

MassMEDIC
Massachusetts Medical Device Industry Council



Collaboration in Medical Devices: Lessons from Nokia and Elsewhere

Presentation to MassMEDIC

Waltham, MA

Tuesday 27th February 2007

Endeavour Partners

My goal today is to convince all of you of the power of collaboration, and outline how to go about it...

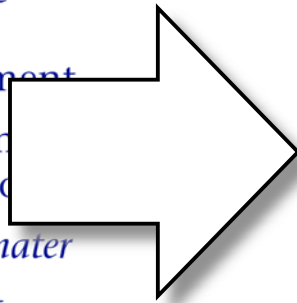
Endeavour Partners works with top management of technology companies on business strategy and technology

- last couple of years working with Nokia's top management team as external stimulus and challenge on transformation of R&D and technology strategy and management
- also responsible for top management development in strategy and technology

Teaching at the local tech and at my *alma mater*

- MIT Sloan School of Management
 - London Business School
- CTO of a medical devices startup

- for **horses...**
- EquuSys, Inc



How do we improve the odds of success?

How do we get more bang for the buck?

What can we learn from cellular and consumer electronics in general, and from Nokia in particular?

What are the ways in which collaboration can improve effectiveness and return on capital invested?



15.905 Spring '07: Technology Strategy

Core program for Systems Design and Management (SDM)

A strategic framework for managing high-technology businesses

Objective is to improve (significantly) the odds of success

- figuring out how to create and capture value,
- make difficult decisions
- develop and deliver technologies, platforms and products

Focus on domains in which systems are important

- products are part of larger and more complex systems
- products are comprised of systems

Coming to MIT Open CourseWare later this year...



E384 SPR07: New Technology Ventures

Joint program with University College London

Participants from science, technology and business

- PhD's, Post-doc's and Professors
- MBAs

Core element is a group project to evaluate the commercial potential of a real-world technology:

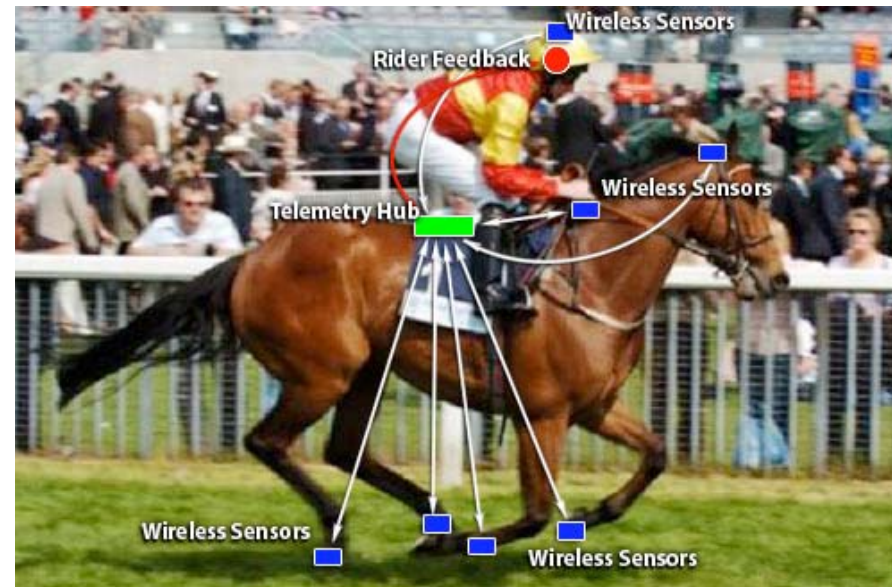
- automatic visualization of emotional content of music
- np-problem application to business
- plastic semiconductors
- smart sensing technologies applied to elite athletes



Ensuring equine excellence through telemetry and informatics

Top equine athletes are very valuable, very fragile and can't communicate
High precision, high speed real-world, real-time measurements using multiple sensors on horse and rider
Ruthless, relentless focus on ease of use
Modular and flexible

Development in partnership with lead users: CSU; Hagyard Equine; Massey
Outsourcing almost all R&D - virtual development organization
Control architecture and core algorithms



Cellular and Nokia today

Cellular

Huge - billions of users

Global - transforming Africa

Diverse

- <\$30
- ...to the iPhone

Brutally competitive

- consolidated around 4½ majors
- extremely hard to maintain position (Motorola)
- recent death of majors (Siemens)

Collaboration has become critical to success for all players

Nokia

#1 worldwide

- global footprint
- from <\$30 to >\$30,000
- consumers, multimedia, enterprise systems and luxury

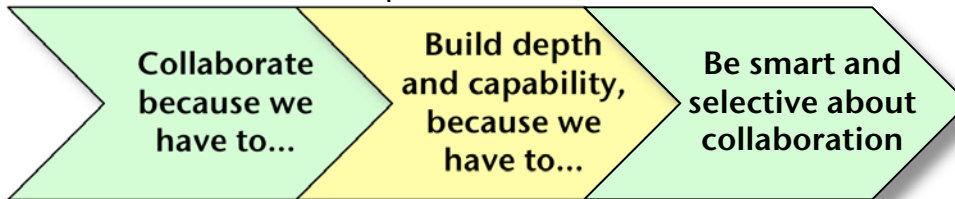
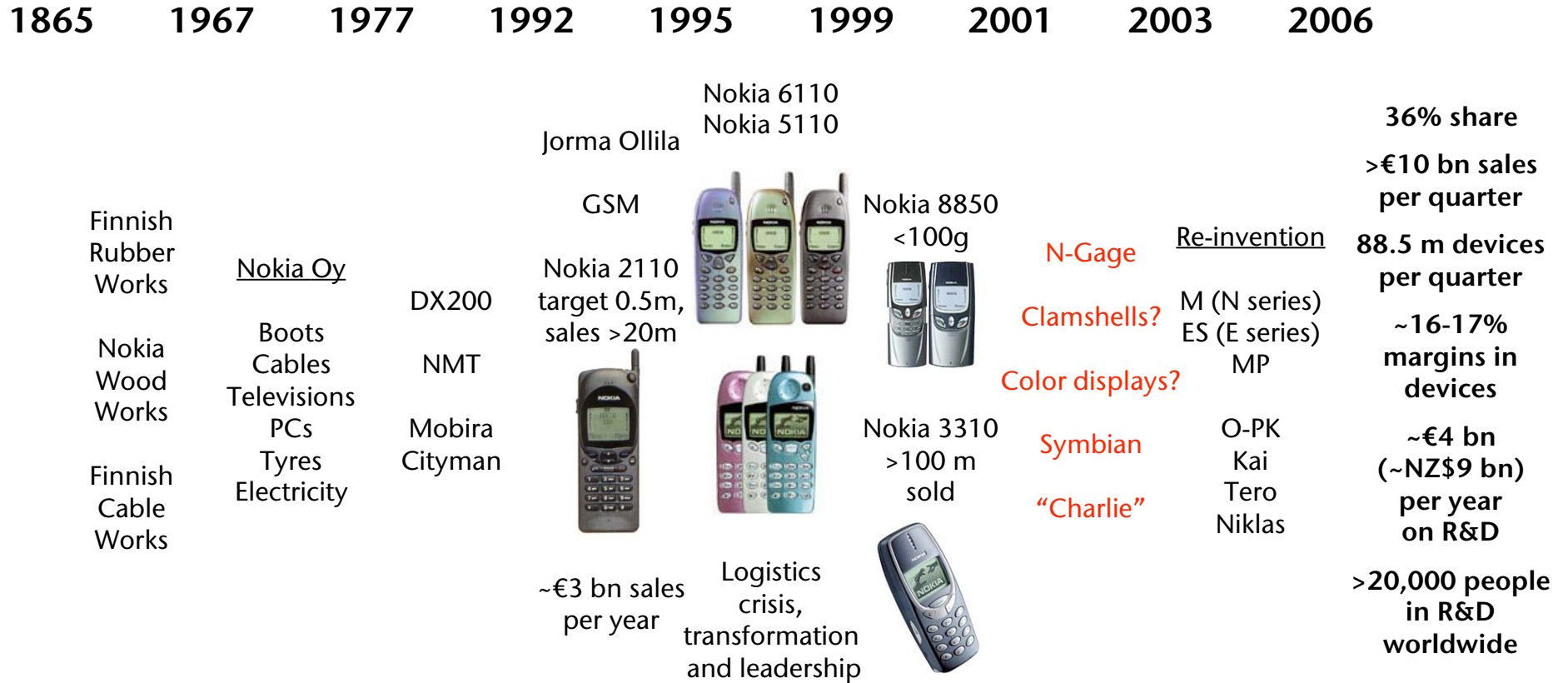
Success built without resources

- built leadership by being smart about how it spent money
- collaboration with broad range of partners - TI in particular

Now large and complex

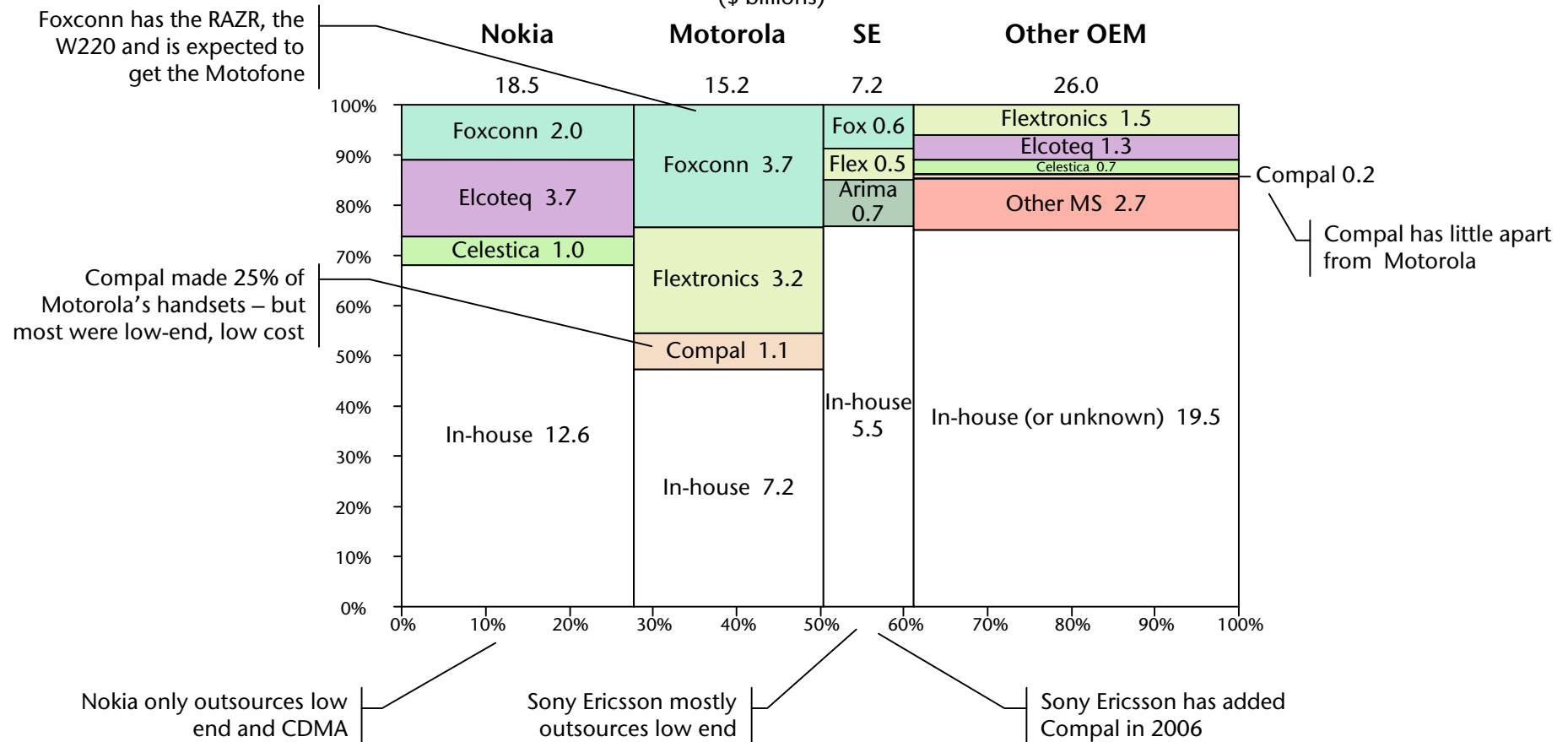
- embracing (smart) collaboration

Collaboration played a critical role in Nokia's growth in <15 years to global leadership



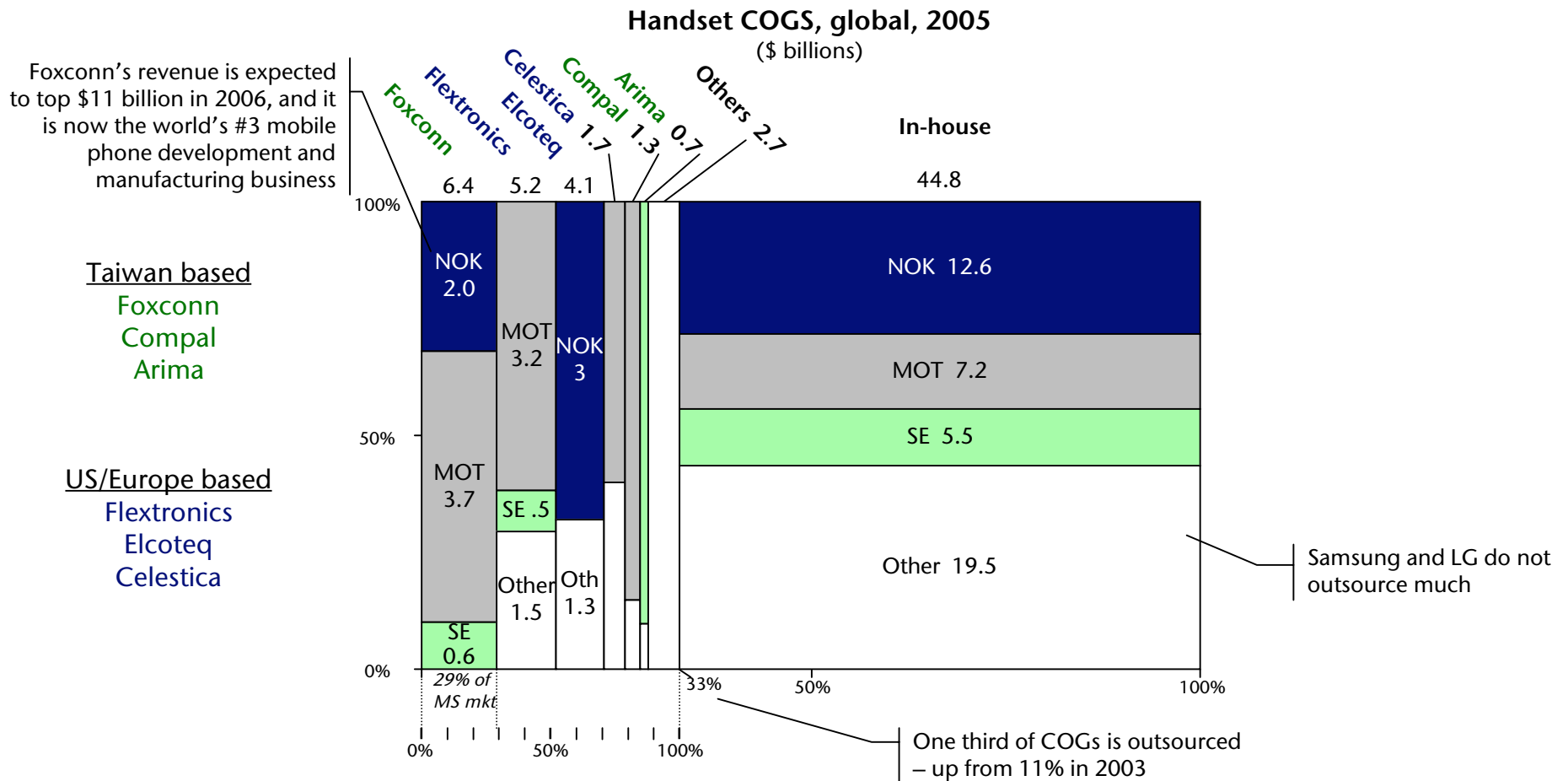
The top three players now outsource at least 25% of their volume, and some more than 50%

Handset COGS, global, 2005
(\$ billions)



Sources: SinoPac; Nomura; ABN Amro; KGI; Yuanta; Ericsson company reports

In '05, top tier cellular device vendors outsourced a third of CoGS; Foxconn is now #3 manufacturer



Sources: SinoPac; Nomura; ABN Amro; KGI; Yuanta; Ericsson company reports; 2003 COGS based on Citigroup, Nov 2004

Despite the importance of collaboration, there are still large differences: Nokia keeps clear leadership

Nokia 1110



Motorola C138



Feature set and cost comparison:

Nokia 1110 phone beats the Motorola C138 on most key measures that matter to customers:

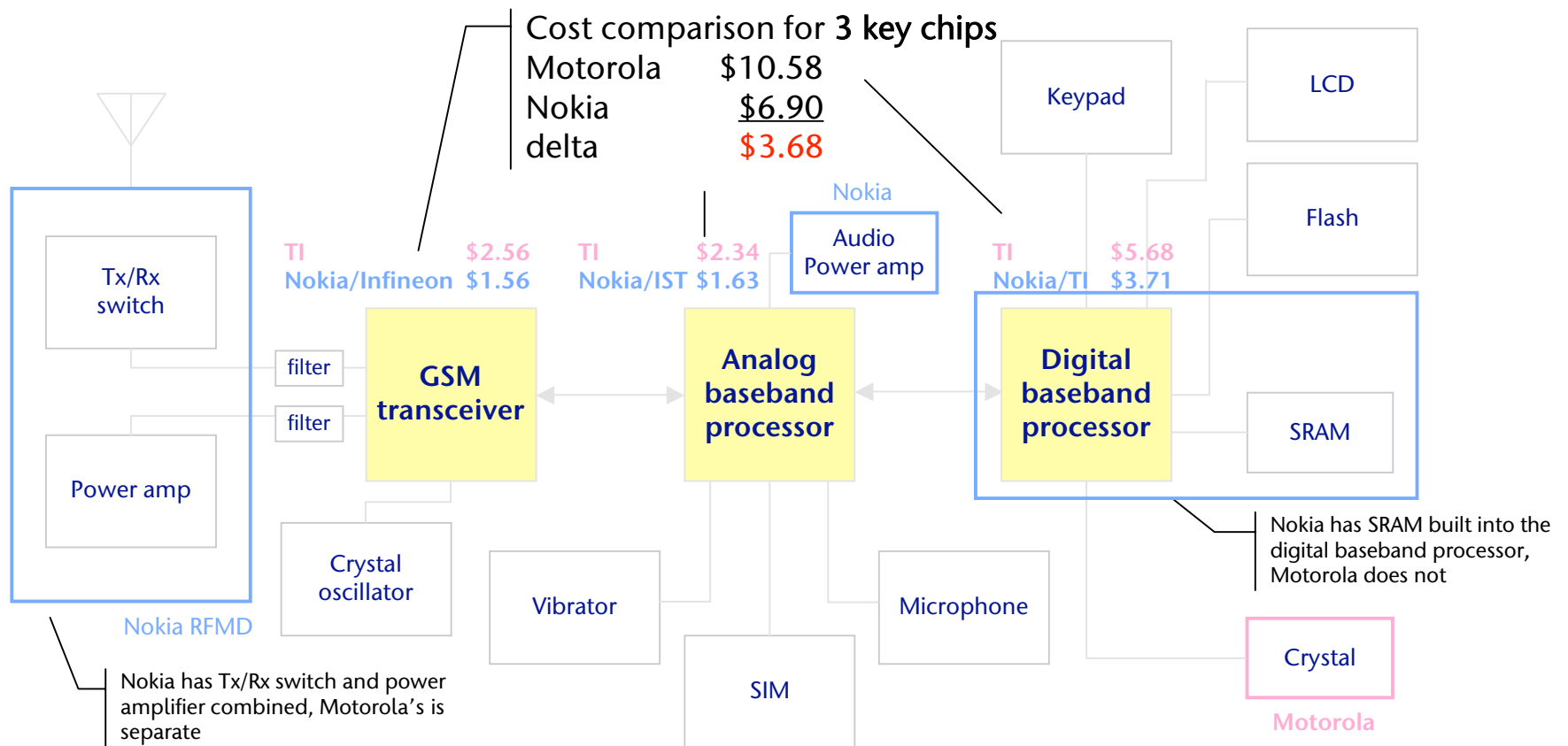
- ✓ 27% more standby time
- ✓ removable covers
- ✓ speakerphone
- ✓ polyphonic MP3 grade ringtones
- ✓ 200 entry phonebook
- ✓ 17% smaller and 20% thinner
- ✗ 33% less talk time

Standby time	Up to 380 hours	Up to 300 hours
Talk time	Up to 5 hours	Up to 7.5 hours
Technology	GSM dual band (900/1800 and 850/1900 versions)	GSM dual band (900/1800)
Weight	80g	81g
Volume	78cc	94cc
Dimension	104 x 44 x 17 mm	100 x 45 x 21 mm
Display	96 x 68 mono	96 x 65 mono
Other features	Removable covers, MP3 grade, multiple language, speaker & jack	Headset jack
Messaging	SMS, EMS (picture messaging)	SMS, EMS
Personalization	Games, polyphonic ring, speaking alarm, stop watch, icon menu	Games, ringtones, alarm clock, calculator, stop watch
Call management	200 entry phonebook	SIM only
Manufacturing cost	\$29.45	\$34.91
Retail price	\$60 to \$75	Around \$50

Sources: Nokia and Motorola website and company documents, Portelligent, CSFB

Nokia maintains a 15% cost advantage by investing in research to lower the costs of three key chips

Architecture teardown and cost comparison: Nokia 1110  and Motorola C138 



Reverse conventional wisdom...put less into R&D to get more out...

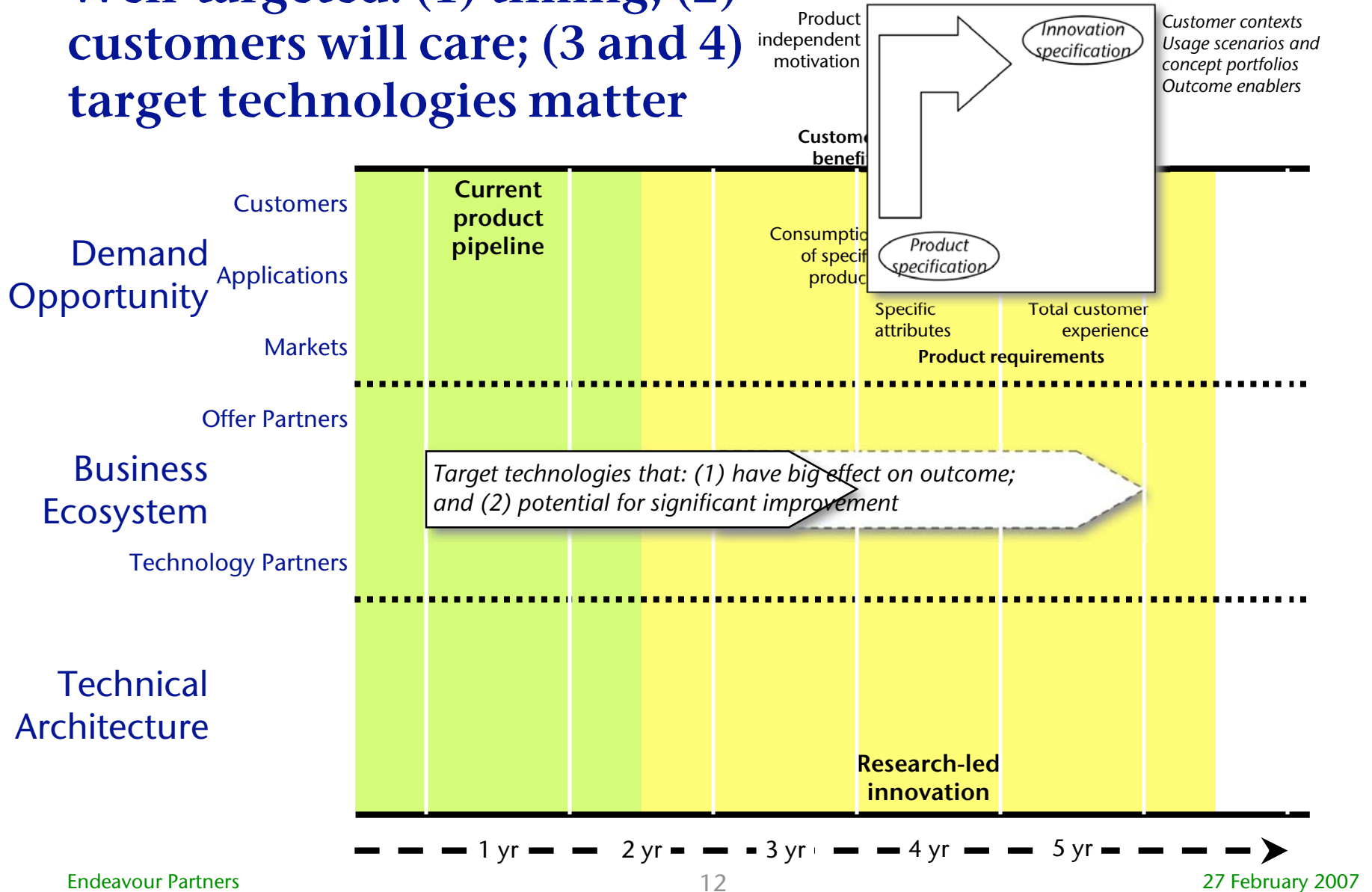
Well-targeted

- shift spending from developing products...
 - ...to collaboration with user
 - ...so that you (really) know what customers want...
- ...and can focus on the technologies that have impact...

Tightly focused

- null hypothesis or nihilist philosophy
 - spend nothing on in-house development
 - ...unless you have to...
 - ...or you can do a better job...
 - ...and capture value created

Well-targeted: (1) timing; (2) customers will care; (3 and 4) target technologies matter



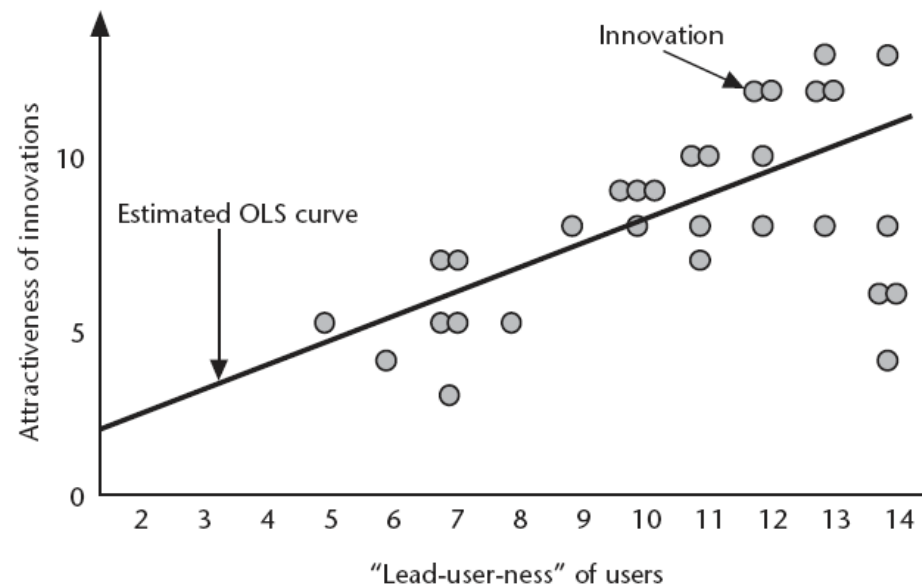
Collaborate with (lead) users and experiment to boost odds customers (really) want what you're developing...

>10% of users innovate for themselves

These “*lead users*” are ahead of the population, and are typically a good proxy for the demand opportunity

And they expect to gain high benefits, so they are prepared to invest in getting it right...

This has long been an integral facet of the development of scientific instruments...



Eric von Hippel, “Democratizing Innovation”

Collaborate with users in low-cost experiments to find out what (really) works...

Revamp routines and breakdown boundaries to enable and encourage interaction with users

Work in small teams that can iterate rapidly

Fail early and often

- well-designed tests with clear objectives and hypotheses
- control the variables, or allow for multiple repeated trials

...and small players with finite resources can beat much larger, older and richer incumbents...

Black Magic



Stefan Thomke, "Experimentation Matters"

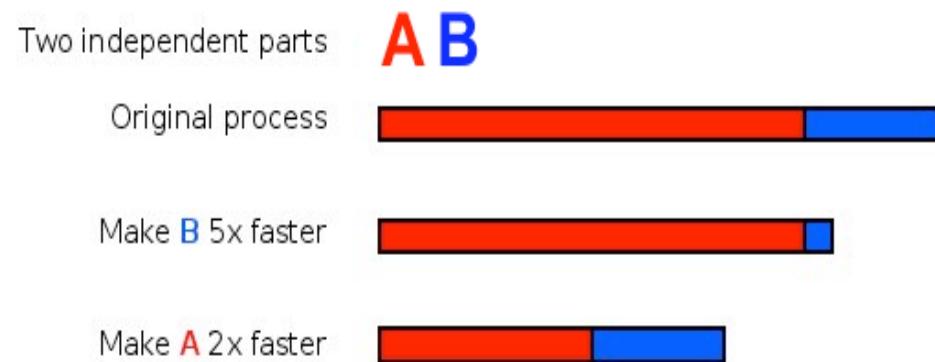
Amdahl's Law: "...make the common case fast..."

Amdahl's Law is concerned with the speedup achievable

- from an improvement to a computation
- affects a proportion P of that computation
- where the improvement has a speedup of S

Amdahl's Law states that the overall speedup of applying the improvement will be

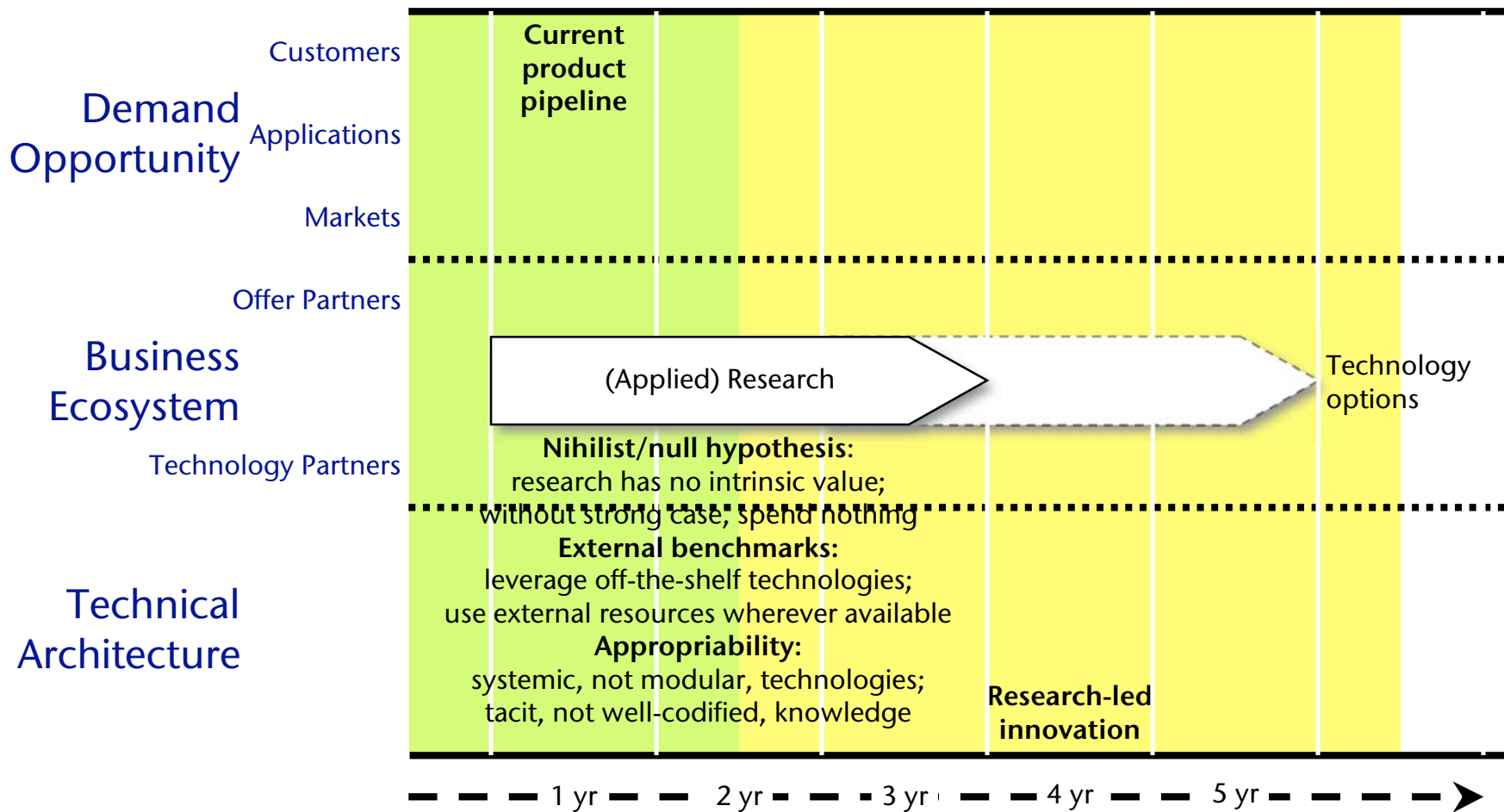
$$\frac{1}{(1 - P) + \frac{P}{S}}$$



“God grant me the serenity to accept the things I cannot change (much); courage to change the things I can (a lot); and wisdom to know the difference.”

- Reinhold Niebuhr

Tightly focused: neither (5) technologies nor; (6) capabilities readily available; (7) you can make distinctive contribution; and (8) *capture* value, as well as creating it



Architecture and appropriability are the keys to making R&D payoff in collaborative environment

Architecture

Develop insight into the *technological architecture*

- interfaces and interdependencies
 - boundaries and bottlenecks

Enable smaller footprint

- selective outsourcing
- collaboration with supply partners within business ecosystem

Achieve greater return on invested capital
...and over the long run, achieve market dominance

Kim Clark and Carliss Baldwin, “Footprint Competition”

Appropriability

Changing environment

- faster, richer information flows
- ...decoupled from physical products
- ...for which systems-level integration is increasingly important

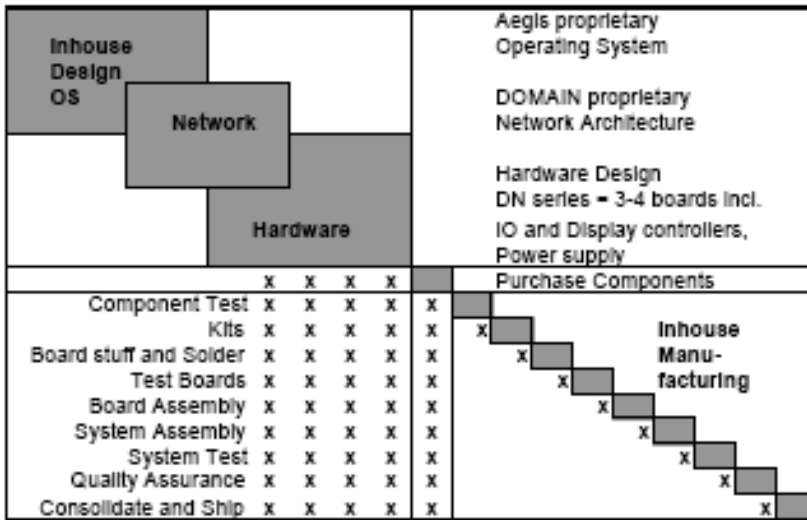
Search for *inimitability*

- know-how that cannot be imitated: IPR; trade secrets; tacit knowledge
- complementary assets: gaining access; exploiting availability
 - dynamic capabilities

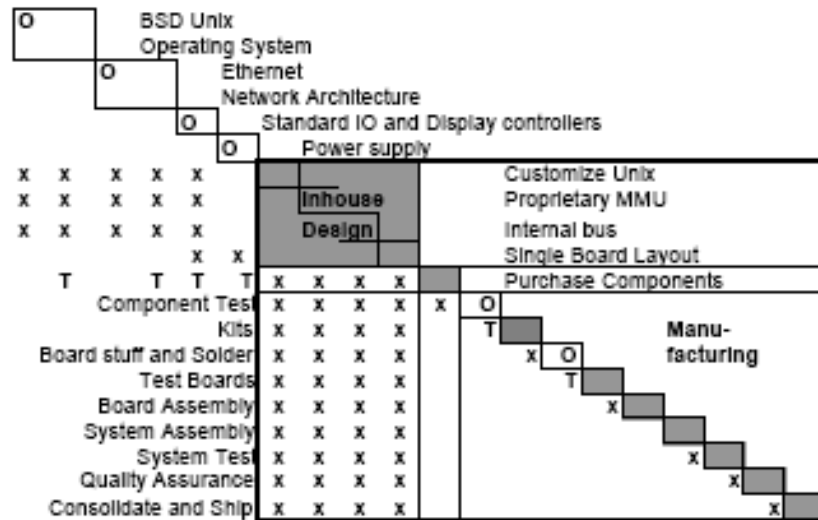
David Teece, “Capturing Value from Knowledge Assets” and “Profiting from Technological Innovation”

Architecture and activities: Apollo Computer *versus* Sun Microsystems

Apollo Computer



Sun Microsystems



Key:

- x= transfer of material or information from column task to row task;
- T= transaction: sale of good by column owner to row owner;
- O= outsourced task blocks;
- highly interdependent task blocks
- Footprint (tasks performed inhouse).

Outcomes from innovation: Innovators and Followers or Imitators

Innovator

Follower-Imitator

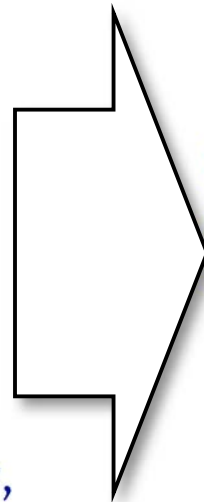
	1	2
Win	<ul style="list-style-type: none"> . Pilkington (Float Glass) • G.D. Searle (NutraSweet) . Dupont (Teflon) 	<ul style="list-style-type: none"> • IBM (Personal Computer) . Matsushita (VHS video recorders) . Seiko (quartz watch)
	4	3
Lose	<ul style="list-style-type: none"> . RC Cola (diet cola) • EMI (scanner) . Bowmar (pocket calculator) . Xerox (office computer) . DeHavilland (Comet) 	<ul style="list-style-type: none"> . Kodak (instant photography) • Northrup (F20) • DEC (personal computer)

Making collaboration work...

Collaboration and cooperation have become the key to success

Spend less (on product development) to get more...

- well-targeted - what customers want, and technologies that matter
- tightly focused - only where unavailable, and you're better, and you can capture value



Collaborate with customers

- lead user innovation
- experimentation

Collaborate wherever possible with supply partners within business ecosystem

- architecture for insight
- inimitability to capture the value created

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