	Q3:00 to Q3:01	4	Dot Com / 9-11 Recession
Q3:01 to Q1:03	14	Q1:03 to Q1:06	4	2004 Over-Investment / 130nm
Q1:06 to ???	???	???	???	
Range	3-7 Years	Range	1-2 Years	

Source: WSTS/Future Horizons



## Forecast Health Warning #4

- ASP Recovery In Q1-08 (Price Wars Abating)
- Memory Price War Run Out Of Steam (\$\$\$\$\$s)
- Inevitable Tightening Of Capacity In 2H-2008
- Strong 2H-2008 Recovery - Capacity / Seasonal

**But ASPs Are The Real Industry Wild Card**

- Excess Capacity ... ‘Fill The Fab Whatever The Cost’**
- Price Wars ... ‘Last Man Standing Wins’**
- Buy Market Share Today (Profits Tomorrow?)**



## 2008 Forecast Summary & Assumptions (Jan 2008)

Single Digit (1992) ... Low Double Digit (No Precedent) ... Strong Double Digit (1993/99/03)

**‘12%’ Growth ... ‘10%’ Units / ‘2%’ ASP**

- No Global Economic Recession**  
Although US/UK/Eurozone Might Wobble
- No Significant Inventory Correction**  
But There Are ALWAYS Q4>Q1 Adjustments
- Lower Fab Capacity Expansion**  
Due To 2007/2008 Cap Ex Slowdown
- More Stable Memory Price Erosion**  
Back To The Learning vs Bleeding Curve
- If Global Economy Holds, 2H-08 Growth Will Be Strong**  
Capacity, ASP, Units All Pulling Together

**That’s The Rational Analysis, But Semiconductors Aren’t Rational  
It Could Just As Easily Be Another Single Digit Growth Year**



## 2008 Forecast Summary & Assumptions (May 2008)

Single Digit (1992) ... Low Double Digit (No Precedent) ... Strong Double Digit (1993/99/03)

### No Change In Forecast ... 12% Growth Still Possible

- ❑ **No Global Economic Recession**  
Although US/UK/Eurozone Might Wobble ... **They Are**
- ❑ **No Significant Inventory Correction**  
But There Are ALWAYS Q4>Q1 Adjustments ... **But Nothing Special**
- ❑ **Lower Fab Capacity Expansion**  
Due To 2007/2008 Cap Ex Slowdown ... **It's Inevitable & Irreversible**
- ❑ **More Stable Memory Price Erosion**  
Back To The Learning vs Bleeding Curve ... **Prices Have Hardened**
- ❑ **If Global Economy Holds, 2H-08 Growth Will Be Strong**  
Capacity, ASP, Units All Pulling Together ... **Absolutely Yes**

**Too Early To Call For A (Major) Downward Revision**  
**Q1 Was A Lot Stronger Than Conventional Wisdom Feared**



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## 2008 Scenarios ... How Do You Get To A 12% Number

F'Cast	Scenario A	Scenario B	Scenario C
Q1-08	-5.9%	-5.9%	-5.9%
Q2	2.0%	3.0%	3.5%
Q3	12.0%	14.0%	16.9%
Q4	4.0%	6.0%	6.7%
2007	217.810	217.810	217.810
2008	233.887	239.175	243.854
YoY%	7.4%	9.8%	12.0%

Qtr	Scenario C			WW \$	WW Units	ASP
	WW \$	WW Units	ASP			
Q1-07	51.815	34.678	1.494	-6.9%	-0.8%	-6.2%
Q2	50.748	36.757	1.381	-2.1%	6.0%	-7.6%
Q3	58.135	39.740	1.463	14.6%	8.1%	6.0%
Q4	57.111	39.925	1.430	-1.8%	0.5%	-2.2%
<b>2007</b>	<b>217.810</b>	<b>151.100</b>	<b>1.441</b>	<b>4.0%</b>	<b>10.0%</b>	<b>-5.5%</b>
Q1-08	53.761	37.864	1.420	-5.9%	-5.2%	-0.7%
Q2	55.643	38.995	1.427	3.5%	3.0%	0.5%
Q3	65.046	44.257	1.470	16.9%	13.5%	3.0%
Q4	69.404	44.549	1.558	6.7%	0.7%	6.0%
<b>2008</b>	<b>243.854</b>	<b>165.666</b>	<b>1.472</b>	<b>12.0%</b>	<b>9.6%</b>	<b>2.1%</b>

**12% Unashamedly Bullish (Fed Up With Everyone Being Down On The Industry)**  
**2008 Could Easily Be A Re-Run Of 1999/2003 (No-One Believed It Then Either!)**

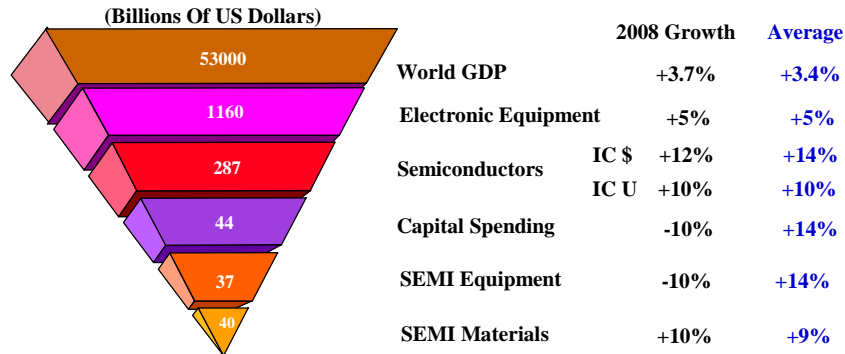
Source: WSTS/Future Horizons



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## 2008 Market Outlook



- ASP Recovery Should Gain Traction (Structural/Mix Driven)
- Tighter Supply Potential For 2H-2008 (If Unit Demand Holds)
- Seasonally Weak First Half (But Nothing Unusual Anticipated)
- Q1-08 Down 5.1% vs Q4-07 (Much Better Than Consensus)
- Need To Watch Units / ASPs / Economy (Capacity's OK)

Source: Various Sources/Future Horizons

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## Danger Signs To Watch

- Capacity** - It's Hard To See How This Can Spoil 2008, Provided Unit Growth Holds Up (**Need To Watch Cap Ex**)
- Demand** - Current IC Unit Demand Is Sustainable Provided The Economy Holds Up (**Need To Watch Inventory**)
- Economy** - Current Outlook Continues Uncertain With Risks All On The Downside (**If It Does Tank, Run For The Life Boats**)
- ASPs** – Key To Recovery ... But Always First Line Of Defence (**ASPs Could Still Derail 2008, But The Trends Are Encouraging**)

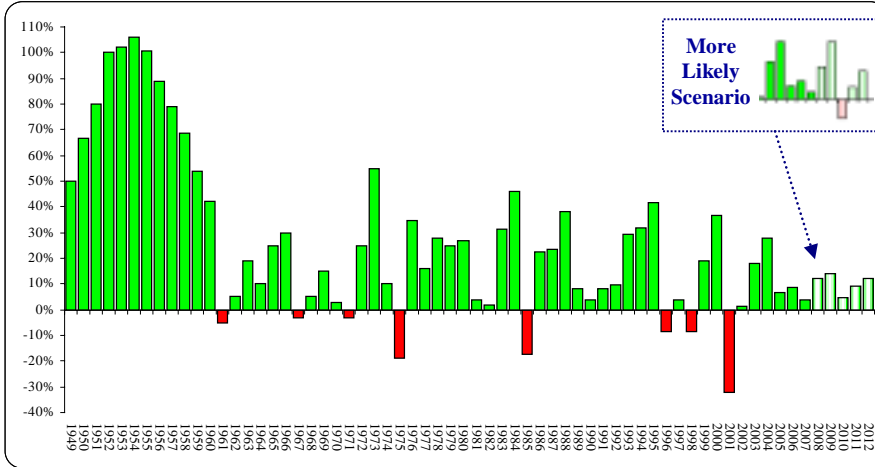
**So ... Not Much Different Here Then!**

**“plus ça change”** (The More Things Change The More They Stay The Same)

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## 2008-12 Market Growth Rate Summary



Source: WSTS-Future Horizons

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## Agenda

Current Industry Status & Outlook

Key Market Drivers

Industry Issues

Summary & Conclusions

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## Semiconductor 7.0 - What's Driving The Market?

Dec 23, 1947

7<sup>th</sup> Decade Of The Transistor Revolution

### The Same Things As Always

- ❑ Technology - Moore's Law / Learning Curve (Market Pull)
- ❑ Legislation - Energy Saving / Conservation (Market Push)
- ❑ Structural - The Relentless Analogue To Digital Conversion

Combining To Do What The Chip Industry Does Best ...

**Enabling Something That Was Previously Impossible**  
(Either Technically, Practically Or Commercially)

**This Industry Has Nowhere Near Run Out Of Steam**



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## New Applications Continue To Drive The Market

Application	2007 Units (m)	2007 Content (\$)	2007 Value (\$b)	TAM % Value
Automotive	72	300.93	\$21.7	8.5%
Biometrics	133	4.50	\$0.6	0.2%
Bluetooth	810	2.75	\$2.2	0.9%
Digital Broadcast Radio	17	20.58	\$0.3	0.1%
Digital Camcorders	17	76.00	\$1.3	0.5%
Digital Still Cameras	114	28.50	\$3.2	1.3%
DVD Players	91	20.53	\$1.9	0.7%
DVD Recorders	49	40.78	\$2.0	0.8%
Global Positioning (GPS)	286	11.01	\$3.1	1.2%
Graphics	353	20.34	\$7.2	2.8%
Hard Disk Drives (HDD)	515	7.40	\$3.8	1.5%
Industrial & Medical	11,600	1.91	\$22.1	8.6%
Integrated Flat-Panel TVs	103	63.34	\$6.5	2.5%
Memory Cards	906	10.27	\$9.3	3.6%
Mobile Phones	1,150	42.09	\$48.4	18.9%
MP3 Players	230	30.00	\$6.9	2.7%
Near Field Communications	35	4.50	\$0.2	0.1%
PC & Servers	270	259.63	\$70.1	27.3%
PDA/Handheld Computers	16	130.06	\$2.1	0.8%
RF-ID Tags (Non-Shop Label)	900	1.20	\$1.1	0.4%
RF-ID Tags (Shop Label)	1,800	0.06	\$0.1	0.0%
Robotics	4	573.66	\$2.1	0.8%
Smartcards	4,150	0.88	\$3.7	1.4%
TV Set-Top Boxes	116	44.00	\$5.1	2.0%
UltraWideBand (UWB)	2	12.10	\$0.0	0.0%
USB Flash Disks	155	22.90	\$3.6	1.4%
Video Game Machines	83	88.97	\$7.4	2.9%
Wi-Fi	310	5.49	\$1.7	0.7%
WiMAX	2	42.50	\$0.1	0.0%
Zigbee	10	2.00	\$0.0	0.0%
<b>Sub-Total (Sb)*</b>			<b>\$237.8</b>	<b>92.6%</b>
Others			\$18.9	7.4%
<b>Total SCs (Sb)</b>			<b>\$256.7</b>	

### FH ASR/SAM2008 Report

#### 30 Applications Tracked

- 92.6% 2007 IC TAM
- 3 Big Ones
- 1 Big 'Bundle'
- 26 \$1b-\$5b 'Niches'

#### Not Currently Tracked

- Wired Telecom & Networks
- Mobile Infrastructure
- Analogue Consumer
- Peripherals & Printers
- Copiers & Faxes
- Automotive Aftermarket

Source: Various Sources/Future Horizons



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## PC Market Still Dominates – But Going Nowhere Fast

- ❑ 27.0 Percent Of 2007 Semiconductor Market
- ❑ 14.8 Percent (CAGR) Units Past Growth
- ❑ 11.0 Percent (CAGR) Units Future Growth
- ❑ Average Cost Breakdown:
  - Processor 48%
  - Memory 24%
  - Chipset 10%
  - Graphics 9%
  - Other 9%
- ❑ 40+ Percent Desktop PC Price Drop Since 2000
- ❑ 50+ Percent Laptop PC Price Drop Since 2000
- ❑ 8.9 Percent Semi Revenue Past Growth (CAGR)
- ❑ 9.1 Percent Semi Revenue Future Growth (CAGR)

### Still Positive IC Growth Despite Price Erosion & Yawn Factor

**Blame Microsoft For The 110% Bore Factor**  
 (Yes There Really Are Lots Of Potential 'Die For' Applications)  
**My 6502-Based Apple II Ran Just As Fast As My Quad Core Pentium!!**

Source: Future Horizons

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## Mobile Phones More Interesting But Conflicting Priorities

### Improvements Help Protect Semiconductor Content Value & Keep Replacement Handset Sales Rolling

- |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                    |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>❑ <b>Current Features</b> <ul style="list-style-type: none"> <li>- MegaPixel Cameras</li> <li>- Better Viewing Screens</li> <li>- Global Positioning</li> <li>- Bluetooth and Headphones</li> <li>- Wi-Fi &amp; Downloads</li> <li>- MP3 Player</li> <li>- FM Radio</li> </ul> </li> <li>❑ <b>Handset Diversification - Feature Centric Phone Offerings</b> <ul style="list-style-type: none"> <li>- "Phones Are The New Cars"?</li> <li>- This Implies A New Level Of Marketing Excellence/Execution</li> </ul> </li> </ul> | <ul style="list-style-type: none"> <li>❑ <b>New Features</b> <ul style="list-style-type: none"> <li>- Gaming</li> <li>- Movie Clip Downloads</li> <li>- Digital TV</li> <li>- Mobile Wallet</li> </ul> </li> </ul> |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|



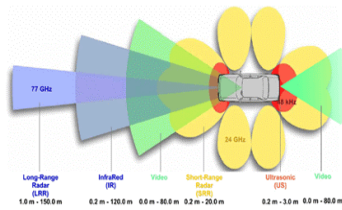
**BUT ... There's Also The "80% Of The Features For 20% Of The Cost" Market  
The Next 1 Billion Customers (Africa, India, Rural China, South America ...)**

**Challenge: How To Protect Existing Cost Structure & Subscriber Base?**  
**How To Add Useful & Affordable Value-Add Services**  
**Chipset Suppliers Love The High-End, Market Loves The Low End**

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## Increasing Automotive Semiconductor Content



Source: Future Horizons

### Short/Medium Term Growth

- Networks
- Bluetooth & Wi-Fi
- Global Positioning
- More Airbags
- Remotely Sensed Tyre Pressure
- More Entertainment
- Anti-Lock Braking Systems (ABS)
- Electro-Hydraulic Braking (EHB)
- Electronic Stability Programme (ESP)
- Traction Control System (TCS)
- Plus Hybrid Cars

### Longer Term

- All Round vision
- Driver Support
- Automatic Driving Control

### Solid Annual Growth (CAGR 2006-11)

- Vehicles ..... 5.5%
- Systems ..... 11.5%
- Semiconductors ..... 13.3%

## Motor Control & Energy ... Lighting & Photovoltaic

- Microcontrollers
- Power logic
- switching regulators
- DC line controllers & converters

- CFL (Compact Fluorescent Lamp)
- Linear Fluorescent Lamps
- Halogen lamp
- HID (High Intensity Discharge)
- CFL (Cold Cathode Fluor. Lamp)

~1.1B Watts power installed in 2005

- Microcontrollers
- Rectifiers
- IGBTs & diodes
- DC/line controllers & drivers
- Power modules
- Voltage regulators

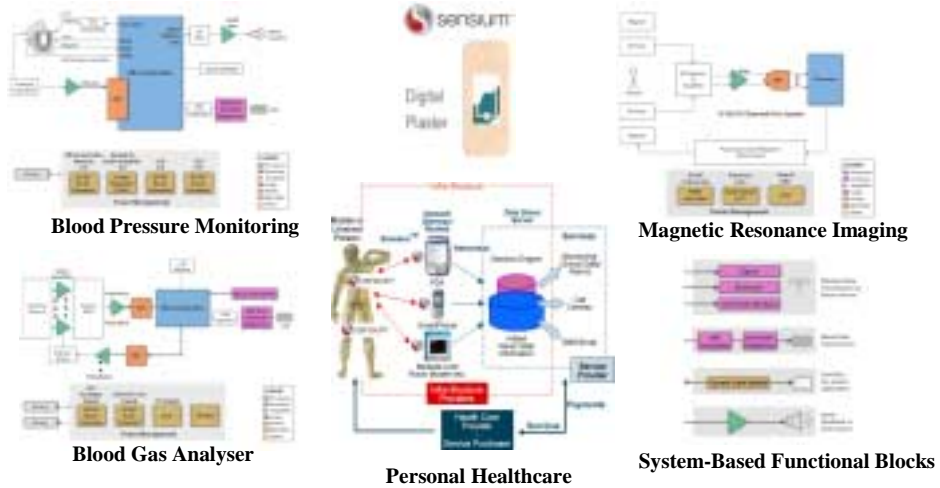
- Microcontrollers
- Smart Card
- Power logic
- Power Management
- RTC, Op. Amp., RF

- Energy management
- Motor control
- Automation
- Utility meter
- HVAC

**Legislation & New Features Are Helping To Overcome Price Issues**



## Now Medical Goes Digital ... Just Like Audio & Video



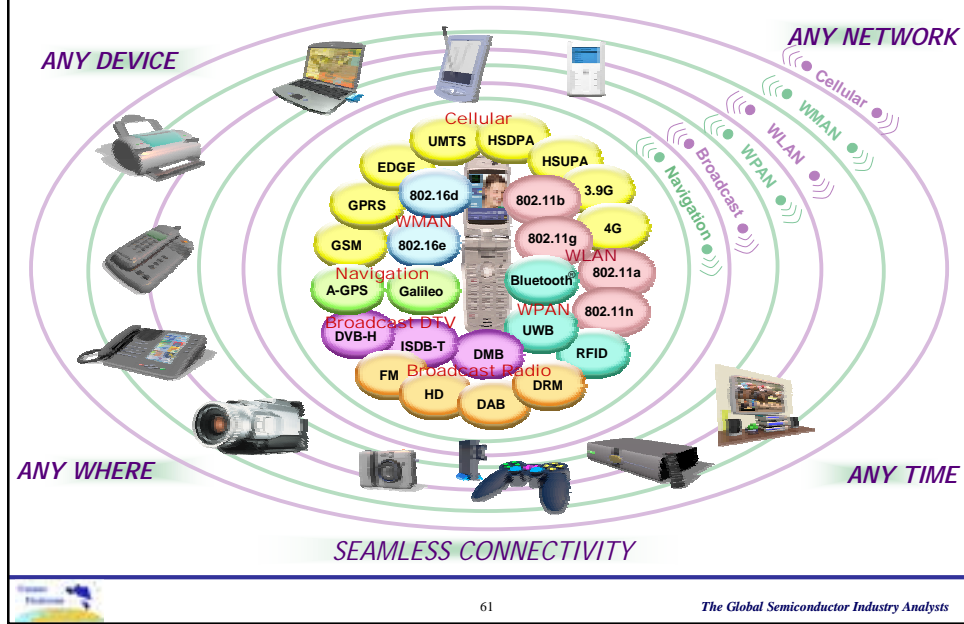
Source: TI/Toumaz/Future Horizons

## Robotics



## Mobile Phone Volumes @ PC SC Content Values

## Enabling Digital Nomadity



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## Agenda

Current Industry Status & Outlook

Key Market Drivers

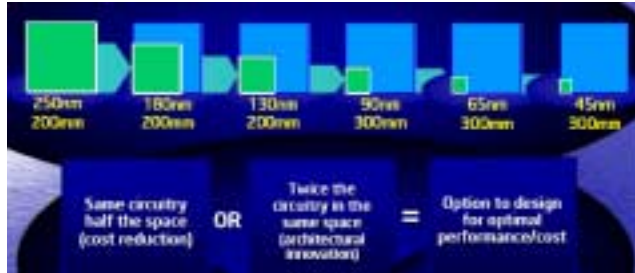
**Industry Issues**

Summary & Conclusions

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## Scaling Enables Product & Cost Innovation



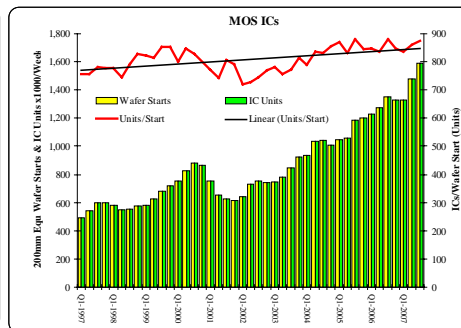
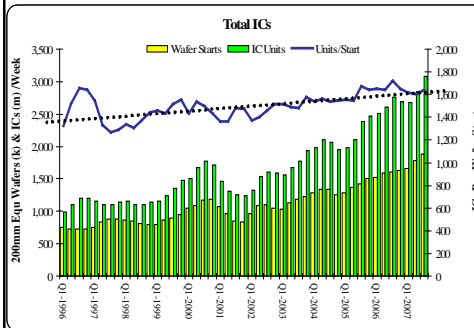
- ❑ More Chips Per Wafer Equals Less Cost Per Chip
  - ❑ More Transistors Per Die Equals More Functionality
- Several Billion Transistors Gives Phenomenal Design Flexibility**



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## Overall The Two Effects Balance Out Each Other



- ❑ Long-Term Average ICs/Wafer Grows Only Very Slowly
- ❑ Capacity Expansion Needs To Match 10% IC Unit Growth
- ❑ '1%' Productivity Gain / '9%' More Wafers Out (Capacity)

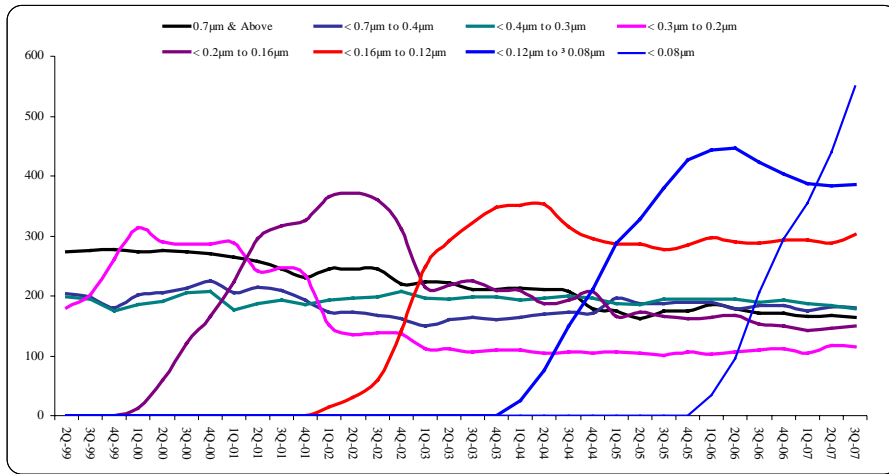
Source: WSTS/SICAS/Future Horizons



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## MOS Capacity Build Out By Technology Node



**No Change In Volume Ramp Profile (Despite All The Hype)**

Source: SICAS/Future Horizons



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## Technology Roadmap

Table 1a Product Generations and Chip Size Model Technology Trend Targets—Near-term Years

Year of Production	2007	2008	2009	2010	2011	2012	2013	2014	2015
DRAM % Pitch (nm) (contacted)	65	57	50	45	40	36	32	28	25
MPU/ASIC Metal 1 (M1) % Pitch (nm)	68	59	52	45	40	36	32	28	25
MPU Physical Gate Length (nm) ??	42	38	34	30	27	24	21	19	17
MPU Physical Gate Length (nm)	25	23	20	18	16	14	13	11	10
ASIC Low Operating Power Physical Gate Length (nm) ??	54	48	42	38	34	30	27	24	21
ASIC Low Operating Power Physical Gate Length (nm)	32	28	25	23	20	18	16	14	13
Flash % Pitch (nm) (un-contacted PolyG)	54	45	40	36	32	28	25	22	20

Table 1b Product Generations and Chip Size Model Technology Trend Targets—Long-term Years

Year of Production	2016	2017	2018	2019	2020	2021	2022
DRAM % Pitch (nm) (contacted)	23	20	18	16	14	12	11
MPU/ASIC Metal 1 (M1) % Pitch (nm)	23	20	18	16	14	12	11
MPU Physical Gate Length (nm) ??	15	13	12	11	9	8.4	7.5
MPU Physical Gate Length (nm)	9	8	7	6.3	5.6	5.0	4.5
ASIC Low Operating Power Physical Gate Length (nm) ??	19	17	15	13	12	11	9
ASIC Low Operating Power Physical Gate Length (nm)	11	10	9	8	7	6.3	5.6
Flash % Pitch (nm) (un-contacted PolyG)	18	16	14	13	11	10	9

Source: ITRS/Future Horizons



## Technology Node Evolution

### Alternate Easy / Difficult Node Generations

**45nm Is A Revolutionary Step From 65nm**

**32nm Will Be A Natural Evolutionary**

**22nm Will Be Another 'Difficult' Transition**

**65nm Will Be Tomorrow's Leading-Edge Workhorse  
(The Same Basic Si Gate / SiO<sub>2</sub> / MOSFET Structure)**

**45nm Will Herald A Totally Different Structure  
(Metal Gate / High-k / Thin FET / Deep Trench Design)**

**Back To The Future? (Si Gate's Done Pretty Well Though!)**



## 45nm Will Herald A New Way Of System Design

### 60m Gates Is The 45nm Chip Size 'Sweet Spot'

- With 3D Packaging & More Layers Of Metal We Can Start To Design Applications Similar To How The Brain Works**
- Lots Of Interconnect Paths With An ARM Core At Each Node**
- Brain Techniques Kick In At 22nm – Heuristic Programming (Using Multi-Level Analogue & Quantum Logic Techniques)**
- Inexact Algorithms aka Game Programmes vs. Fixed Concepts**
- Insect-Level Herd/Group Intelligence (Individually Brainless/Collectively Do High-Level Strategies)**

**First Prototypes At 45nm ... First Products At 32nm**

**European Commission, BT Martlesham,  
Cambridge, Nokia, Ericsson, Cisco ...**



## **What Now For Private Equity-Based Chip Firms?**

### **Enter The Third Era Of Private Equity Funding**

#### **Phase 1: The Deal Makers**

(With Buyers Usually More Sophisticated Than Sellers)

#### **Phase 2: The Financial Engineering**

(Through Highly-Leveraged Cheap Capital )

#### **Phase 3: The Operations Challenge**

(Bring In The Experts To Run The Acquisitions  
Productively On A Global Scale)

**Right? ... Wrong? ... Neutral? ... The Jury's Still Out  
But The Debt Doesn't Come Quite As 'Cheap' As It Used To  
Plus Too Much Debt Will Limit Acquisition Potential**



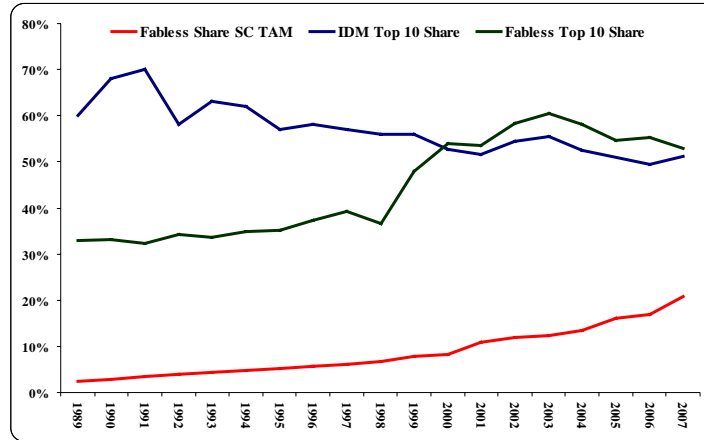
## **Fablite – Valid Option Or More Smoke & Mirrors?**

### **Then There's The IDM Going Fablite Thorny Issue**

- Nothing Wrong With Being Fabless Just Not Sure The Best Starting Point Is Being IDM**
- Spinning Out & Streamlining Guarantees What's Left Gets Smaller & Grows Slower**
- Downsizing The (Inherited) Infrastructure Is Perhaps A Bigger Challenge Than Managing A Wafer Fab, Always Assuming It's Legally Possible &/Or Practical**
- If The Process & Libraries Are Identical, The Value Add Is The People (Execution)**
- Teamwork ... It Has To Be Perfectly Orchestrated Because The Competition's So Tough**



## Market Share Dynamics



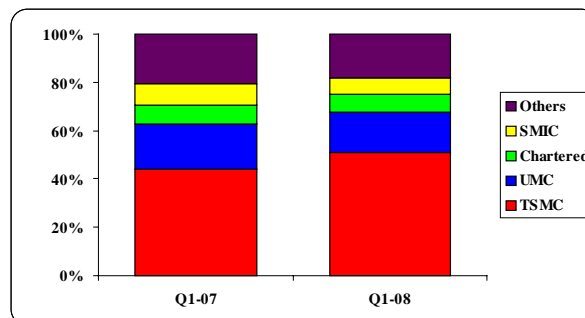
**Fables Share Growing ... But Still Relatively Small  
Big Firms (IDM & Fables) Grow Slower Than Market**

Source: Company Reports/Future Horizons

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## Foundry Market Reality



- TSMC's Market Lead Now Unassailable  
(Both In \$ Sales, \$/Wafer Start & Capacity)**
- If TSMC Was IDM, They'd Be #2  
(Passing Samsung / Challenging Intel)**
- Moving More Into Design Is Inevitable  
(Technically & Commercially)**

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## Opportunities Abound ... Standing Still Is Not An Option

Decade	SC 1.0	SC 2.0	SC 3.0	SC 4.0	SC 5.0	SC 6.0	SC 7.0
Rank	1955	1965	1975	1985	1995	2005	2015
1	Hughes	TI	TI	NEC	Intel	Intel	?
2	Transitron	Motorola	Motorola	TI	NEC	Samsung	?
3	Philco	Fairchild	Philips	Motorola	Toshiba	TI	?
4	Sylvania	GE	NSC	Hitachi	Hitachi	Toshiba	?
5	TI	RCA	Intel	Toshiba	Motorola	ST	?
6	GE	Sprague	NEC	Fujitsu	Samsung	Infineon	?
7	RCA	Philco/Ford	Hitachi	Philips	TI	Renesas	?
8	Westinghouse	Philips	Fairchild	Intel	IBM	TSMC	?
9	Motorola	Transitron	RCA	NSC	Mitsubishi	Sony	?
10	Clevite	Raytheon	GE	Matsushita	Philips	Philips	?
Market	\$75.2m	\$1,528m	\$4,012m	\$21,479m	\$144,404m	\$227,484m	?
Technology	Discretes	Std Logic	MOS	CMOS	MPU	SoC	?

Decade	SC 4.0	SC 5.0	SC 6.0	SC 7.0
Rank	1985	1995	2005	2015
1	C&T	Xilinx	Qualcomm	?
2	Lattice	Altera	Broadcom	?
3	Exar	S3	Nvidea	?
4	Altera	Alliance	Sandisk	?
5	Xilinx	Cyrix	ATI	?
Fabless	\$110	\$2,650	\$32,800	?
% TAM	<1%	2%	15%	?
Driver	PC	Telecom	Mobile	?

**The Incumbents Don't  
Make It In Successive  
Generations**



## Agenda

Current Industry Status & Outlook

Key Market Drivers

Industry Issues

Summary & Conclusions



## Execution (Not Technology) Is Everything

- ❑ Technology Is A Given ... Execution Makes The Difference
- ❑ Be First & “Good Enough” ... Market Windows Close Fast
- ❑ Learn To Compete ... There Are No High Volume, High Value Niches
- ❑ Design Is The Means To An End ... NOT The End
- ❑ (Applications) Software Is A Key Differentiator ... Plus It Has Value

*Today's State Of The Art Is Tomorrow's Commodity*



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## The Chip Industry In Perspective

- ❑ Technology Marches On, New Markets Open, Old Ones Expand, Enhancing Our Lives  
- The Fall Out At The Macro Level Affects The Entire World Economy
- ❑ Electronic Market Was Traditionally Japan, North America & Western Europe  
- It Now Encompasses The Whole Asian Rim, China, Eastern Europe & India  
- A Middle Class Market Growth From 500 Million To Three Billion People
- ❑ Large Chip Markets Get Larger, Niches Become Commodities, & New Niches Arise  
- Far From Maturing, The Industry Is Still In Its Volatile High Growth Phase  
- With At Least A Further 20 Years Of Strong Growth In Prospect
- ❑ Third Digital Wave Leaders Will Be Different From Today's
- ❑ The Underlying Growth Drivers For Chips Has Never Been Better

**The Market's NOT Maturing NOR Slowing  
Neither Have The Industry Dynamics / Psyche  
(Globally Competitive / Intensely Competitive)**

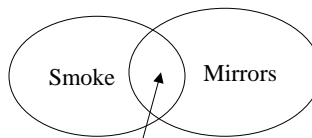
**He Who Dares May Not Necessarily Win  
But The Faint-Hearted Will Definitely Lose**

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The Global Semiconductor Industry Analysts

## The Great Sub-Prime/CDO/SIV Fiasco

Q4-2007 Losses	Amount
Citigroup	\$18b
Merrill Lynch	\$19b
UBS	\$13b
Deutsche Bank	\$3b
Morgan Stanley	\$9b
JP Morgan	\$1b
<b>Total</b>	<b>\$63b</b>



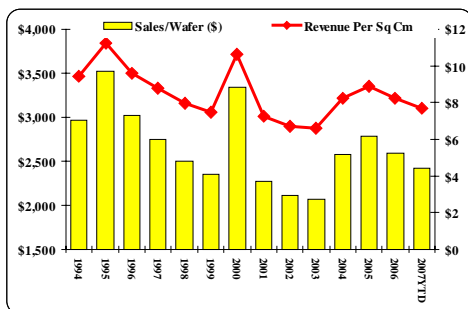
**“Complex Financial Securities”**  
 (Something For Nothing Driven By Pure Greed & Ego)

1. Hand out a dodgy loan to people who can't afford it on a property in a less than desirable neighbourhood
2. Dress it up with a fancy name
3. Sell it on at a premium as an AAA prime investment to an unsuspecting punter making a hefty commission en route
4. Run cap in hand to government when it all goes sour ... keeping all the past commissions and bonuses of course

- Two Year's Total Semiconductor Cap Ex Blown In A Single Quarter
- These Are The Same People Who Blew A Fortune In The Dot Com Era
- The Self-Professed 'Experts' Telling You How To Run Your Business ...
- Yet They Are Incapable Of Looking After Their Own Business Sensibly!
- This Makes Snake Oil & The Emperor's New Clothes Seem 'Honest'!!
- Time To Re-Think Long-Term Not 'Puppet Dancing' Nonsense?



## Industry Profitability – ‘Nine Bucks/cm<sup>2</sup>’



(\$4 For The Foundries)

Company	2003	2004	2005	2006
Chartered	\$1,008	\$1,034	\$1,076	\$1,115
STAC	\$769	\$1,060	\$878	\$904
TSMC	\$1,302	\$1,514	\$1,462	\$1,305
UMC	\$1,112	\$1,235	\$1,012	\$1,073
<b>Average/Wafer</b>	<b>\$1,316</b>	<b>\$1,343</b>	<b>\$1,227</b>	<b>\$1,197</b>

Company	2003	2004	2005	2006
Chartered	\$3.28	\$3.29	\$3.40	\$3.55
STAC	\$2.40	\$3.38	\$2.88	\$3.08
TSMC	\$5.04	\$4.82	\$4.66	\$4.25
UMC	\$3.34	\$4.00	\$3.22	\$3.42
<b>Average/Sq Cm</b>	<b>\$4.19</b>	<b>\$4.28</b>	<b>\$3.90</b>	<b>\$3.81</b>

**\$0.05 At The Chipless/IP Level**

**50 Bucks At The OEM Level**

**This Is A Cost NOT Value Driven Industry  
 (That Sets The Bar Height For Everyone)**

Source: SEMI/Company Reports/Future Horizons



## Back To Industry Basics – MGP Observations

**Don't Invest In Low Cost Areas Just Because They Are Cheap**

(They Have A Habit Of Becoming High Cost Tomorrow Plus The Hidden Extras)

**Don't Make Outsourcing Decisions Just Because They Are Easy**

(Especially If There's No Way Back)

**Don't Make Strategic Cut-Backs Just To Trim The Bottom Line**

(Some Decisions e.g. R&D Take A Long Time To Impact, Then It's Too Late)

**Stop Looking For High Volume/High Value Market Niches**

(They Don't Exist, Need To Learn How To Compete)

**Do Show Strong Leadership**

(If You Don't Believe It Can Be Done It Won't Be Done)

**Do Have A Long-Term Plan & Stick With It**

(Even If It Negatively Impacts 'The Next Quarter' Balance Sheet)

**Do Show A Commitment & Determination To Succeed**

(Revenue & Profits Are Deterministic ... They Come From Doing The Job Right)

**Do Stay Focused & Resistant To External Meddling**

(Especially From The Financial Analysts & Bean Counters ... They Lack Vision)

**Do Execute Ruthlessly**

(This Is The Key Competitive Differentiator)

**Do ... Just Do It With Passion** (It's The Passion That Makes The Difference!)



# Thank You ... Any Questions ?

**[www.futurehorizons.com](http://www.futurehorizons.com)**

**e-mail: [mpenn@futurehorizons.com](mailto:mpenn@futurehorizons.com)**

**Tel: +44 (0)1732 740440 or (0)7000 TELFUT**

**Fax: +44 (0)1732 740442 or (0)7000 FAXFUT**

**Future Horizons Ltd**

**44 Bethel Road, Sevenoaks, Kent TN13 3UE, England**

**Plus Affiliates In Japan, Russia & The USA**

