The opinions offered in this presentation are solely the author's unless otherwise stated

Building an Autonomous & Scalable Semiconductor VLSI Business

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Outline

Introduction	• **LSI overview** • **What is autonomy & scale?** • **Motivation for this talk** • **Key messages**
Why Autonomy & Scale	• **Key VLSI industry trends** • **First-to-market vs. lasting leadership** • **Growth isn't easy** • **Exchange rates & globalization**
Autonomy in Semi Business	• **Functional autonomy** • **Management autonomy**
Scaling the Semi Business	• **Imagining scale** • **Framework for driving scale** • **Organization** • **Strategy/Planning** • **Operations**
Looking Ahead	• **Closing Thoughts**

LSI - A History of Leadership & Innovation

- History of industry firsts:
  - First single-chip DSP
  - First 32-bit Microprocessor
  - First single-chip HDD processor
  - First 3Gb/s SAS Controller
  - First 6 Gb/s SAS Switch
  - First 6Gb/s RAID on Chip (ROC)
  - Pioneered gate arrays and cell-based ASICs

- Over 10,000 active patents
- 10 active research projects aligned to both product roadmap innovation and path-finding activities with leading universities
- LSI holds leadership positions in many industry standards organizations, alliances, consortiums, customer partnership groups and trade groups

LSI Overview

Focused on Converged Infrastucture

(Storage + Networking)
~ 80% of Revenue Tied to Enterprise IT Spending

Significant Strategic Transformation

9 Acquisitions ($4B+), 3 Divestitures
Elimination of all Internal Manufacturing

Solid Financial Foundation

$2.57B Revenue in 2010
$677M in Cash and Short Term Investments

Strong Global Presence

4500 Employees
> 50 Worldwide Site Locations

Culture of Innovation

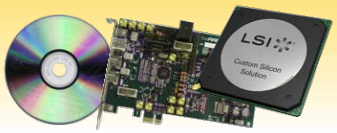
11,000+ Patents and Patent applications

LSI's Product Lines and Technology Foundation

Storage Peripherals

- Hard Disk Drive SoCs
- Pre-Amplifiers
- SSD Controllers

Storage Components

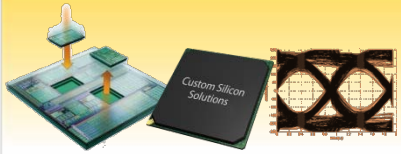


- SAS ROCs/Controllers
- SAS Expanders/Bridges
- SAS HBAs

Networking Components

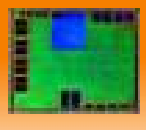
- Content Processors
- Packet Processors
- Media Processors

Custom Silicon Solutions

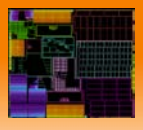


- Serial Connectivity
- Rich IP Portfolio
- Flexible Model

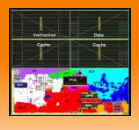
Fundamental Storage and Networking Technologies



SERDES

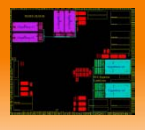


Memory



CPUs

Security



PHY

Silicon Platform Technologies

110 nm | 90 nm | 65 nm | 40 nm | 28 nm | BiCMOS

LSI

What is Autonomy & Scale?

Autonomy

End-to-end ownership of business that is more or less independent & is run with limited direction required from a 'parent' business

Scale

A business that is successful in responding to the stringent demands of strong growth & avoids becoming inelastic to rapidly changing conditions

Motivation for this talk

- **VLSI industry has been at the forefront of dramatic advances**
  - Has uniquely contributed to human advancement & broad economic growth
- **Vibrancy of VLSI industry worldwide is impressive**
  - India's participation and leadership in VLSI has been growing dramatically
  - There are opportunities to extend leadership & global VLSI footprint
- **However, many VLSI products stumble or fail in their end markets**
  - Even established giants falter; hurdle higher for newer or smaller companies
  - Product development & innovation focus is necessary but not sufficient
- **Driving more autonomy & scale necessary for successful growth**
  - Indian VLSI industry in a good position to move further in this direction
- **This talk explores the underpinnings of driving autonomy & scale**
  - Based in part on LSI's experiences worldwide & especially in India

Key Messages

- **Growth challenges can be met more effectively w/ autonomy & scale**

- **Additional factors could influence long-term success in geos like India**
  - *Possible headwinds*: Growing pains, globalization & exchange rate trajectories
  - *Possible tailwinds*: Increased exposure to in-country OEMs & manufacturers

- **More autonomy requires end-to-end capabilities & stronger management**
  - Functional & management autonomy are both key

- **Scale-building requires focus on org, strategy/planning & operations**

- **Due-diligence in managing entire product life-cycle is key to success**

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VLSI Industry - Key Trends

Facet	Key Trends
Product Complexity	• Growing w/ generational increases in transistors & frequencies
Manufacturing Complexity	• More challenging with node shrinks and more nano-scale effects • Supplier base consolidation
R&D Cost	• Increasing w/ design complexity & higher mask costs
Industry Growth	• Maturing but higher growth in emerging geos
Customers	• Continued industry consolidation - bigger & more demanding customers
Competition	• Significant w/ strong incumbents - not easy to penetrate $B-size markets
Globalization	• Increasing across the board • “Round the clock” activity • Geos across the world capitalizing on unique skillsets or building VLSI hubs

VLSI Industry - Key Trends

Facet	Key Trends	…That Drive a Need for…
Product Complexity	• Growing w/ generational increases in transistors & frequencies	• Robust understanding of technology & product development process
Manufacturing Complexity	• More challenging with node shrinks and more nano-scale effects • Supplier base consolidation	• Skilled engagement w/ & oversight of manufacturing/assembly/test • Effective supplier management
R&D Cost	• Increasing w/ design complexity & higher mask costs	• Minimal errata/spins & strong product planning & execution due diligence
Industry Growth	• Maturing but higher growth in emerging geos	• Increase in end-to-end ownership & scale in emerging geos
Customers	• Continued industry consolidation - bigger & more demanding customers	• Building strong loyalty via depth of understanding of cust. needs & execution w/ limited room for product failures
Competition	• Significant w/ strong incumbents - not easy to penetrate $B-size markets	• Near-flawless strategy/planning & strong execution due diligence
Globalization	• Increasing across the board • “Round the clock” activity • Geos across the world capitalizing on unique skillsets or building VLSI hubs	• Strong global management teams to drive a culture of discipline • Geos to take on more ownership to differentiate themselves from others

Autonomy & scale increasingly important to keep up with trends

First-to-Market vs. Lasting Leadership *(examples)*

Commercial Product	First Market Entrant
Portable computer	GM Research's Micro Star; Osborne Computer Corp.'s Osborne1 was first to mass mkt
Personal computer	Depends on "computer" defn; R2E's Micral, Kenbak-1 & MITS Altair 8800 usually cited
Mainframe computer	Remington Rand's (now Unisys) UNIVAC I
Handheld cell phone	Motorola Dynatac
Smartphone	IBM Simon
DRAM chip	Intel 1103
CPU chip	Intel 4004
FPGA	Xilinx XC2064

First-to-Market vs. Lasting Leadership *(examples)*

Commercial Product	First Market Entrant	Current Market Leader(s)	Source(s)
Portable computer	GM Research's Micro Star; Osborne Computer Corp.'s Osborne1 was first to mass mkt	HP (excl. Tablet PCs) Apple (incl. Tablet PCs)	PC Mag, Wikipedia, Digitimes, Display Search
Personal computer	Depends on "computer" defn; R2E's Micral, Kenbak-1 & MITS Altair 8800 usually cited	HP	Computer History Museum, Wikipedia, Center for Computing History, Fast Company
Mainframe computer	Remington Rand's (now Unisys) UNIVAC I	IBM	Comp History Museum, Wikipedia, IBM
Handheld cell phone	Motorola Dynatac	Nokia	Wikipedia, PC World, Gartner
Smartphone	IBM Simon	Nokia (handset) Google Android (OS)	Gartner, IDC, Time, Ars Technica, PC World,
DRAM chip	Intel 1103	Samsung	Wikipedia, DRAMeXchange
CPU chip	Intel 4004	Intel	Intel
FPGA	Xilinx XC2064	Xilinx	Wikipedia

Retaining #1 spot requires much more than an early mover advantage – lack of autonomy & scale could be significant disadvantages

Growth Isn't Easy

Examples from Computer Industry

Company	Profitability/Growth Setback
Intel	Sandy Bridge CPU chipset (Cougar Point) recall/replacement due to design flaw; $300M rev impact & $700M cost to replace
AMD	Lost revenue due to Phenom quad-core CPU TTM delay & HW bug
Nvidia	~$475M charge against earnings to repair/replace GPUs/chipsets with quality issue ("weak die/pkg material"/underfill); TTM delay & financial impact due to foundry mfg yield issues
Dell	Successful direct sales model lost momentum with retail notebook PC growth over desktop
	Revenue/share loss from PCs shipped w/ bad capacitors; $300M charge; replaced millions of motherboards
Microsoft	$1B+ charge against earnings to cover Xbox hardware failures tied to design and/or mfg. quality issues
Sun Microsystems	Delayed move from Sparc to x86 platforms; weak financial monetization/returns on key investments (*recently acquired by Oracle*)
Silicon Graphics	Biz mgmt did not scale with rev growth leading to TTM, quality, & inventory mgmt issues; missed industry transition to cheaper PCs; went bankrupt
Gateway	Biz mgmt & customer service issues, costly mix of product choices & reliance on owned retail stores during PC price war (*acquired by Acer*)

Growth Isn't Easy

Examples from Computer Industry

Company	Profitability/Growth Setback	Spotlight On	Sources
Intel	**Sandy Bridge CPU chipset (Cougar Point) recall/replacement due to design flaw; $300M rev impact & $700M cost to replace**	• *Quality* • *Financials*	Information Week, AnandTech
AMD	**Lost revenue due to Phenom quad-core CPU TTM delay & HW bug**	• *Quality* • *Schedule/TTM* • *Financials*	Tech Radar, Tech Report, CRN
Nvidia	**~$475M charge against earnings to repair/replace GPUs/chipsets with quality issue ("weak die/pkg material"/underfill); TTM delay & financial impact due to foundry mfg yield issues**	• *Quality/Mfg.* • *Schedule/TTM* • *Financials*	CNET, CNET, EE Times, Computer World
Dell	**Successful direct sales model lost momentum with retail notebook PC growth over desktop**	• *Strategy* • *Customer Needs*	NYT, WSJ
	Revenue/share loss from PCs shipped w/ bad capacitors; $300M charge; replaced millions of motherboards	• *Quality/Manuf.* • *Customer Mgmt* • *Financials*	Business Insider (BI), NYT, NYT, CNN Money, Industry Std
Microsoft	**$1B+ charge against earnings to cover Xbox hardware failures tied to design and/or mfg. quality issues**	• *Quality/Manuf.* • *Customer Mgmt* • *Financials*	Microsoft, Venture Beat, CBS, Computer World
Sun Microsystems	**Delayed move from Sparc to x86 platforms; weak financial monetization/returns on key investments (*recently acquired by Oracle*)**	• *Strategy* • *Customer Needs* • *Financials*	Network World
Silicon Graphics	**Biz mgmt did not scale with rev growth leading to TTM, quality, & inventory mgmt issues; missed industry transition to cheaper PCs; went bankrupt**	• *Schedule* • *Quality/Manuf.* • *Financials*	Business Week, The Register, VizWorld
Gateway	**Biz mgmt & customer service issues, costly mix of product choices & reliance on owned retail stores during PC price war (*acquired by Acer*)**	• *Strategy* • *Financials* • *Customer Mgmt*	Fortune, CNET, CNET

Growth Isn't Easy

Examples from Telecom/Mobility Industry

Company	Profitability/Growth Setback	Spotlight On	Sources
Nortel Networks	**114-yr old Canadian giant was unable to recover from post-Y2K demand fallout & compete with more innovative/cheaper products; acctg. irregularities; filed for bankruptcy & sold some businesses**	• *Financials* • *Customer Needs*	Canadian Business, NYT
Motorola	**Introduced first commercial cell phone but leadership biz plummeted due to late entry to smartphone mkt, delayed adoption of digital (vs. analog) technologies, diversion on Iridium, equipment quality issues & financials**	• *Strategy* • *Quality* • *Customer Needs* • *Schedule/TTM* • *Financials*	CNET, WSJ, Business Week, Forbes, NYT
Nokia	**Long-dominant position in smartphone market eroding, challenged on innovation and keeping up w/ market trends & pricing pressures; moving away from Symbian OS platform**	• *Strategy* • *Customer Needs* • *Schedule/TTM* • *Financials*	Forbes, The Independent, Gartner
Research In Motion (RIM)	**Revenue & share loss due to less competitive UI & features compared to iOS & Android phones**	• *Strategy* • *Customer Needs*	BI, BI

Autonomy & scalability enable better end-to-end visibility & comprehensive business management – strong design R&D is just one of many elements required for success

Exchange Rates & Globalization

The US Dollar

The Washington Post with Bloomberg
BUSINESS
Where Washington and Business Intersect

Source: Washington Post

Economy | Industries | Local Business | Markets | Policy & Regulation | Technology | World Business | Blogs & Columns

The dollar, less almighty: Big investors see possible long-term currency weakness

By Steven Mufson, Published: April 21

"….."I would recommend against buying long-term fixed-dollar investments," [Warren] Buffett said at a public appearance in New Delhi. **"If you ask me if the U.S. dollar is going to hold its purchasing power fully at the level of 2011 five years, 10 years or 20 years from now, I would tell you it will not."**

[…]

In March, the dollar — adjusted for inflation — hit its lowest point against major U.S. trading partners' currencies since its value was allowed to fluctuate in January 1973, according to Federal Reserve data.
"This is the true measure of what the dollar's worth," said Kenneth Rogoff, a Harvard economics professor and former chief economist at the International Monetary Fund. "It shows what you can buy with the U.S. dollar."
A weak dollar isn't necessarily a bad thing, Rogoff said — it can make the United States more competitive, bolster exports and help domestic companies that are vying against imported goods here in the United States. It effectively would be playing the China card against China in a battle for manufacturing jobs.

[…]

Moreover, the U.S. deficits seem likely to continue for years. Under current law, the federal government will run deficits totaling $4.5 trillion over the next five years; by 2021, the federal debt held by the public would soar to $19 trillion, up 75 percent from 2011, according to the Office of Management and Budget's 2012 proposal. **Many fund managers say the only way out of that box is a weaker dollar**, reducing the value of the massive amount of U.S. debt held by foreigners and increasing the value of American investments abroad…."

LSI

Exchange Rates & Globalization

Global Labor Costs

BCG
THE BOSTON CONSULTING GROUP

[Source: Boston Consulting Group]

PRESS RELEASES

May 05, 2011

Made in the USA, Again: Manufacturing Is Expected to Return to America as China's Rising Labor Costs Erase Most Savings from Offshoring

Reinvestment During the Next Five Years Could Usher in a 'Manufacturing Renaissance' as the U.S. Becomes a Low-Cost Country Among Developed Nations, According to Analysis by The Boston Consulting Group

CHICAGO, May 5, 2011—Within the next five years, the United States is expected to experience a manufacturing renaissance as the wage gap with China shrinks and certain U.S. states become some of the cheapest locations for manufacturing in the developed world, according to a new analysis by The Boston Consulting Group (BCG).

With Chinese wages rising at about 17 percent per year and the value of the yuan continuing to increase, the gap between U.S. and Chinese wages is narrowing rapidly. Meanwhile, flexible work rules and a host of government incentives are making many states—including Mississippi, South Carolina, and Alabama—increasingly competitive as low-cost bases for supplying the U.S. market.

In upcoming decades, weaker dollar & sharp labor cost increases in emerging geos could potentially dampen MNC investments there – geos with more autonomy & scale are less likely to lose their global footprint *

Naturally, multiple factors determine global business investments – e.g., customer locations, supply chain, cost, quality, TTM, skillsets, etc. However, geos with narrow product focus could be more vulnerable to global changes & increased cross-geographic competition

LSI

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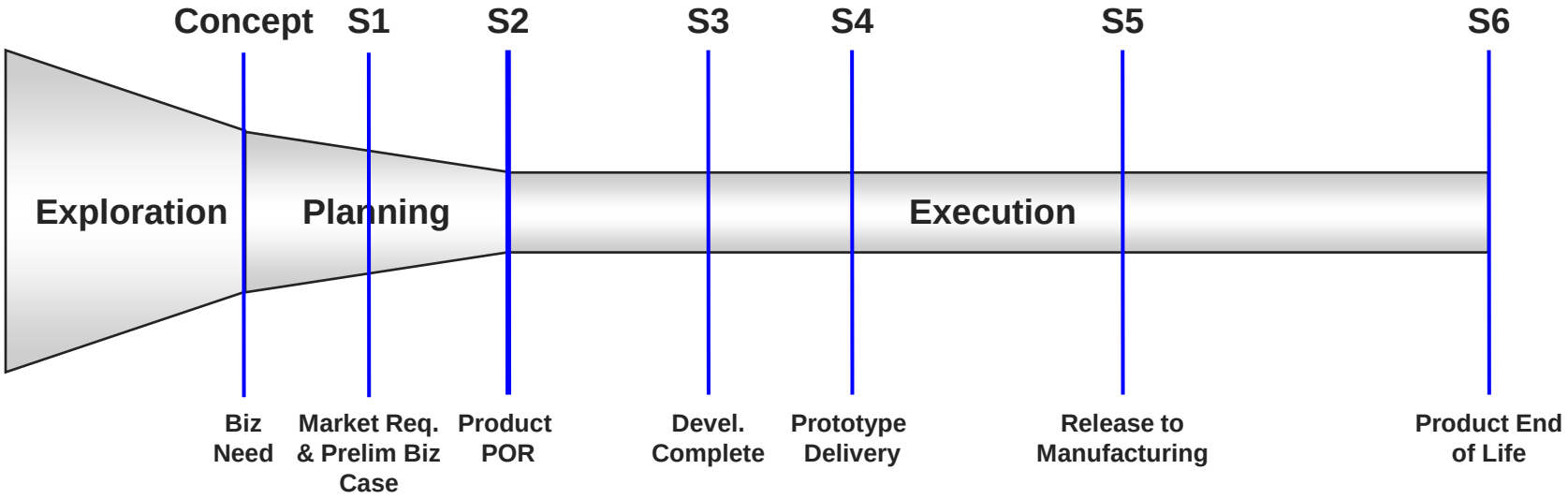
Looking Ahead	• **Closing Thoughts**

Functional Autonomy - Greater End-to-End Capabilities



- Roadmap/ Strategy Dev
- Strategic cust. engagement
- Product Definition

- Arch definition
- Product POR

- Design & Verif.
- Emulation
- Proto & prodn. planning

- Proto build & validation
- Customer samples/support
- Pre-production ramp/qual

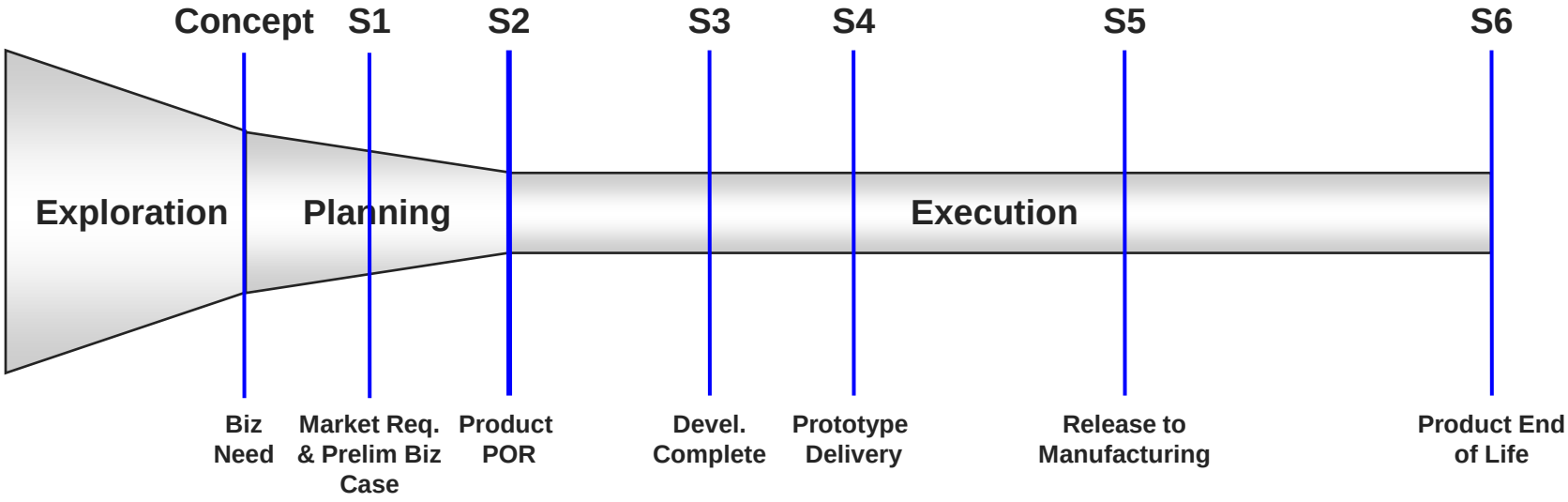
- Manufacturing mgmt
- Demand/supply mgmt
- Customer support

Capability Type*

***NOTE: Capabilities listed here are not meant to be a comprehensive list**

LSI

Functional Autonomy - Greater End-to-End Capabilities



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- Proto build & validation
- Customer samples/support
- Pre-production ramp/qual

- Manufacturing mgmt
- Demand/supply mgmt
- Customer support

Capability Type*

Extent and depth of functional autonomy in India varies by sector
Increased exposure to in-country OEMs usually drives more autonomy

Management Autonomy – Strong Mgmt/Leadership

Journal of Economic Perspectives—Volume 24, Number 1—Winter 2010—Pages 203–224

Source: World Management Survey

Why Do Management Practices Differ across Firms and Countries?

Nicholas Bloom and John Van Reenen

"…First, **firms with "better" management practices tend to have better performance on a wide range of dimensions**: they are **larger, more productive, grow faster, and have higher survival rates**.

[…]

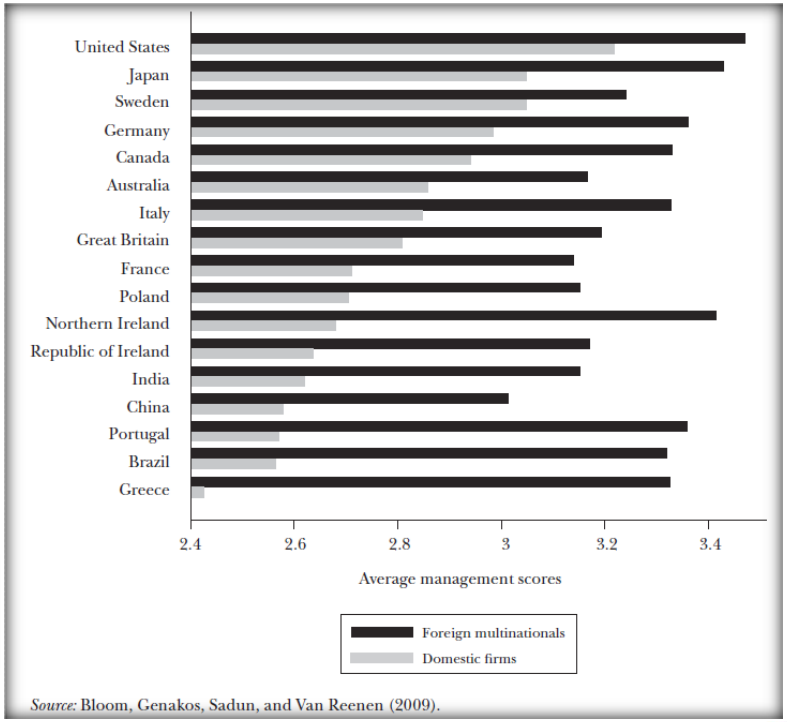
Fourth, **strong product market competition appears to boost average management practices** through a combination of eliminating the tail of badly managed firms and pushing incumbents to improve their practices.

[…]

Fifth, **multinationals are generally well managed in every country**. They also transplant their management styles abroad….

[…]

Sixth, **firms that export (but do not produce) overseas are better-managed than domestic non-exporters, but are worse-managed than multinationals**…"



Management Autonomy – Strong Mgmt/Leadership

Source: McKinsey Quarterly, April 2011

McKinsey Global Survey results

R&D strategies in emerging economies

Exhibit 6

Variable management skills

% of respondents,[1] n = 454

Performance of R&D managers relative to each other, by characteristics required for project success

Characteristics in order of importance	Managers of emerging-economy projects: Much stronger	Stronger	The same	Stronger	Managers of developed-economy projects: Much stronger
Highest: Leadership skills	4	8	30	28	17
Communication skills	7	15	27	23	16
Functional skills	4	14	35	25	10
Local influence	20	36	19	6	7
Lowest: Management proficiency	4	10	30	25	18

[1]Respondents who answered "don't know" are not shown.

Functional autonomy needs to be matched with management autonomy
Requires building superior management skillsets to drive the business

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Imagining Scale

Success **Typically Means More….**	**Which Calls For** ***Non-Linear*** **Improvements in….**
Customers **Channel Partners**	• Customer requirements management • Customer support • Marketing and sales • Partner management
Products **Volumes** **Revenues** **Profits** **Cash**	• Strategy & product definition • Time to market performance • Product quality • Product delivery • Financial management
Employees	• Management/leadership team • Management structure • Right skillsets
Suppliers **Logistics** **Infrastructure**	• Supplier/vendor management • Logistics management • Infrastructure management
Competitors	• Competitive assessment & response plans
Investors **Communication**	• Investor relationship management • Media management • Policy engagement • Communication framework
M&A….over time	• M&A management

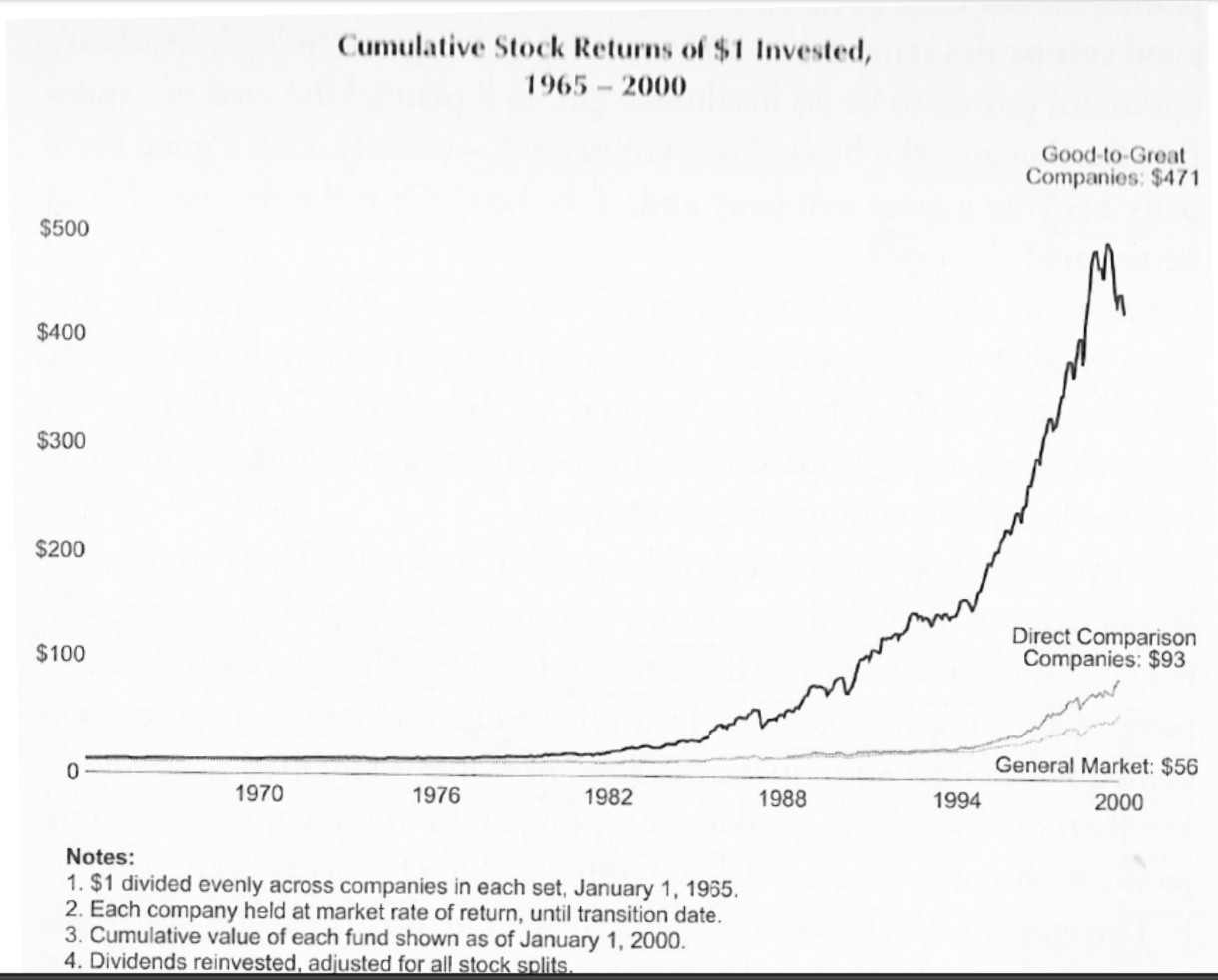
Scale requires recognizing where & when new or different approaches are required to solve challenges of growth

LSI

Jim Collins' "Good to Great" Companies

Collins & his team did an assessment on 1000+ US companies and identified a subset that they believed reflected superlative performance over at least 15 years

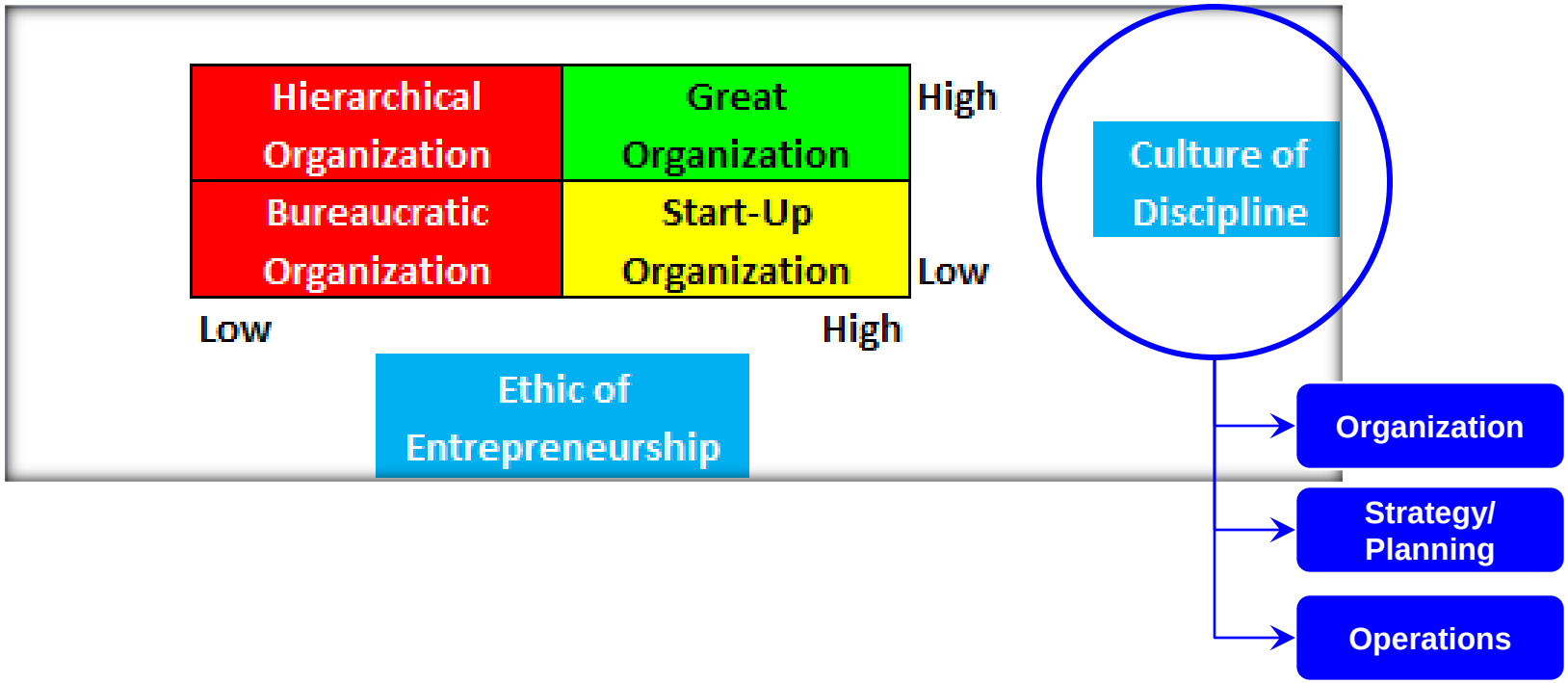
Chart from Jim Collins' book "*Good to Great*", Harper Collins, 2001, p. 4



Scaling doesn't happen by luck or accident – and you're never "done"

Driving Scale – A Culture of Discipline

Chart adapted from Jim Collins' book "*Good to Great*", Harper Collins, 2001, p. 122
"The Good-to-Great Matrix of Creative Discipline"



Discipline should never be an end into itself
Intent should be to achieve & accelerate business goals

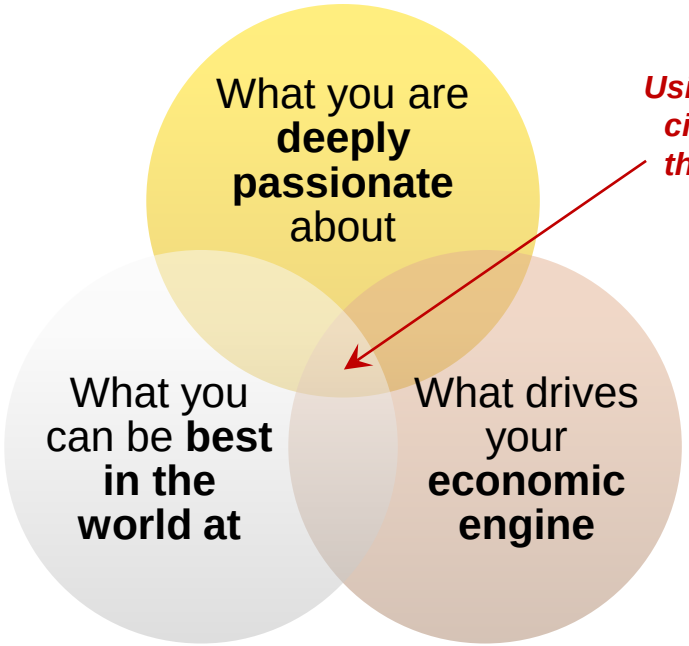
Organization – Focus & Diligence

Key Focus Area	Optimal Scenario for Scale-Building
Leadership	• Company comes first, over personal goals • Based on a foundation of trust across teams
Structure	• Optimized for long-term success & scalability • Not built around specific personalities per se
Skillsets	• Tailored for building world class capabilities
Goals & Alignment	• Clear goals & ownership with full alignment • Goals understood broadly within org
Ownership & Accountability	• Unambiguous roles & responsibilities

Organizational discipline is one of the three pillars of creating scale

Strategy / Planning - Focus

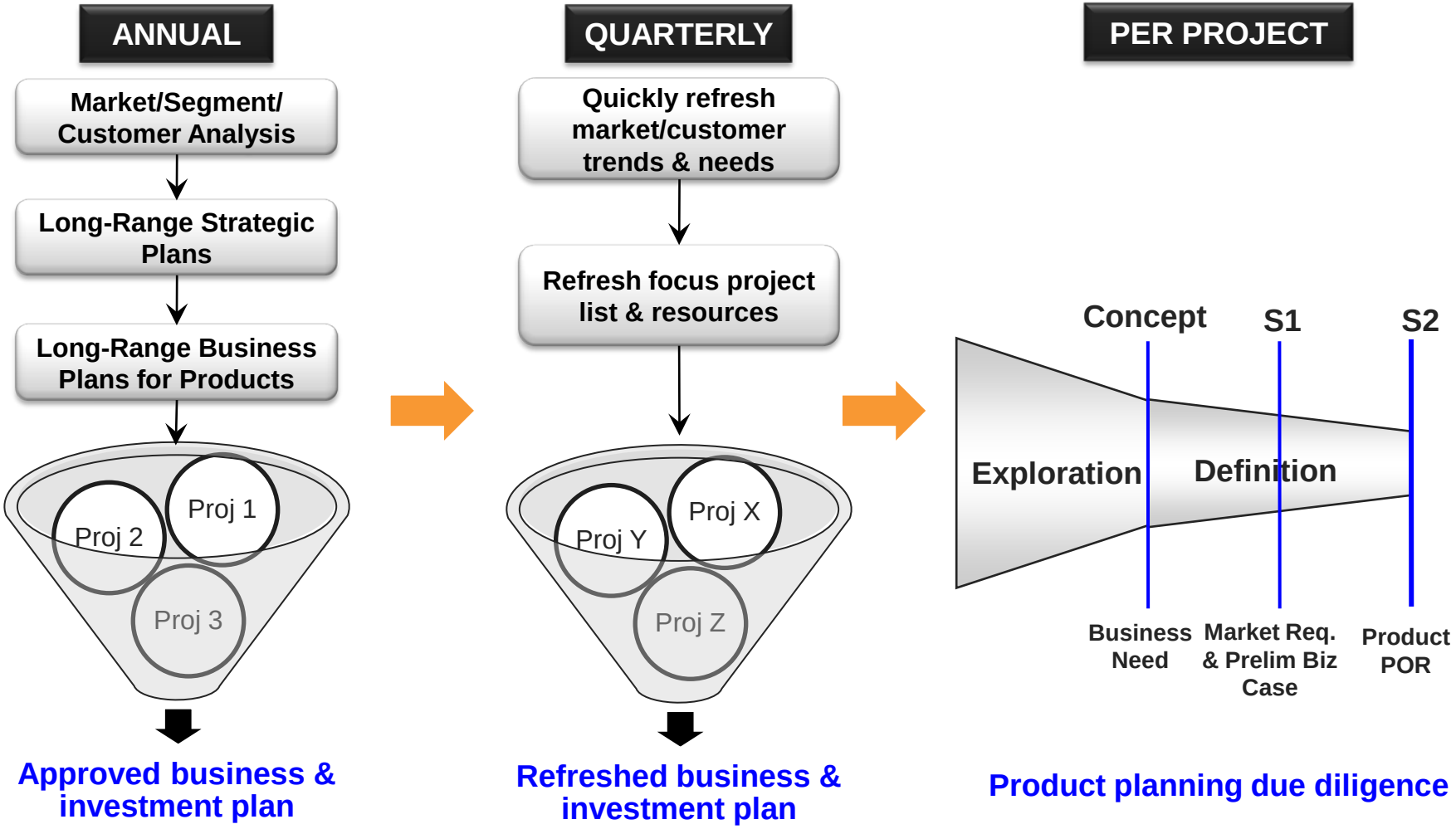
Chart adapted from Jim Collins' book "*Good to Great*", Harper Collins, 2001, p. 118
"Three Circles of the Hedgehog Concept"



Using the intersection of these three circles to hone in on the focus for the company will likely enable the most sustainable growth path

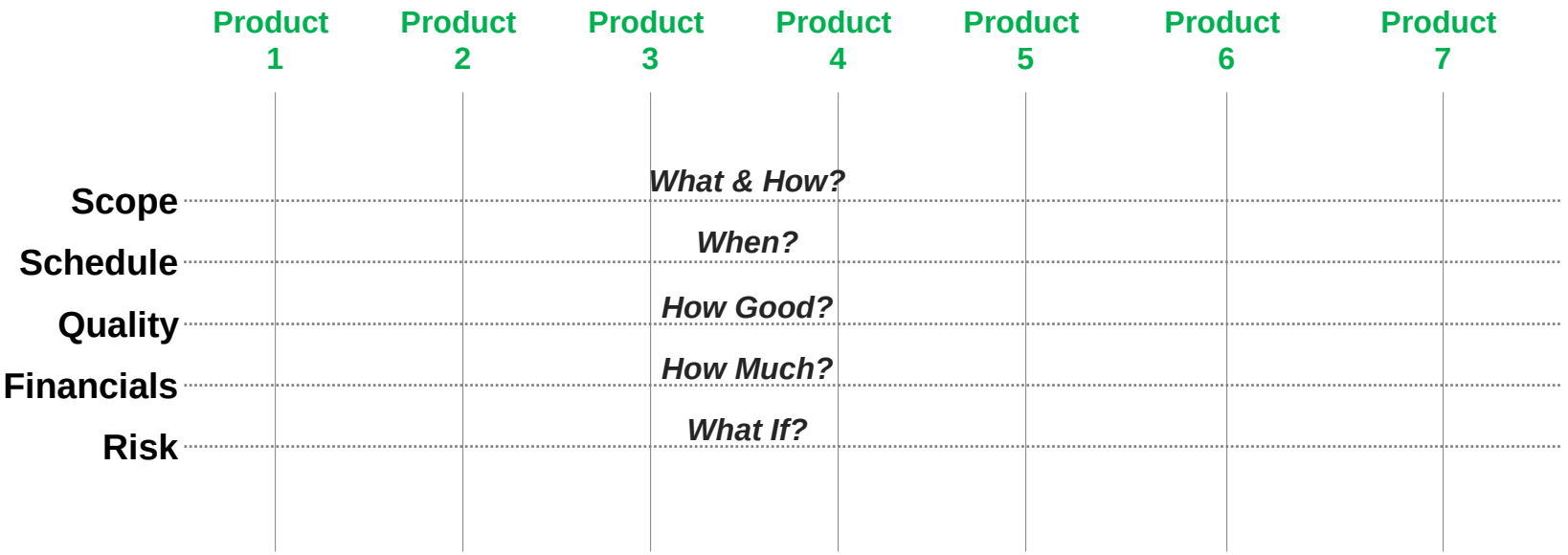
Discipline in setting strategic direction starts with laser-like focus
Strategic agility on business environment changes is essential

Strategy / Planning - Diligence

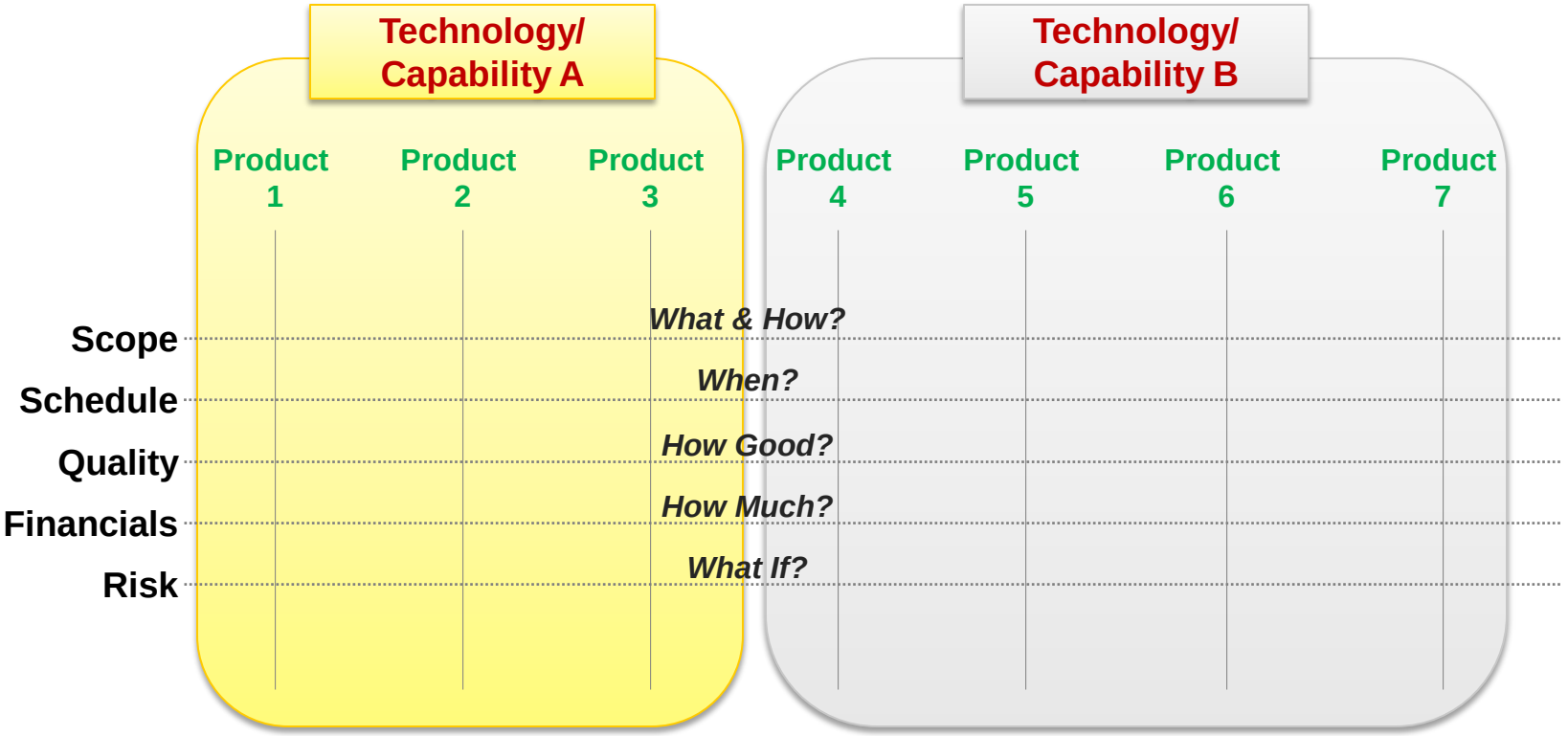


Establish focus on what needs to be done at a high-level & drive due diligence on the planning to get it done

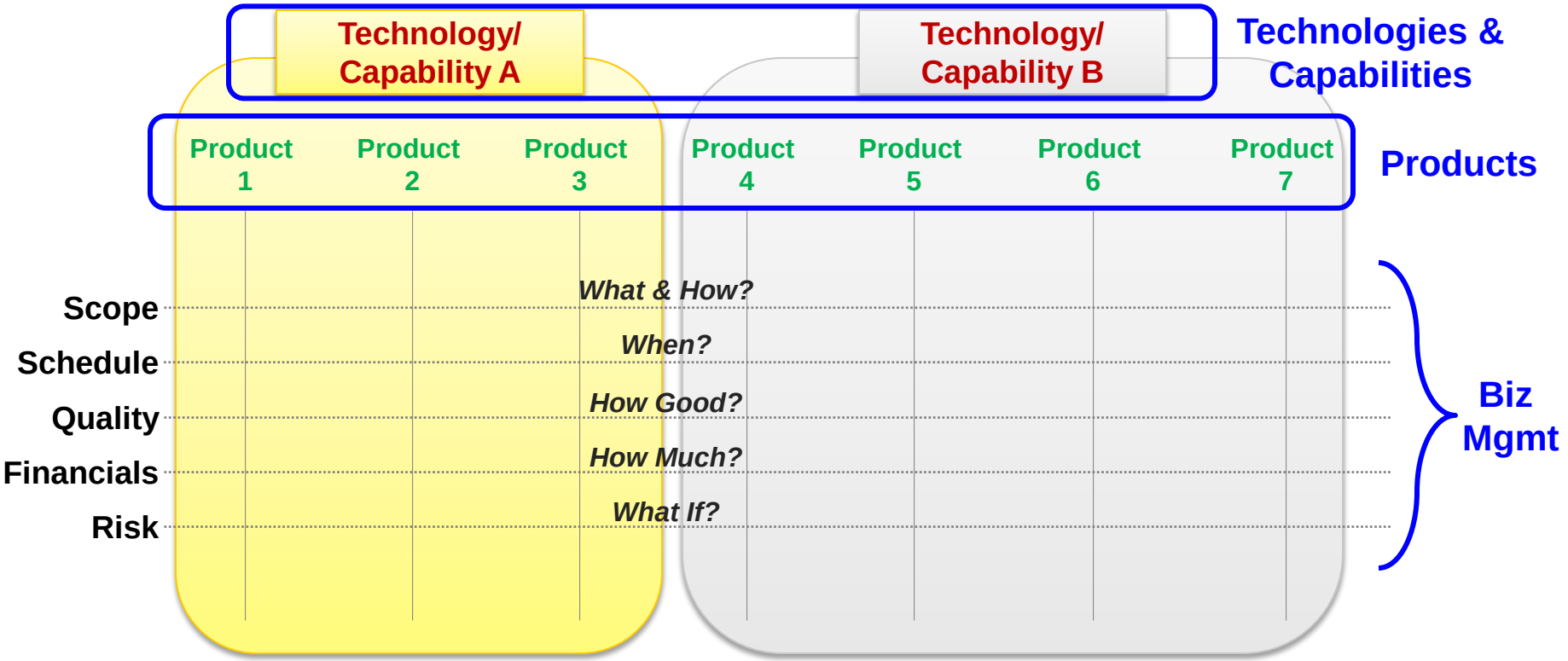
Operations - Focus



Operations - Focus

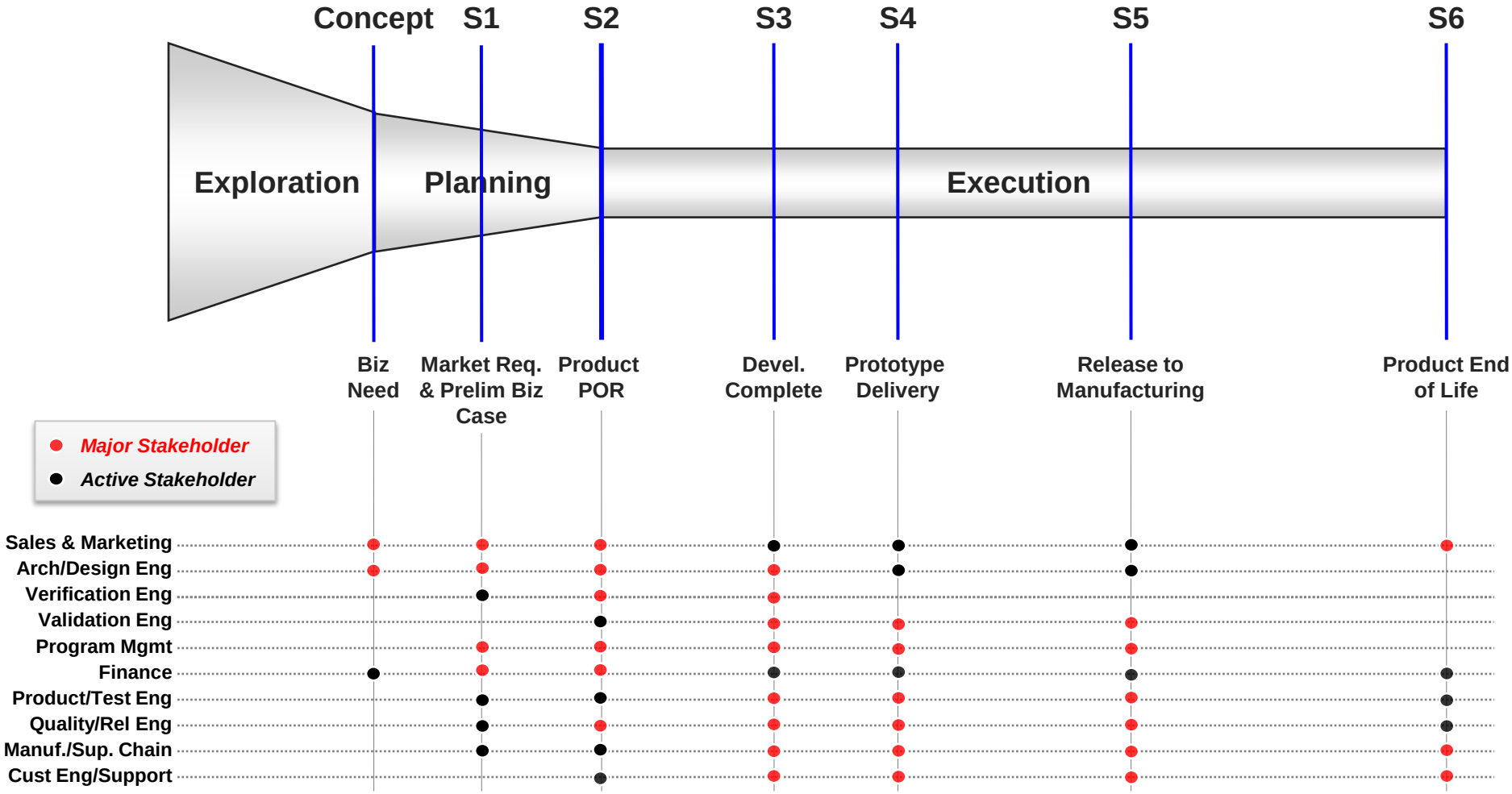


Operations - Focus



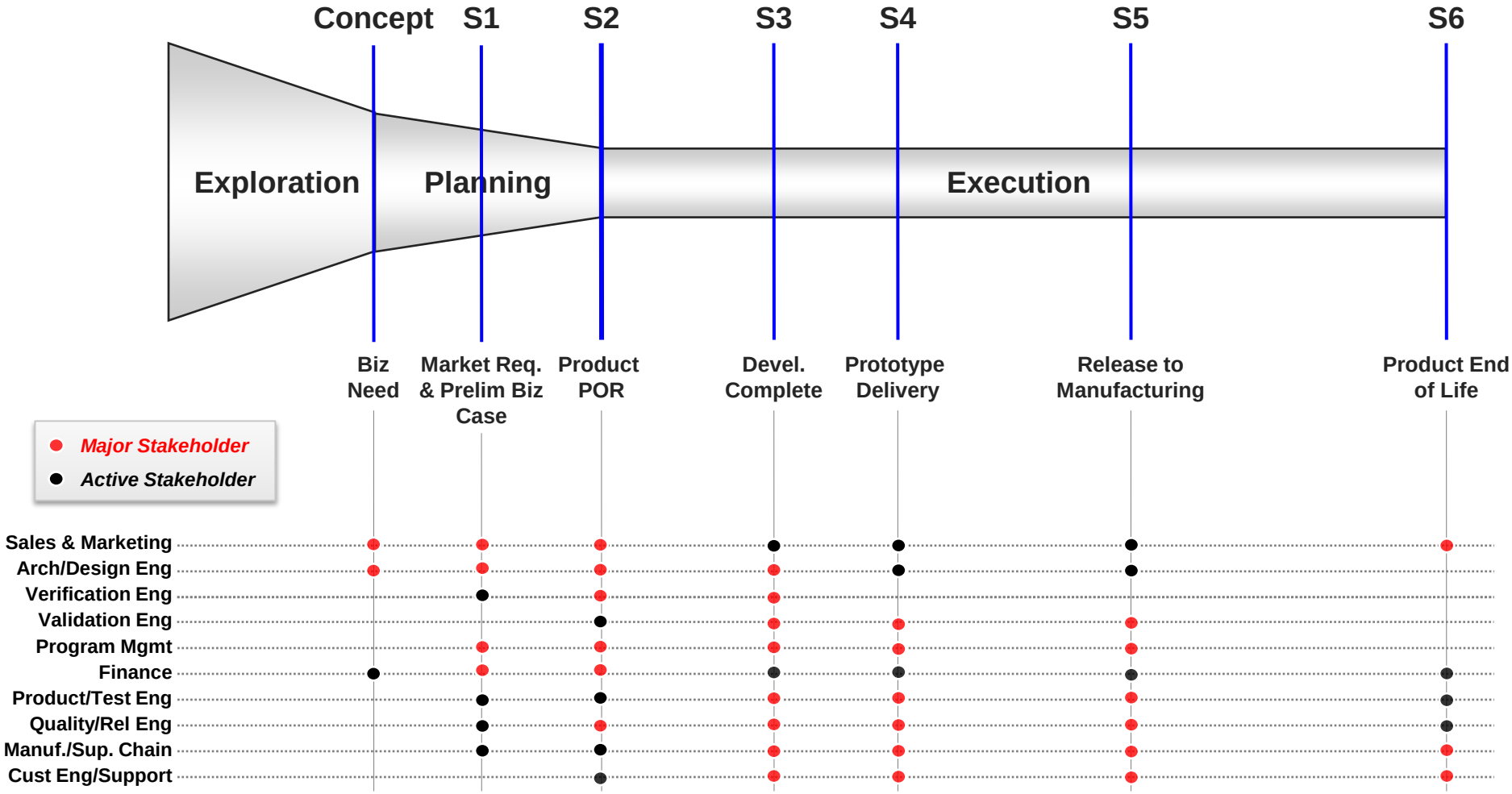
Due diligence in operations cuts across products, technologies/capabilities & overall business management

Operations - Diligence *(e.g., product)*



1. Establish who does what & what every stakeholder needs from others at all stages
2. Plan & state what we intend to do (e.g., POR), then follow-up & do what we said (actual v. POR)
3. Eliminate communication barriers and always face up to reality & customer needs
4. Drive a culture of discipline for scalability, but provide appropriate flexibility

Operations - Diligence *(e.g., product)*



"I tell this story to illustrate the truth of the statement I heard long ago in the Army: Plans are worthless, but planning is everything."
– Late US President Dwight David Eisenhower, 1957

Outline

Introduction	• **LSI overview** • **What is autonomy & scale?** • **Motivation for this talk** • **Key messages**
Why Autonomy & Scale	• **Key VLSI industry trends** • **First-to-market vs. lasting leadership** • **Growth isn't easy** • **Exchange rates & globalization**
Autonomy in Semi Business	• **Functional autonomy** • **Management autonomy**
Scaling the Semi Business	• **Imagining scale** • **Framework for driving scale** • **Organization** • **Strategy/Planning** • **Operations**
Looking Ahead	• **Closing Thoughts**

Closing Thoughts

- **Industry trends & challenges call for autonomy & scale building**
  - Businesses in “emerging” geographies like India should embrace this more
- **Opportunities exist in India to expand scope of VLSI businesses**
  - End-to-end VLSI capabilities that encompass greater system-level knowledge could increasingly be an asset & value-add
  - Design IP might be primary value-add currently, but businesses can’t take more control over their destiny without mastering end-to-end capabilities
- **India can participate more broadly on the global stage**
  - Industry & government should look to enable the right environment & infrastructure to facilitate greater autonomy & scale over the next decade
  - Growth of in-country OEMs & manufacturing could offer favorable conditions

Backup Slides

Growth Isn't Easy

Automobile Industry Anecdote

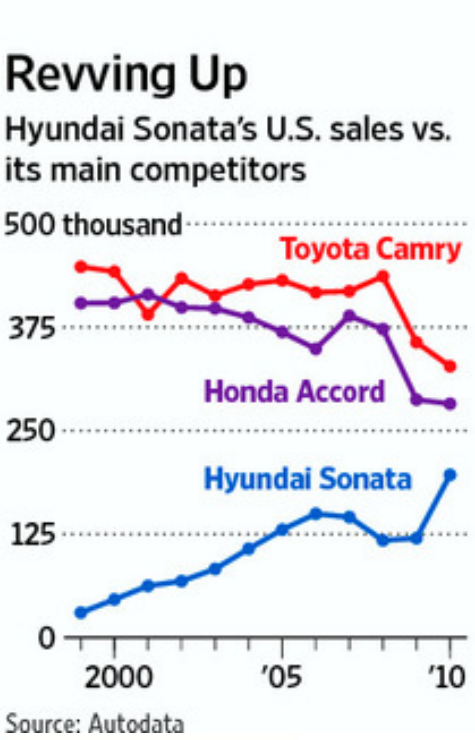
Thursday, June 30, 2011 As of 12:00 AM

THE WALL STREET JOURNAL. | AUTOS

[Source: Wall Street Journal]

Once a Global Also-Ran, Hyundai Zooms Forward

By MIKE RAMSEY And EVAN RAMSTAD



"….. Lately, Hyundai, and the affiliate it controls, Kia Motors Corp., have become formidable competitors. **About a decade ago, Hyundai was a global also-ran—a maker of small, cheap, no-frills cars with a reputation for breaking down**. In the late 1990s, Hyundai and Kia together ranked as the world's 13th-largest auto maker, according to the International Organization of Motor Vehicle Manufacturers.

But in the past decade, the company worked hard to root out defects, improve quality and design, expand production into low-cost locations and offer cars with more features than its competitors, like a 10-year warranty. And it has pulled off some feats that many of its rivals haven't been able to accomplish, or dared to try.

[…]

Several years ago, **Hyundai made no secret that it hoped to become the world's largest auto maker some day. Mr. Yang says that thinking has changed**.
GM and Toyota became the world's largest and then stumbled, he noted, adding that making 10 million cars a year would require running 50 factories—more, in his view, than a company can run effectively.

"Should there be a certain range, maybe 6 million or 7 million, that is best?" Mr. Yang said. "We don't know what size is optimum. But bigger, bigger, biggest is always good? We don't think so."……"

LSI

Linking Strategy & Execution

- **Assuming that a company's strategy has been well defined & communicated, serious challenges might prevent that from being translated into sound execution**

- **OnPoint Consulting 2006 survey of senior managers and executives at numerous companies elicited the following response:**
  - *"Nearly 50% of business leaders say there is a gap between their organization's ability to develop strategy and their ability to execute it"*
  - *"Even more disturbing, 64% lack confidence in their org[…]'s ability to close that gap*"

- **Numerous analyses & surveys have called out the impact of poor requirements definition & planning & impact of resource conflicts on high percentages of IT project failures (e.g., ZDNet 1, ZDNet 2)**

- **HBR's "Why Most Product Launches Fail" (*by Joan Schneider and Julie Hall*) highlighted areas where misunderstanding of market needs, as well as quality & manufacturing issues end up amongst the top reasons why new products don't succeed**