

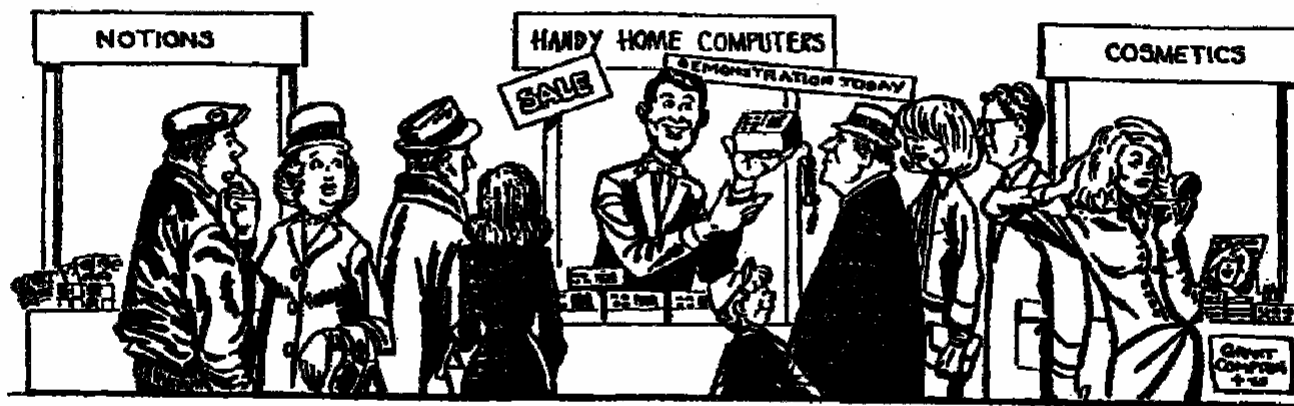


# Mediating Instruments and Making Markets

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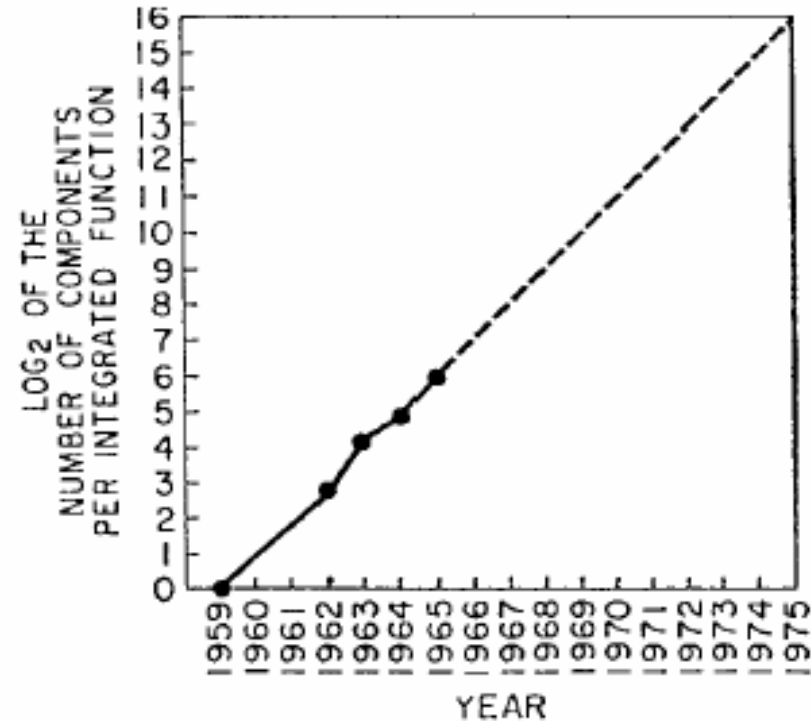
**“ICTs in the Contemporary World”  
6 February 2007**



From: Gordon Moore, *Electronics* (1965)

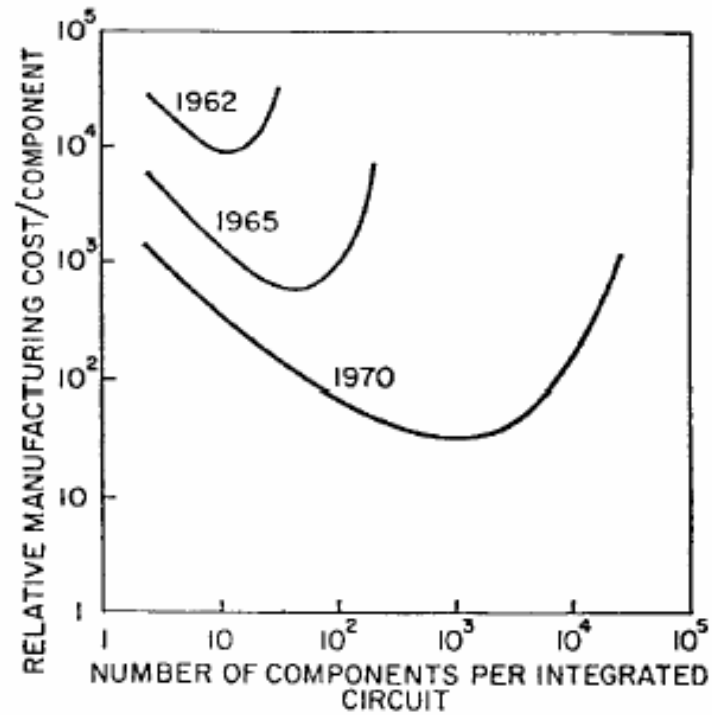
# Moore's Law (I)

## A technological prediction



**From: Gordon E. Moore,  
“Cramming more components onto integrated circuits”  
Electronics, April 19, 1965, p. 116**

## Moore's Law (II): A cost function



**Minimum Component Cost per 'generation'**  
**From Moore (1965, p. 115)**

# Investment Decisions, Technology Roadmaps and Moore's Law at Intel Corp (I)

- “We obviously do ROI [calculations] on products and things of that sort. But the core decisions the company makes, the core decisions are basically *technology roadmap decisions* ..”
- “Moore's Law is not a law of physics. On the other hand, it's a pretty strong economic law, because once the industry deviates from Moore's Law, then the rate of investment is going to change, and the whole structure will change”.

## **Investment Decisions, Technology Roadmaps and Moore's Law at Intel Corp (II)**

- “You spend \$2 billion, and you don't have a designated product or even a customer for the product... [...] it takes, you know, as long to build one of these big [production] facilities as it takes to design a product, means you do things in parallel. You do things on – I won't say 100% hope and faith – but we absolutely rely on past history ... to make major capital bets either on manufacturing technology development or product design.”

## Science/technology

- ‘Mediating Instruments’ to explain indirect effect of ‘social context’
- “... instruments, units, mathematical techniques, and other elements of everyday practice...” (Wise, 1988)
- Links between science and the economy (cf ‘techno-economic networks’)

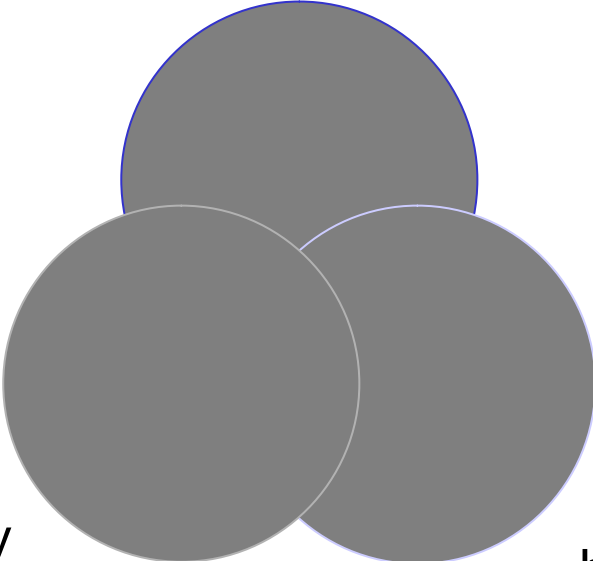
# Economy/economic Sociology

- ‘Making Markets’: how this is achieved in practice
- Rule-making and Market-Making (Fligstein)
- Market-Making more than rule-making, and dependent on ‘mediating instruments’ such as Moore’s Law and Technology Roadmaps

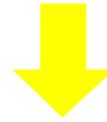
Science

Economy

Capital  
budgeting



Moore's Law



Technology Roadmaps  
(Industry level)

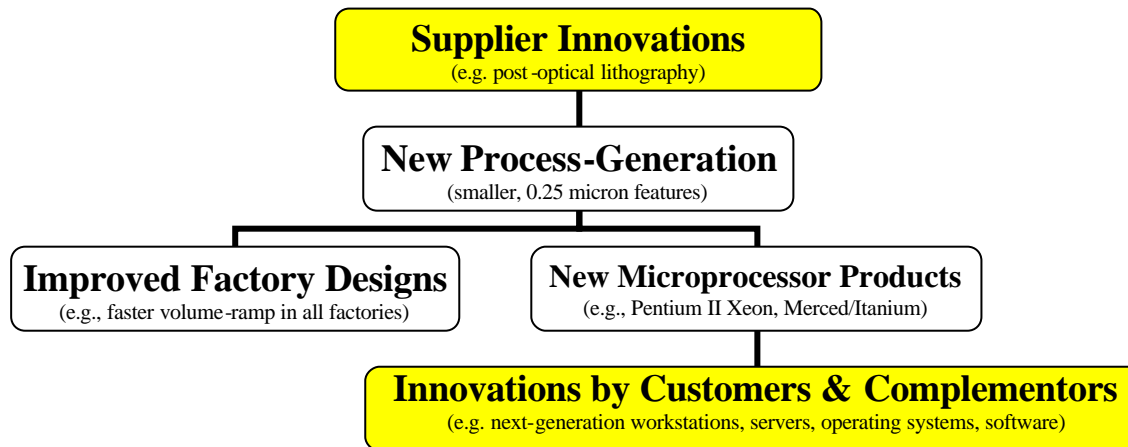


Technology Roadmaps  
(Firm level)



Firm level investment  
Decisions (cost of ownership)

# Intra-firm and Inter-firm investments



# Technology Roadmaps: ITRS 2001

Year of first production:	2001	2004	2007	2010	2013	2016
Technology node:	(T <sub>N0</sub> )	(T <sub>N1</sub> )	(T <sub>N2</sub> )	(T <sub>N3</sub> )	(T <sub>N4</sub> )	(T <sub>N5</sub> )
Node designator (nanometres):	130nm	90nm	65nm	45nm	32nm	22nm
<b>Advances in product designs (high volume microprocessors)</b>						
Functions per chip at introduction (billions of transistors):	0.193	0.386	0.773	1.546	3.092	6.184
<i>Multiple per 3 year technology cycle:</i>		2	~2	2	2	2
Affordable production cost per chip at introduction ('000 micro cents):	176	62	22	7.78	2.75	0.97
<i>Rate of cost reduction per cycle (%):</i>		~65	~65	~65	~65	~65
<i>Annualized cost reduction/ transistor (%)</i>		~29%	~29%	~29%	~29%	~29%
Chip size at introduction (mm <sup>2</sup> ):	280	280	280	280	280	280
<b>Innovations in lithographic equipment for microprocessor manufacture</b>						
Electronic feature ½ pitch (nm):	150	90	65	45	32	22
Printed gate length (nm):	90	53	35	25	18	13
Physical gate length (nm):	65	37	25	18	13	9
Type of lithographic technology:	Direct ultraviolet (DUV)			Extreme-ultraviolet (EUV) <i>Or</i> Electron projection (EPL)		

## Technology Roadmaps: Definition

- “The International Technology Roadmap for Semiconductors (ITRS) is an assessment of the semiconductor technology requirements. The objective of the ITRS is to ensure advancements in the performance of integrated circuits. This assessment, called roadmapping, is a cooperative effort of the global industry manufacturers and suppliers, government organizations, consortia, and universities.”

(ITRS, May 2006; <http://public.itrs.net/>)

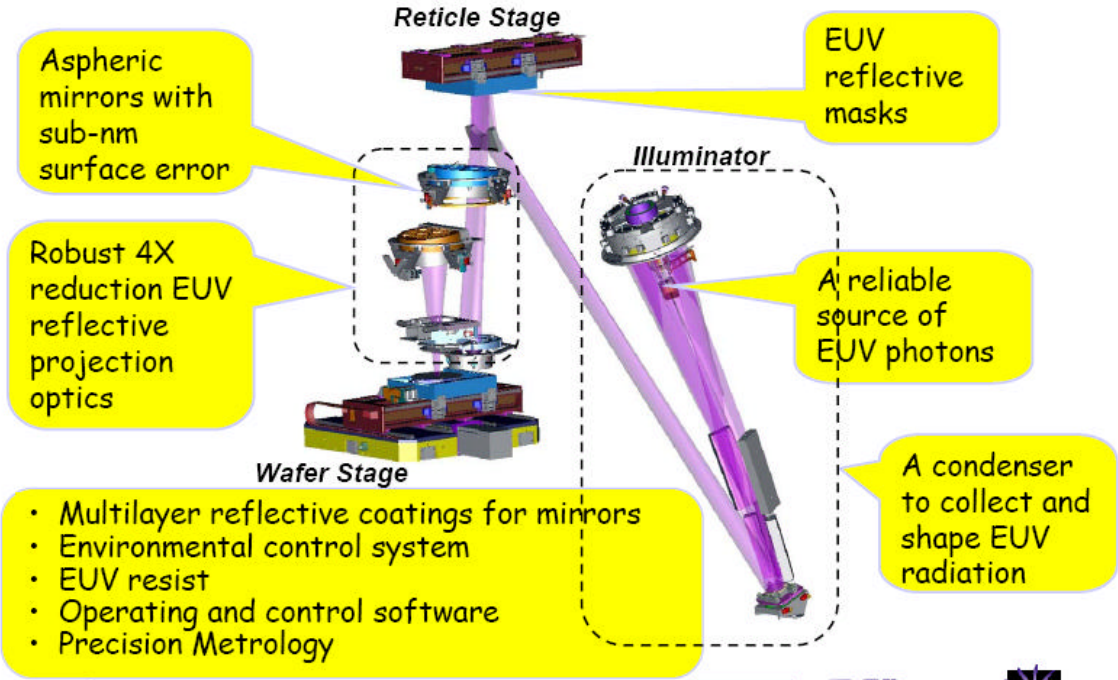
## Technology Roadmaps: Levels at which roadmaps are constructed

<b>Level</b>	<b>Horizon</b>	<b>Roles</b>
<b>Industry</b>	<b>5 generations (~15 years)</b>	<b>Coordinate early technology development to generic or pre-competitive design rules</b>
<b>Inter-firm</b>	<b>2-3 generations (~6-9 years)</b>	<b>Coordinate later phases of technology development to product-specific, proprietary design rules</b>
<b>Intra-firm</b>	<b>2-3 generations (~6-9 years)</b>	

# Technology Roadmaps: Some Background

- November 1992: group of 179 scientists and engineers (including Moore) met in Irving, Texas
- Their task: to prevent further erosion of US pre-eminence in semiconductors
- Such erosion held to be result of a lower rate of investment in semiconductors than other nations
- Result of meeting was first ‘technology roadmap’ for semiconductors published by SEMATECH
- Roadmap set out key engineering and cost attributes expected of semiconductor technologies at five points until 2007

# Schematic of an Extreme-Ultraviolet Lithography System



# Mediating Instruments and Hybrids

- By 'hybrid' is meant: an entity, process or practice composed of two or more elements normally found separate
- Includes organizational arrangements that do not readily fit traditional models of hierarchies or markets
- Includes 'hybrid' calculative practices
- Includes also hybrid expertises

# Mediating Instruments in Health Care: (1)

Kurunmaki (2004):

- Acquisition of management accounting expertise by medical professionals (Finland)
- Overall context: New Public Management reforms
- Accounting changes: devolved budgets, costing and pricing

## Mediating Instruments in Health Care (2)

- “We prepare our own financial reports. The statistics provided by those people (pointing towards the hospital administration) are not sufficient for us.” (Chief Physician)
- “For us it seemed essential to know what our expenditure consisted of, and that was the time when we started doing cost accounting, and we got our costing system ready. After that it was then, of course, very easy to construct the prices as we had the costing system there...” (Chief Physician)
- “There is no alternative, and in the training of doctors we have to begin on a completely different scale, teaching doctors various things (such as accounting), not just medicine.” (Chief Physician)

# Mediating Instruments and Health Care in UK (1)

## Reference Costs and Payment by Results

“a financial system will be needed that:

- Pays NHS Trusts and other providers *fairly* and *transparently* for services delivered, while managing *demand and risk*
- Supports the introduction of *patient choice* by ensuring that diverse providers can be funded according to where patients choose to be treated
- Rewards *efficiency* and *quality* in providing services
- Helps match capacity to demand” (DOH, *Reforming NHS Financial Flows*, Oct 2002, p. 3)

## Mediating Instruments and Health Care in UK (2): Costs of Paramedic Services

Code	Paramedic Services : Category A / Red	No. of Incidents	National Average Unit Cost £
PS01A	01 Abdominal Pain/Problems	1 659	151
PS02A	02 Allergies / Rash / Med. reaction / Stings	7 352	144
PS03A	03 Animal Bites / Attacks	127	135
PS05A	05 Back Pain [non traumatic]	937	163
PS06A	06 Breathing Problems	148 057	147
PS07A	07 Burns / Explosion	3 287	133
PS08A	08 Carbon Monoxide / Inhalation / Hazardous Material	439	125
PS09A	09 Cardiac / Respiratory Arrest	21 805	180
PS10A	10 Chest Pain	199 709	164
PS11A	11 Choking	5 194	131

## Mediating Instruments and Health Care in UK (3): Costs of Audiological Services

<b>Code</b>	<b>Audiological Services : Hearing Aids</b>	<b>No. of Hearing Aids</b>	<b>National Average Unit Cost £</b>
ASHA1	Analogue : Standard Aids	231 400	63
ASHA2	Analogue : Superior Aids (including Directional Control)	38 727	88

<b>Service Code</b>	<b>Audiological Services : Fitting of Hearing Aids and Counselling [including Tinnitus]</b>	<b>No. of Attendances</b>	<b>National Average Unit Cost £</b>
AS1A	Fitting of Hearing Aids and Counselling : Assessments	276 968	50
AS1FA	Fitting of Hearing Aids and Counselling : Fitting	188 739	57
AS1FU	Fitting of Hearing Aids and Counselling : Follow Up	206 332	36
AS2	Counselling and Issue of Aids for Tinnitus	36 811	73