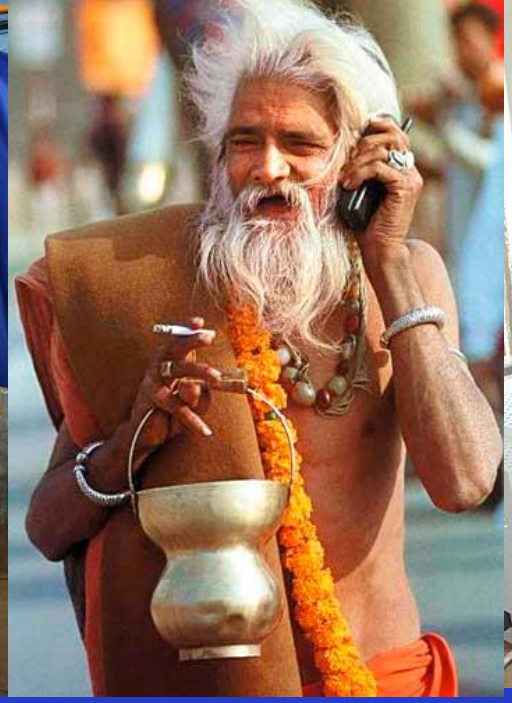

The manifold definitions of the digital divide and their diverse implications for policy responsibility

38th Research Conference on Communication, Information, and Internet Policy
GMU, Arlington, Virginia, October 2, 2010

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USC UNIVERSITY OF SOUTHERN CALIFORNIA

NACIONES UNIDAS
CEPAL ECLAC

Overview

I. Theoretical background: Diffusion of Innovations

II. Four Perspectives on the digital divide

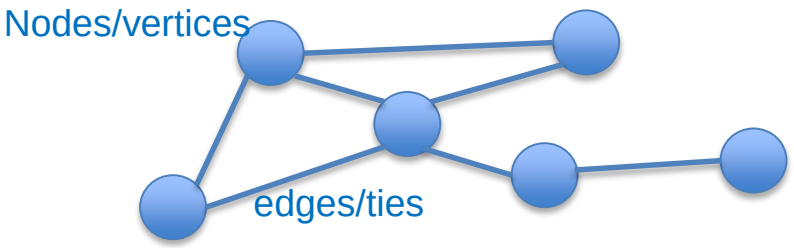
- Type of technology
- Level of analysis
- Attributes of nodes and ties
- Level of digital sophistication

III. Policy responsibility: so who's in charge?

- Budgetary consequences: the case of Chile

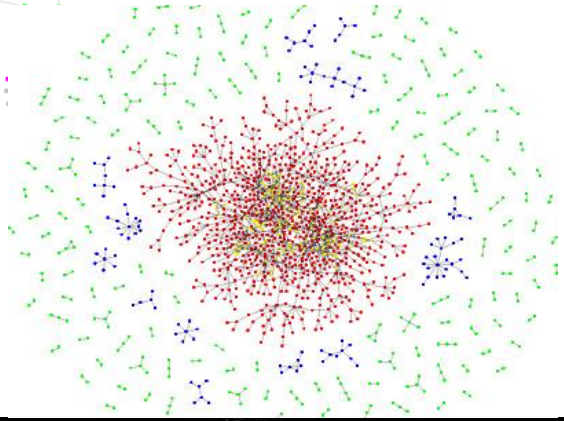
Social Networks:

the channels through which innovations (and other diseases) spread

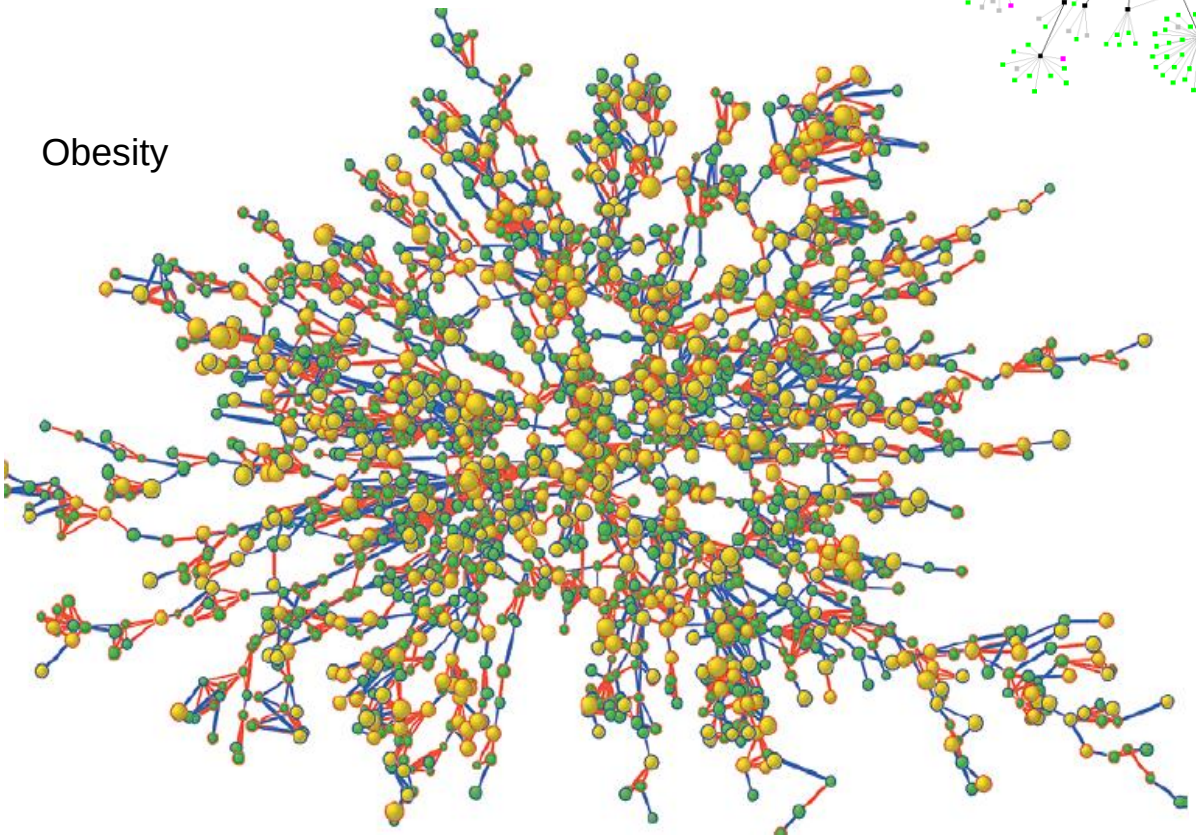


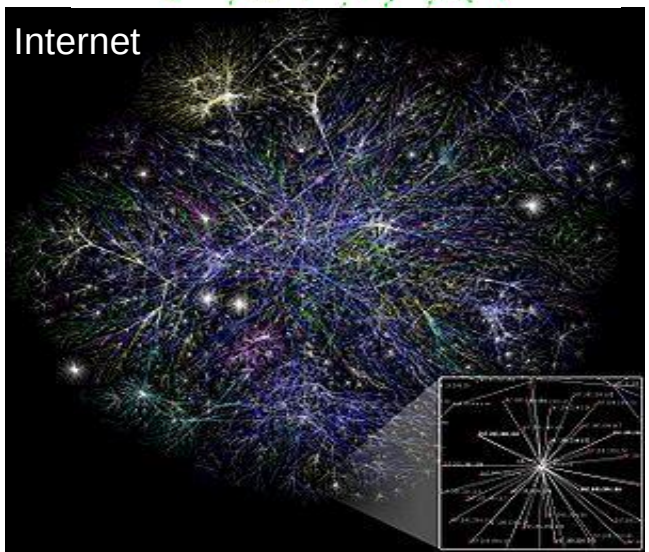
Disease

Online community



Obesity



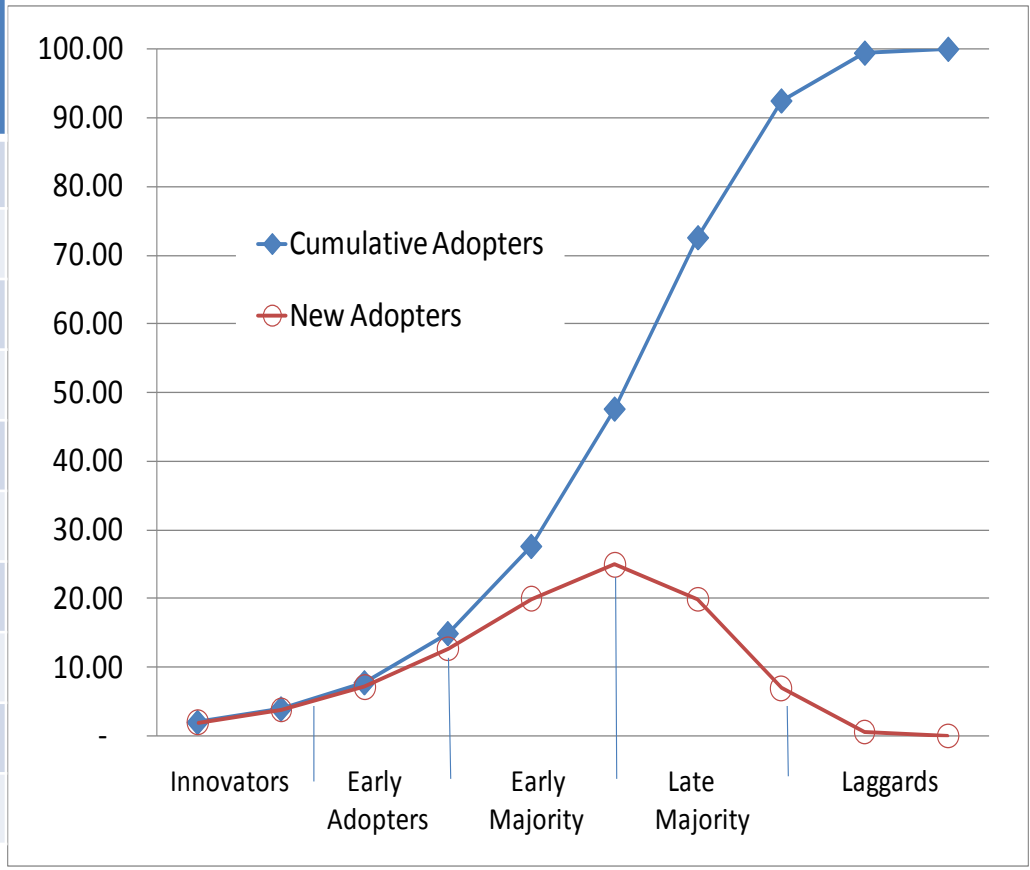


Source: Christakis and Fowler, 2007; Krebs, 2003; 2005

Idealized diffusion of innovation through Social Networks:

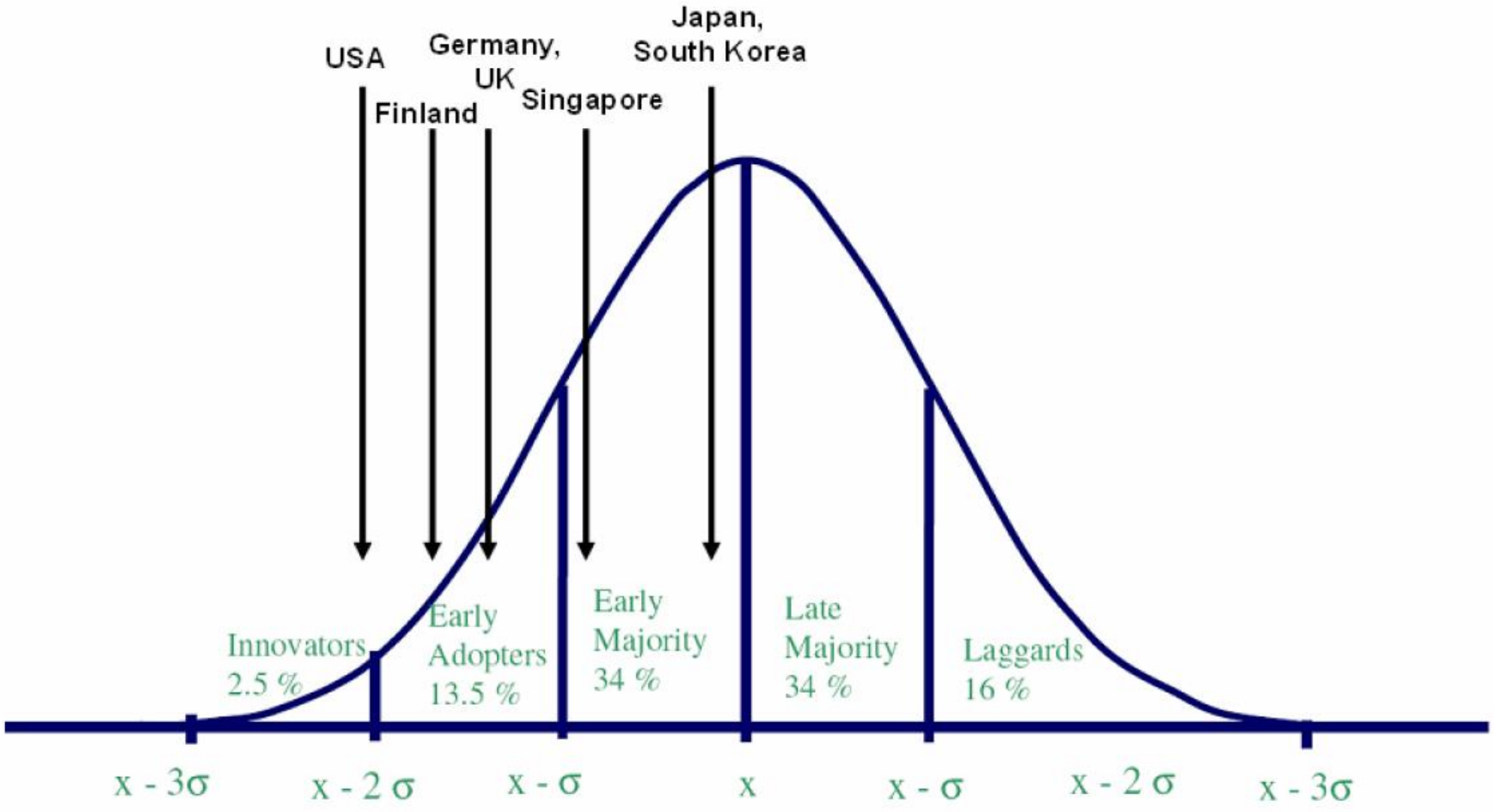
Network of 100 nodes with 2 innovators

	Cumulative Adopters		Rate of adoption		Non-adopters		New Adopters
	2.00	x	0.01	x	98.00	=	1.96
=>	3.96	x	0.01	x	96.04	=	3.80
=>	7.76	x	0.01	x	92.24	=	7.16
=>	14.92	x	0.01	x	85.08	=	12.70
=>	27.62	x	0.01	x	72.38	=	19.99
=>	47.61	x	0.01	x	52.39	=	**24.94**
=>	72.55	x	0.01	x	27.45	=	19.91
=>	92.47	x	0.01	x	7.53	=	6.97
=>	99.43	x	0.01	x	0.57	=	0.56
=>	100.00	x	0.01	x	0.00	=	0.00



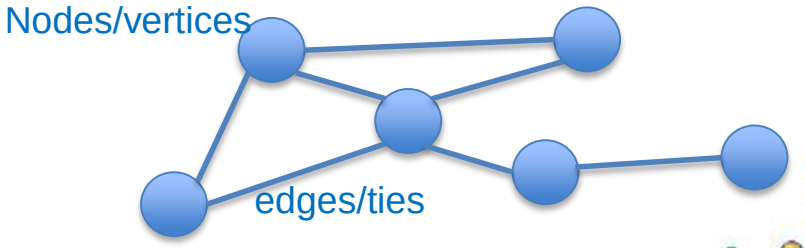
Source: based on Rogers, 2003 and Valente, 2010

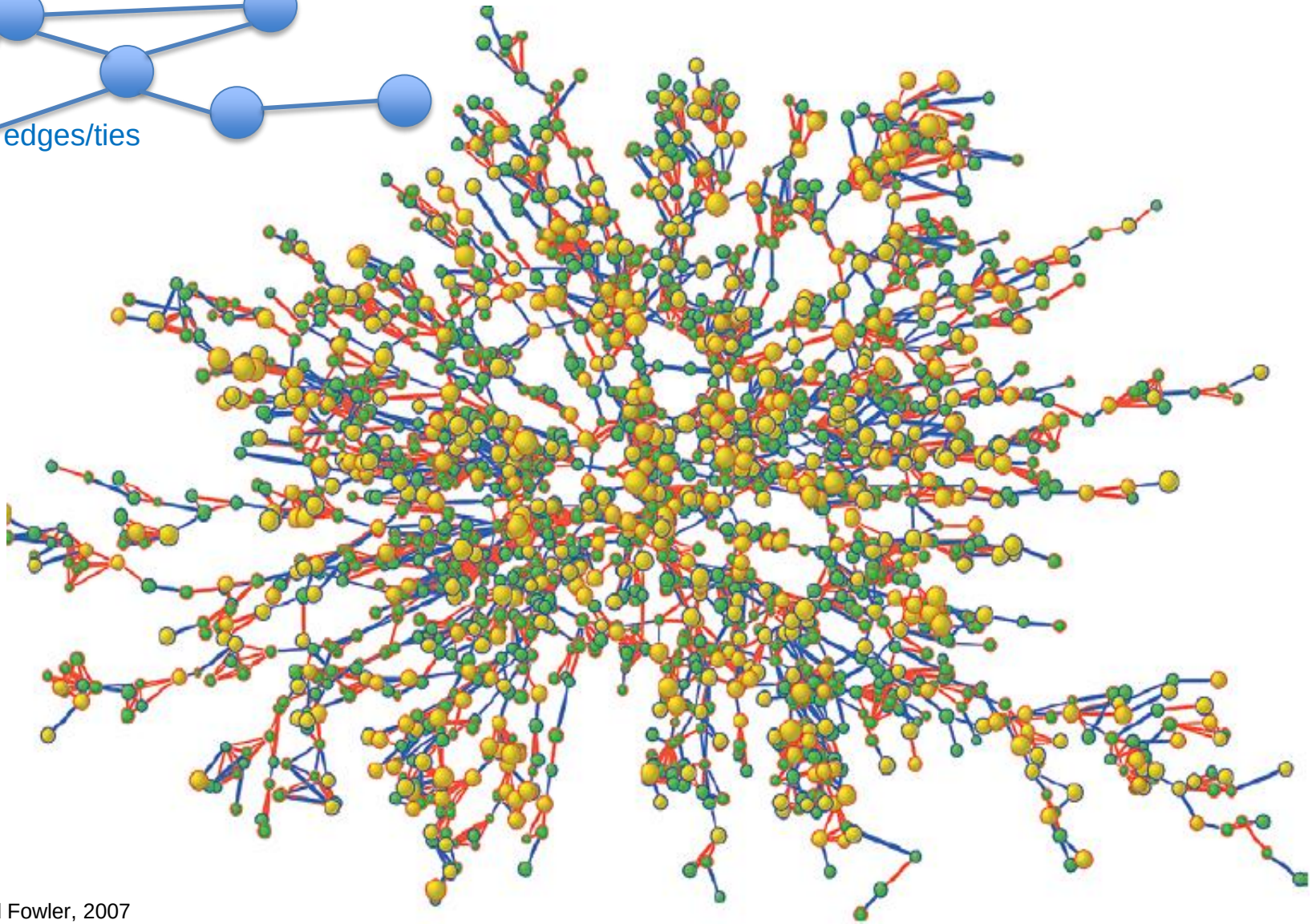
The case Internet-capable phones



Source: Adapted from Verkasalo (2007), based on Ali-Vehmas (2005) and Rogers (1962)

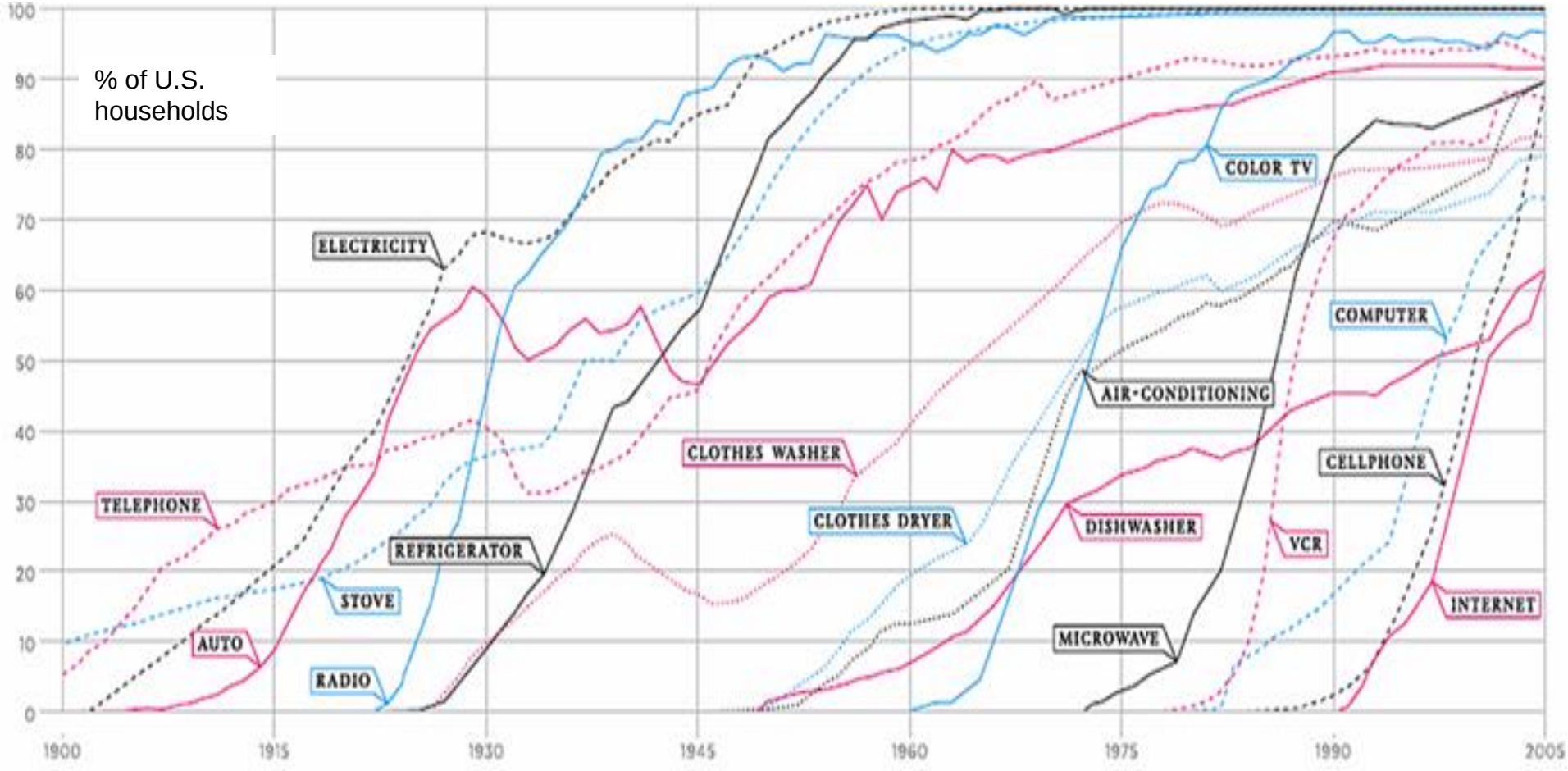
In reality: structure of network influences diffusion process





Source: Christakis and Fowler, 2007

Increased social connectedness contributes to increased speed of diffusion



1900 1915 1930 1945 1960 1975 1990 2005

BUT: never immediate and constantly opens up again with every new innovation!

Different ways to analyze the digital divide

- Type of technology:
  - Fixed/mobile phones, computers, Internet, broadband, d-TV, etc
- Level of analysis:
  - Individuals vs. organizations/communities vs. societies/countries
- Attributes of nodes:
  - Individuals: income, education, geography, age, gender, etc
  - Organizations/communities: type of ownership, size, profitability, sector, geography, maturity, culture, etc
  - Societies/countries/regions: level of development, income, size, geography, ethnicity, etc
- Level of digital sophistication:
  - Access
  - Usage
  - Impact: cultural transformation/ modernization

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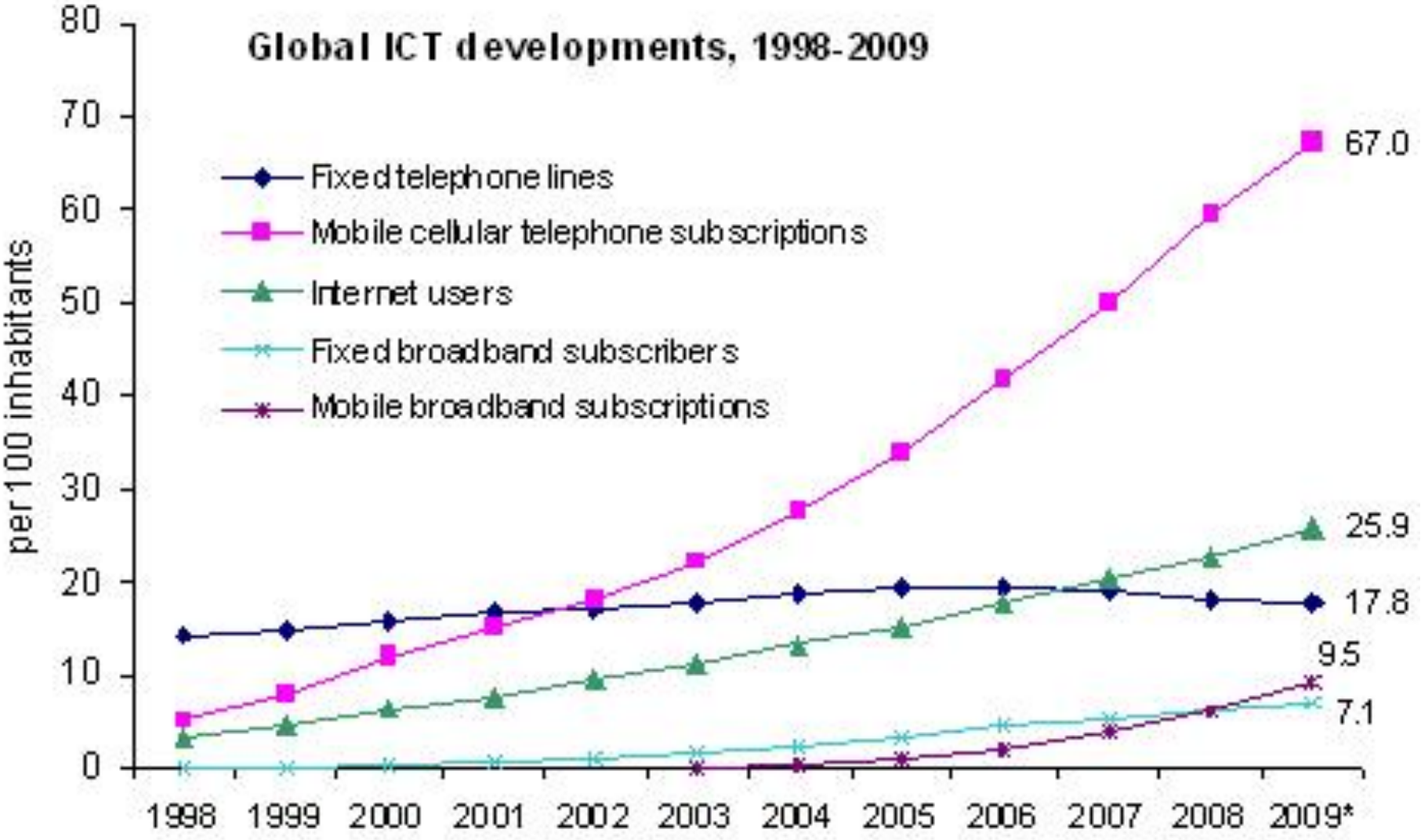
Types of technologies: focus on the “C”



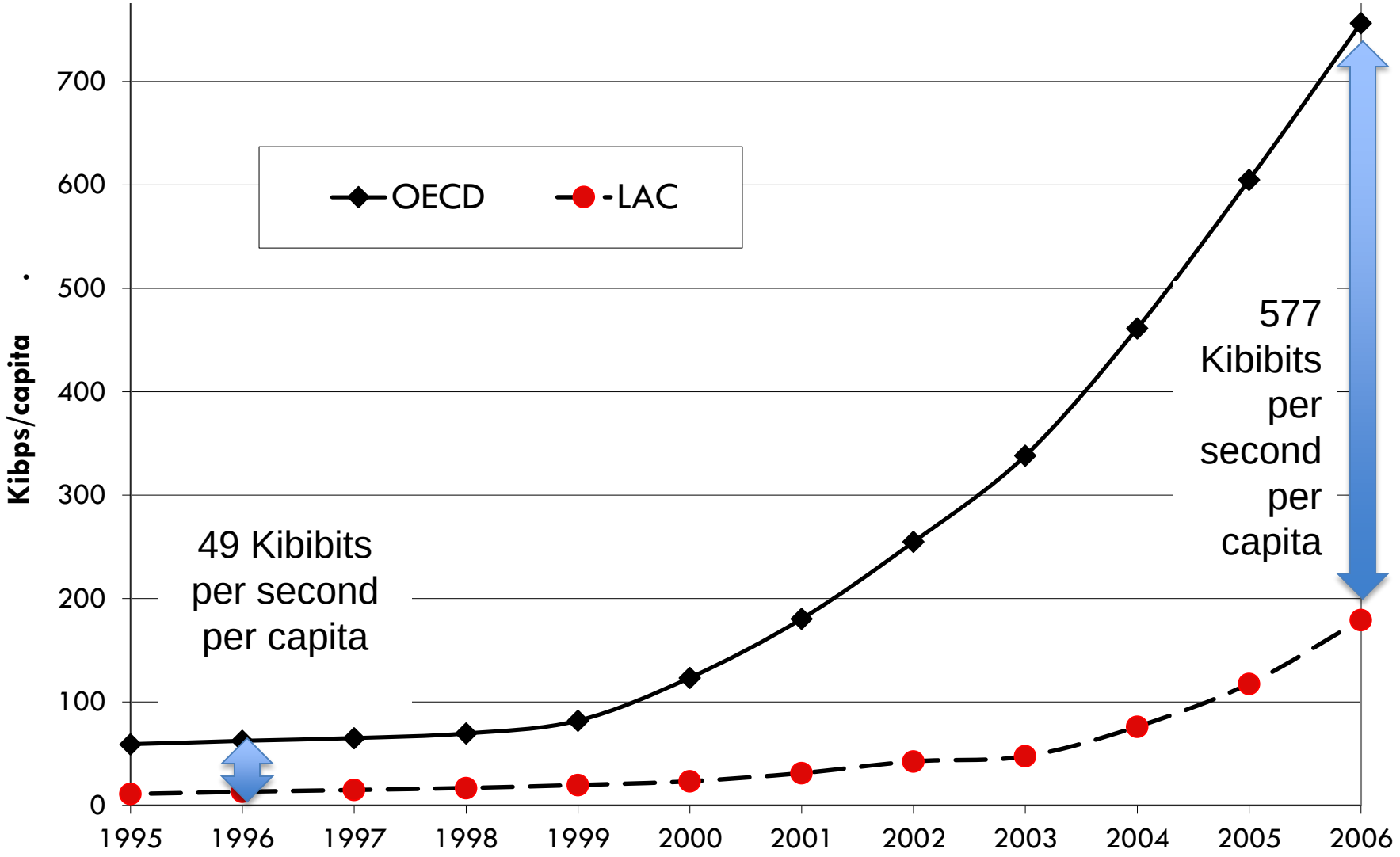
Source: ITU: http://www.itu.int/ITU-D/ict/statistics/

Types of technologies: composite indices

1. Composite index of technological capabilities (ArCo)
2. Digital Access Index (DAI)
3. Digital Opportunity Index (DOI)
4. Economist Intelligence Unit (EIU) e-readiness
5. Index of Knowledge Societies (IKS)
6. Knowledge Economy Index (KEI)
7. Network Readiness Index (NRI)
8. Technology Achievement Index (TAI)
9. UNCTAD Index of ICT Diffusion
10. UN PAN E-Readiness Index
11. World Bank ICT Index.
12. Orbicom Digital Divide Index
13. **ITU's ICT Development Index (IDI)**

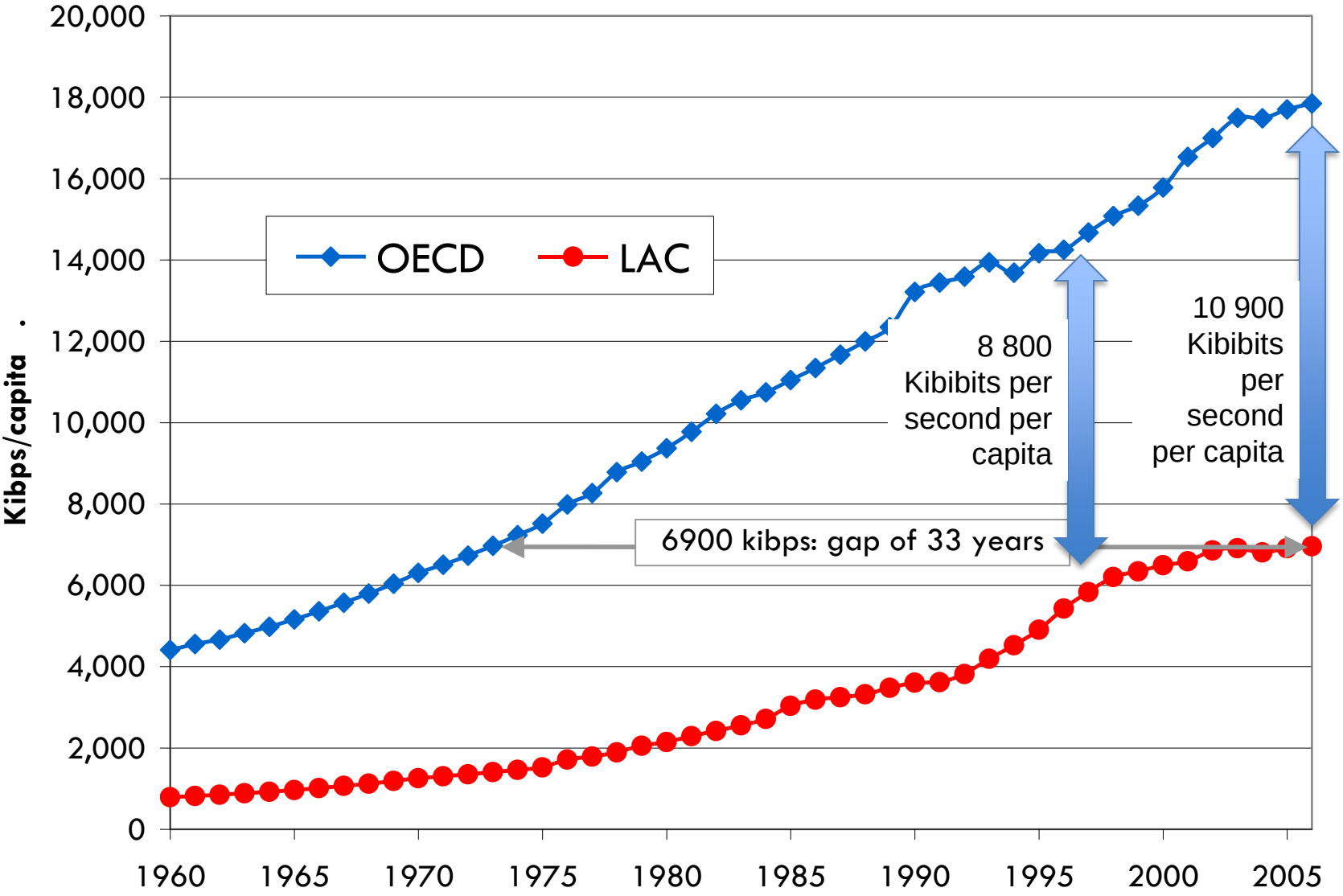
Source: Minges, 2005, ECLAC United Nations, http://www.eclac.org/SocInfo/

Another look at combining different ICT: measuring ALL KINDS OF COMMUNICATION through fixed line, mobile telephony and Internet



Source: M. Hilbert, P. López y C. Vázquez, "Information Societies or "ICT equipment societies"? Measuring the digital information processing capacity of a society in bits and bytes ", The Information Society Journal, 2010

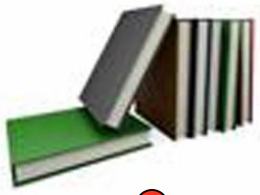
Another look at combining different ICT: measuring ALL KINDS OF BROADCASTING through radio and TV (terrestrial, satellite, cable)



Source: M. Hilbert, P. López y C. Vázquez, "Information Societies or "ICT equipment societies"? Measuring the digital information processing capacity of a society in bits and bytes ", The Information Society Journal, 2010

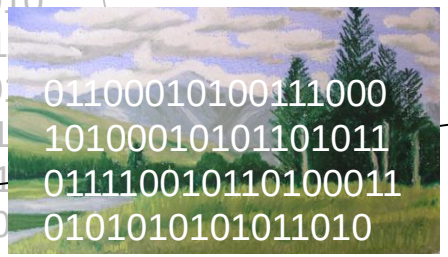
Types of technologies

Three kinds of "ICT"

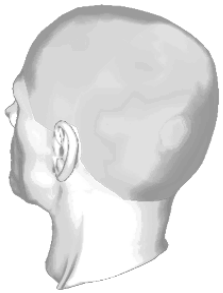


Storage

Transmission



Capture & interoperation



Biologic processing

Computation

interface

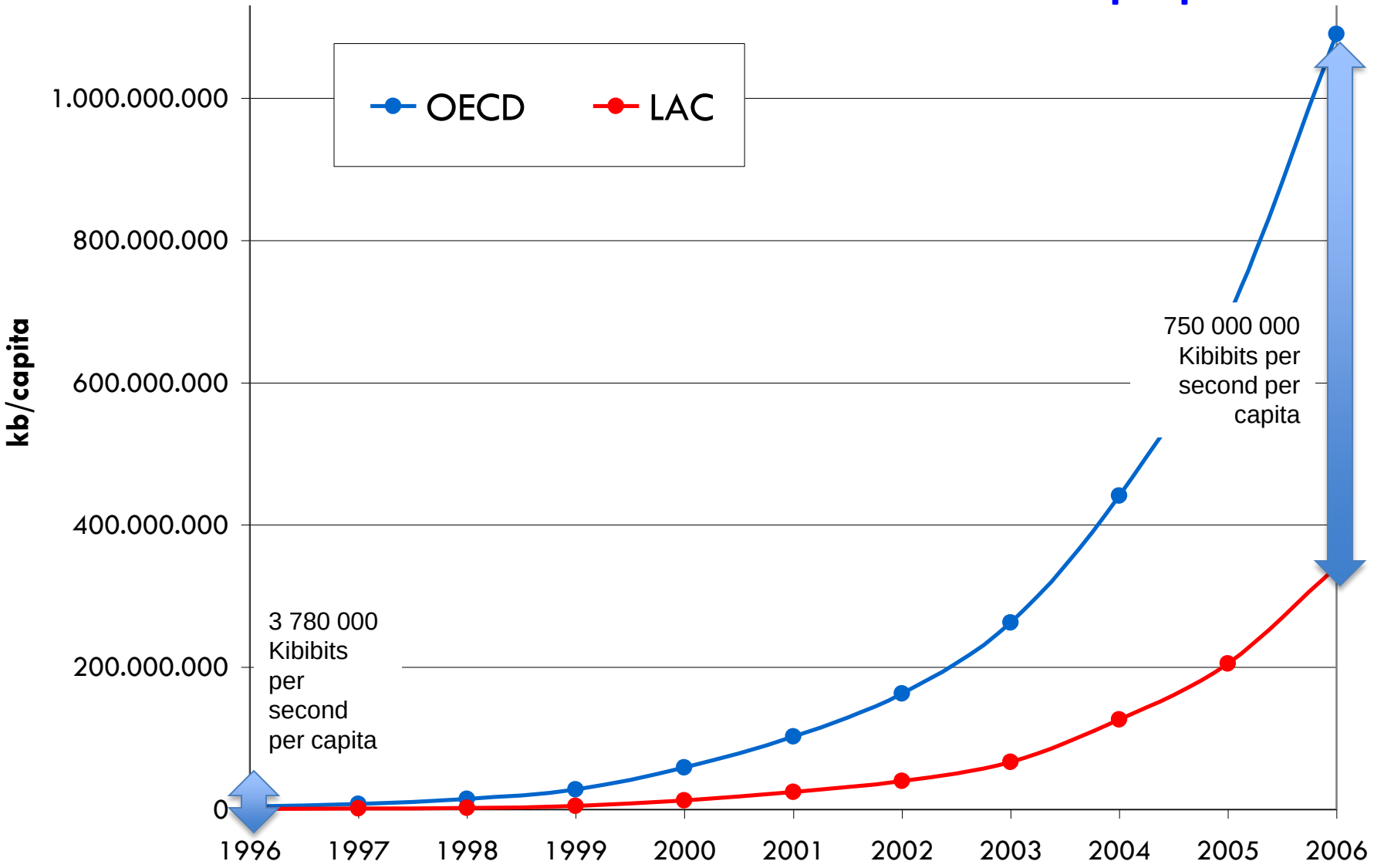
interface

interface

interface

Source: Hilbert, 2007.

Another look at combining different ICT: measuring ALL KINDS OF STORAGE in hard disks of PCs and laptops



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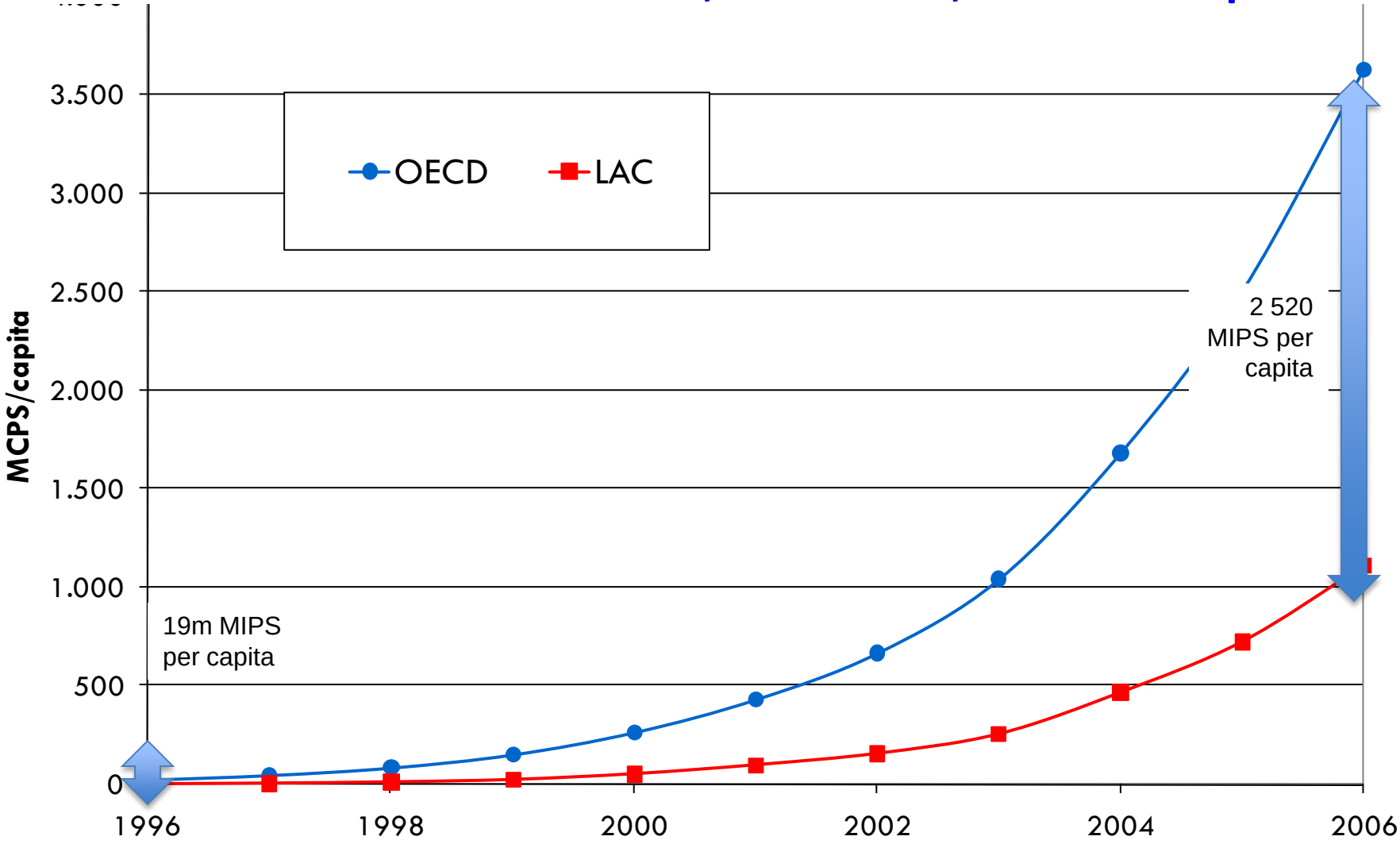
Another look at combining different ICT: measuring ALL KINDS OF COMPUTATION with PCs, notebooks, and mobile phones



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The red queen effect: the technological frontier is a moving target

- “Well, in our country," said Alice, still panting a little, "you'd generally get to somewhere else — if you run very fast for a long time, as we've been doing."

- "A slow sort of country!" said the Queen. "Now, here, you see, it takes all the running you can do, to keep in the same place. If you want to get somewhere else, you must run at least twice as fast as that!"

Carroll, Lewis . Through the Looking-Glass and What Alice Found There

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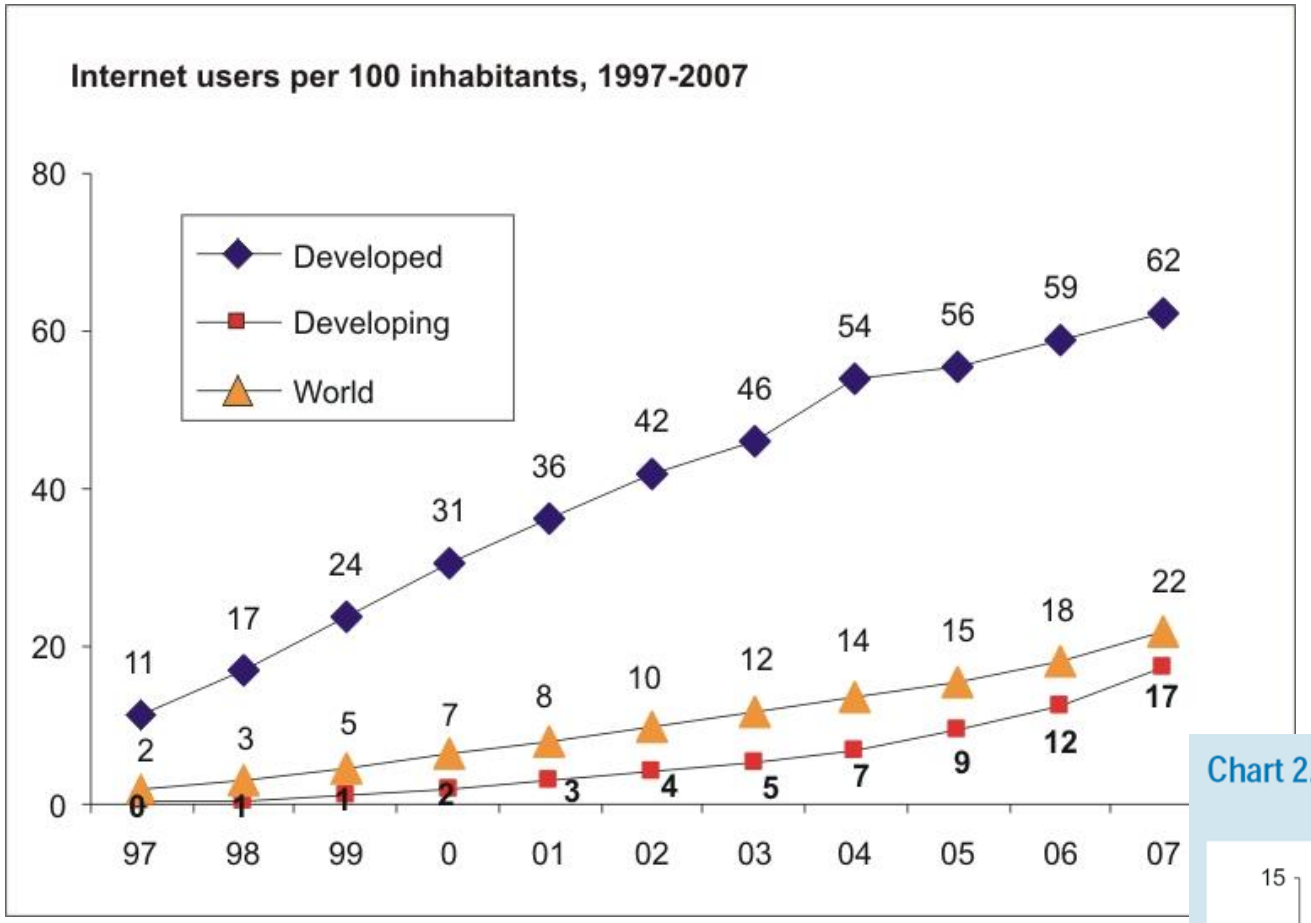
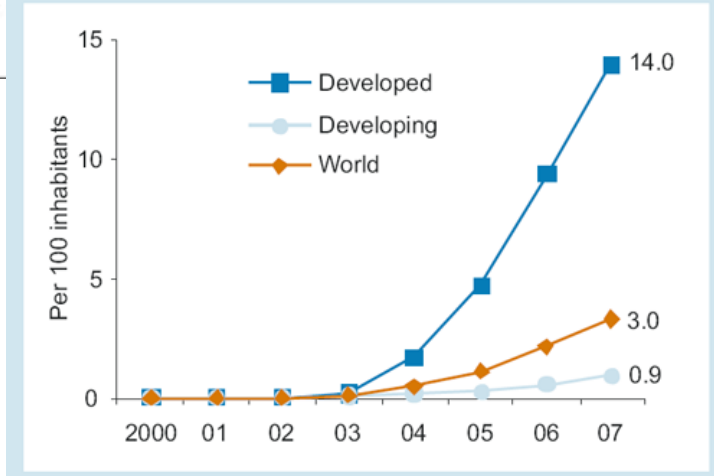
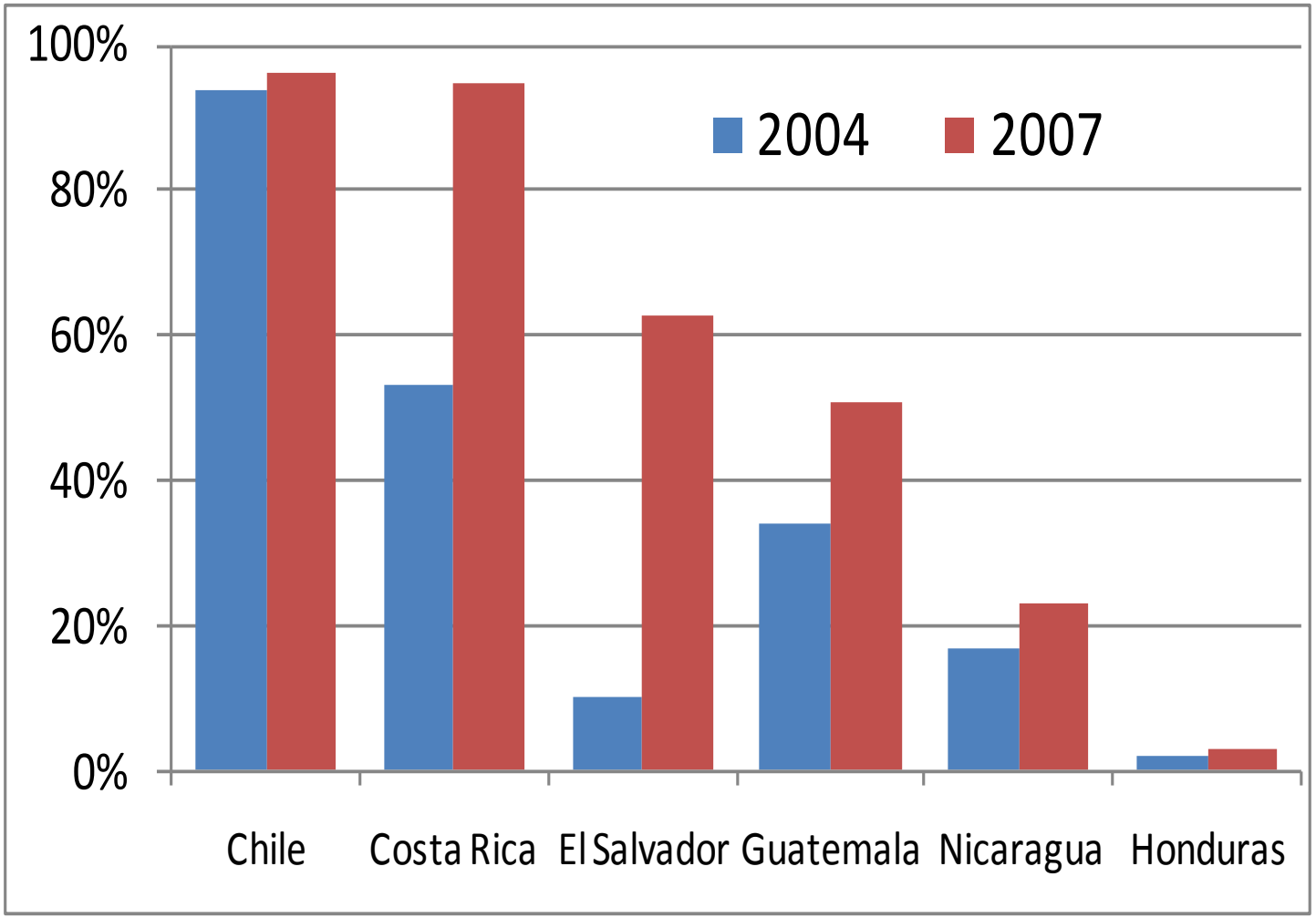
Level of analysis: international groupings



Source: ITU: http://www.itu.int/ITU-D/ict/statistics/

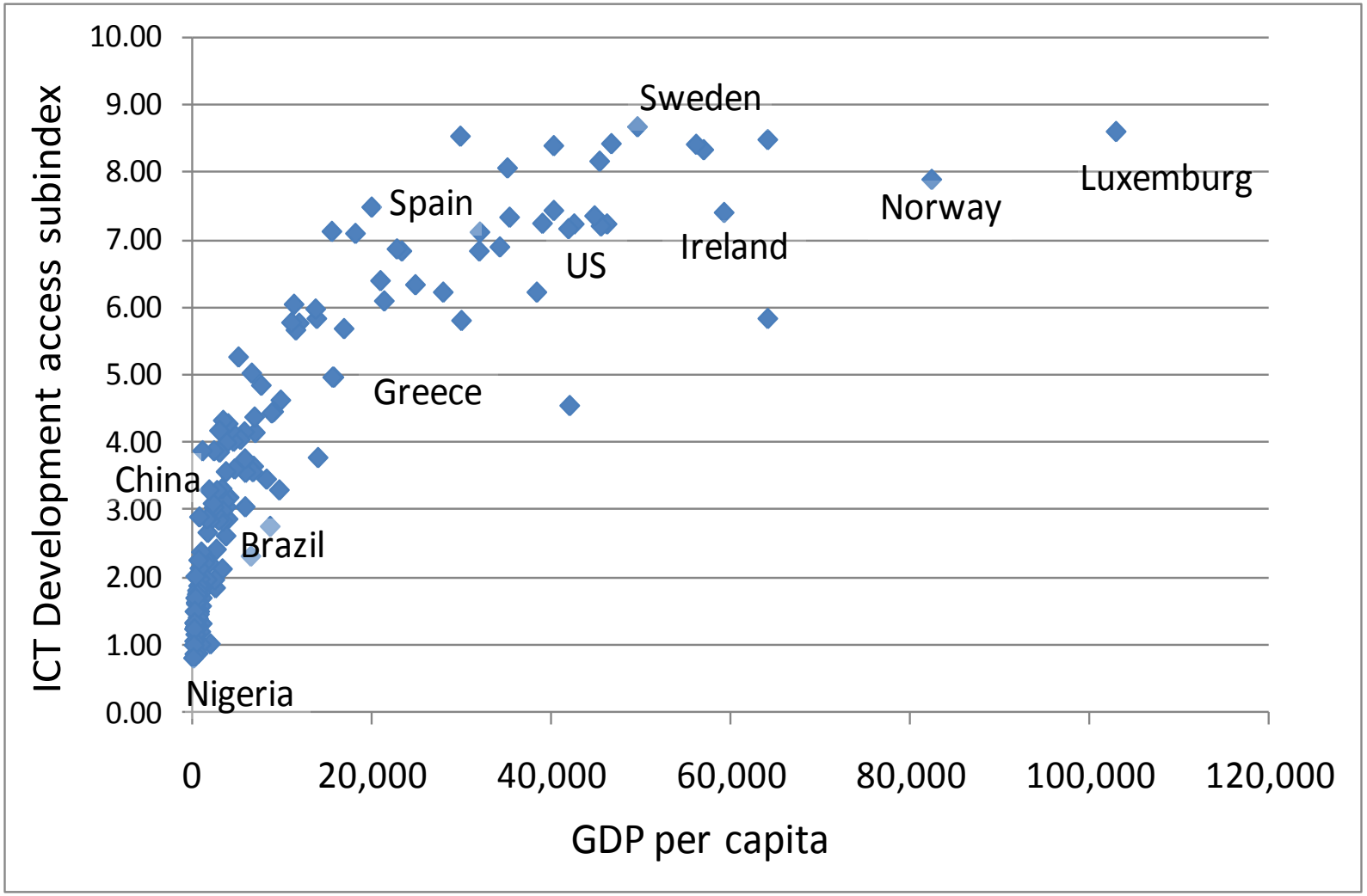


Level of analysis: Email at local governments



Source: OSILAC, 2007

Level of analysis: countries



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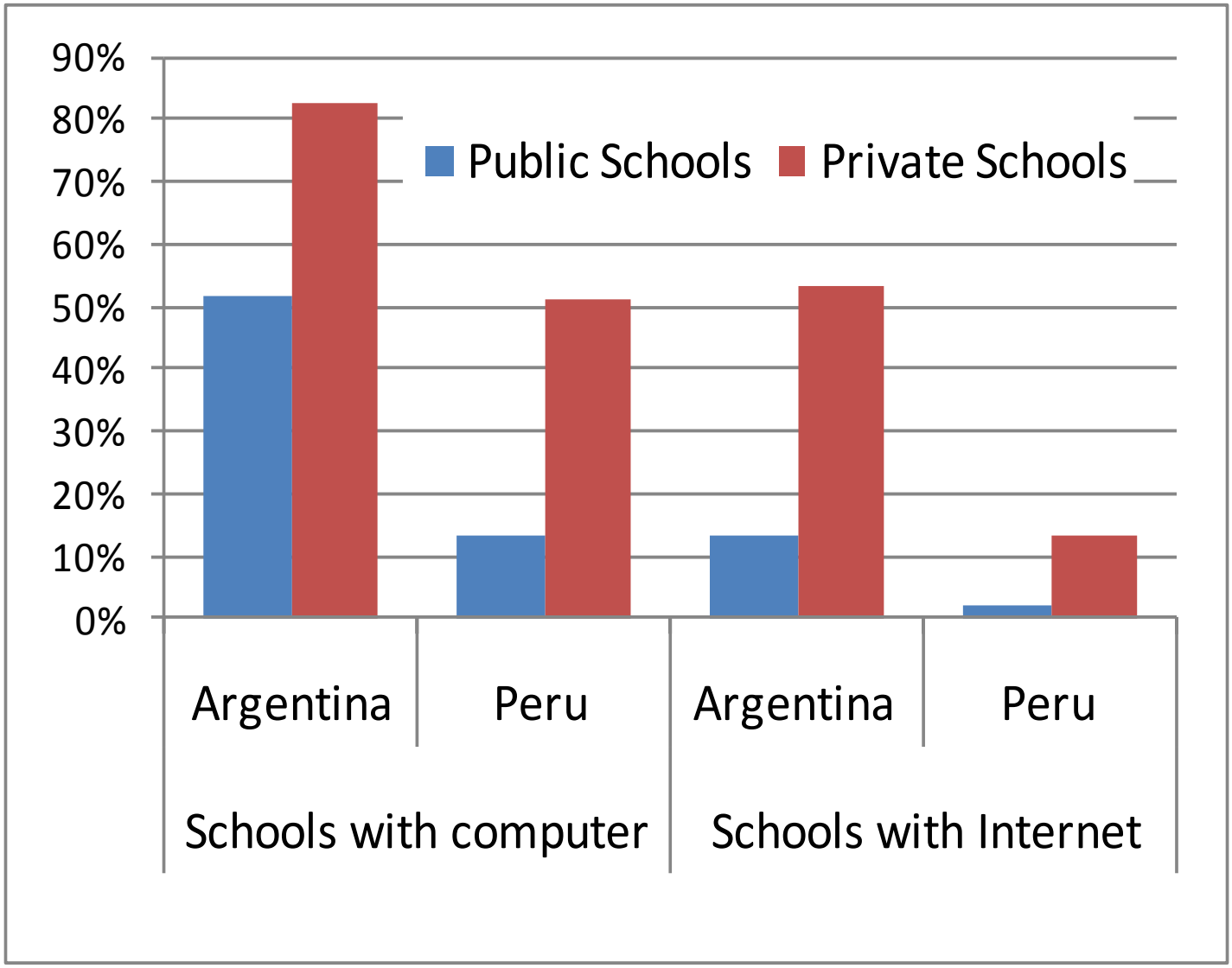
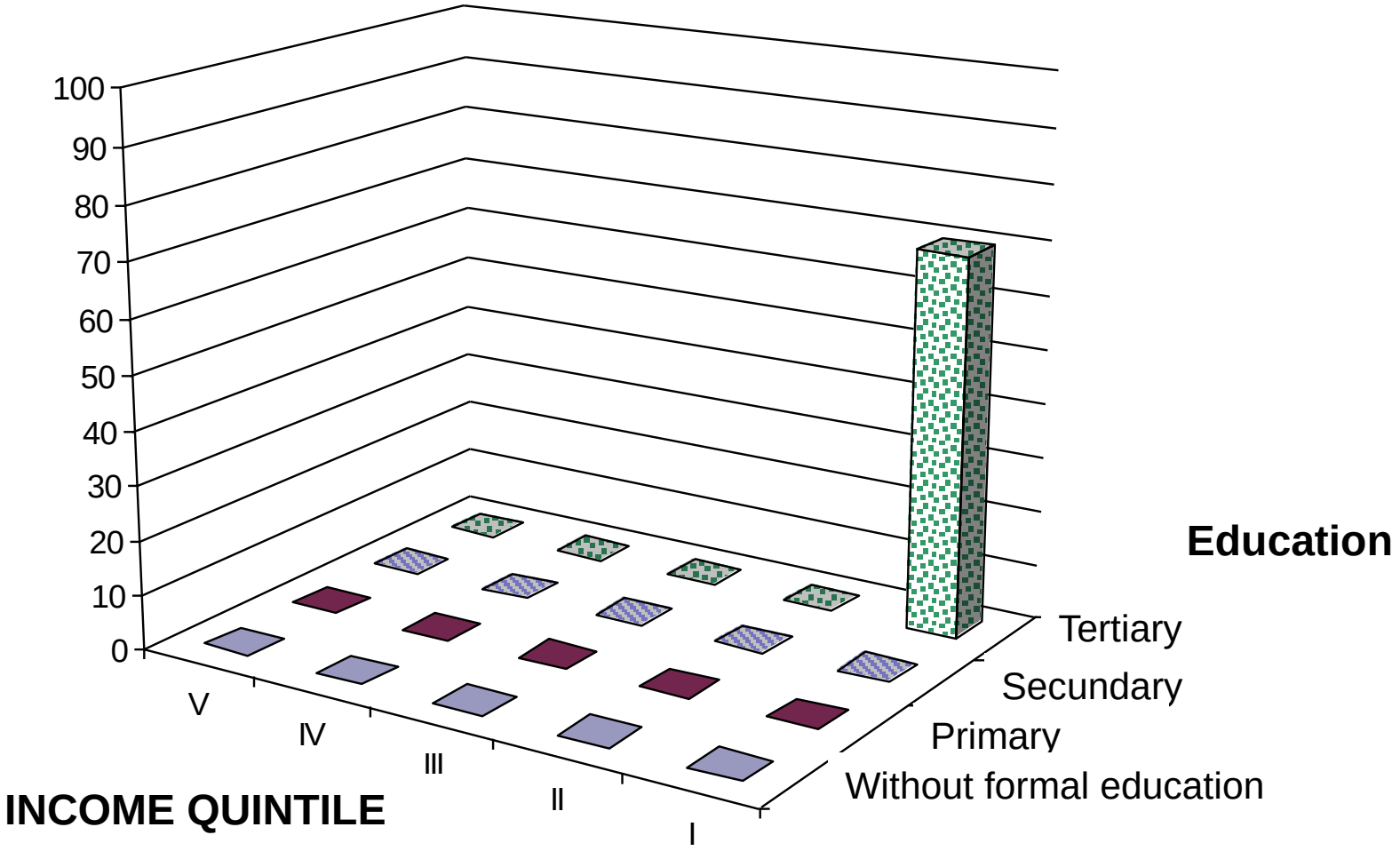
Attributes of nodes: schools of public and private character



Source: ITU: http://www.itu.int/ITU-D/ict/statistics/

Attributes of the network nodes: Independent effects

Mobile penetration in Brazil



Fuente: OSILAC, CEPAL, 2008.

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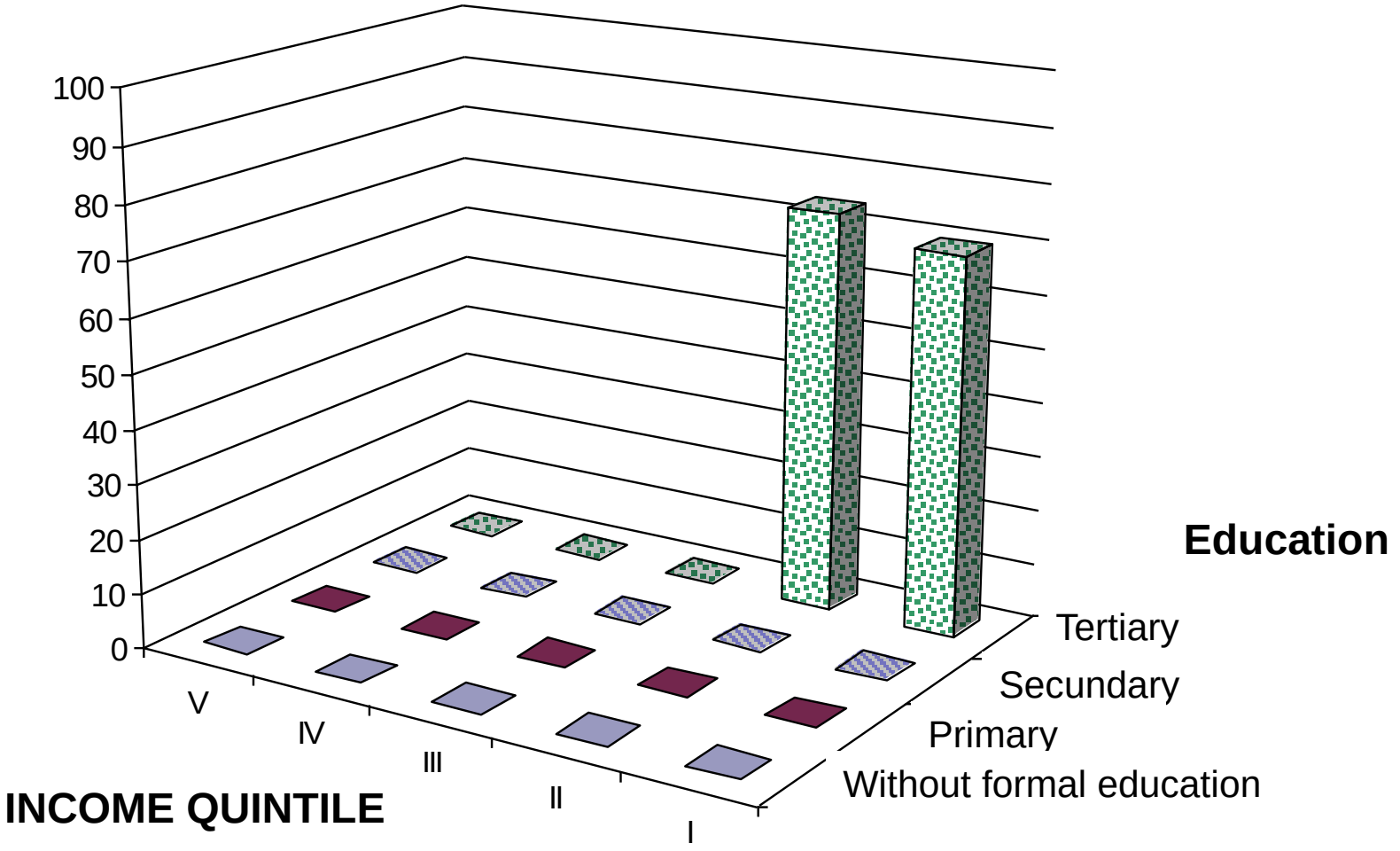

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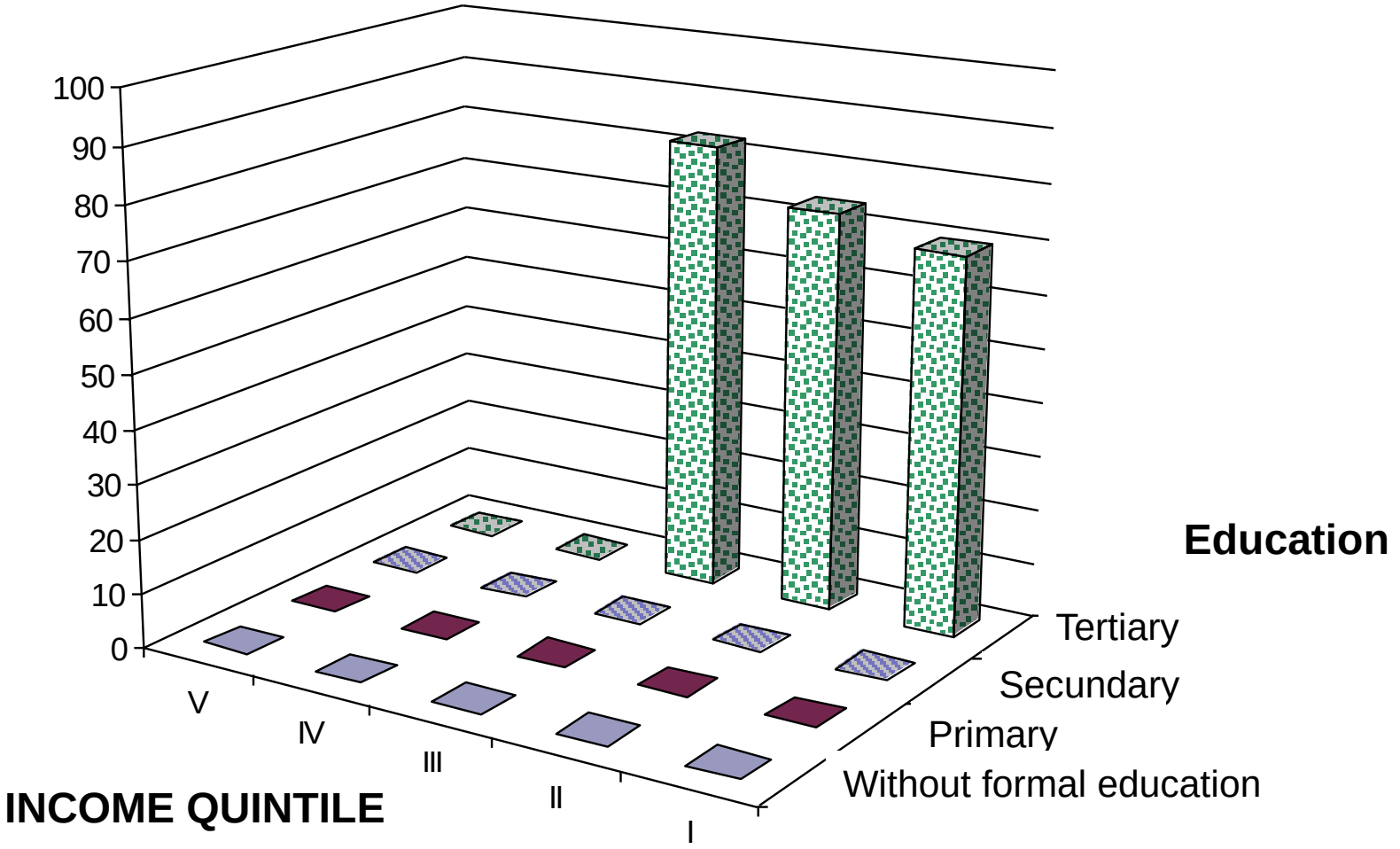

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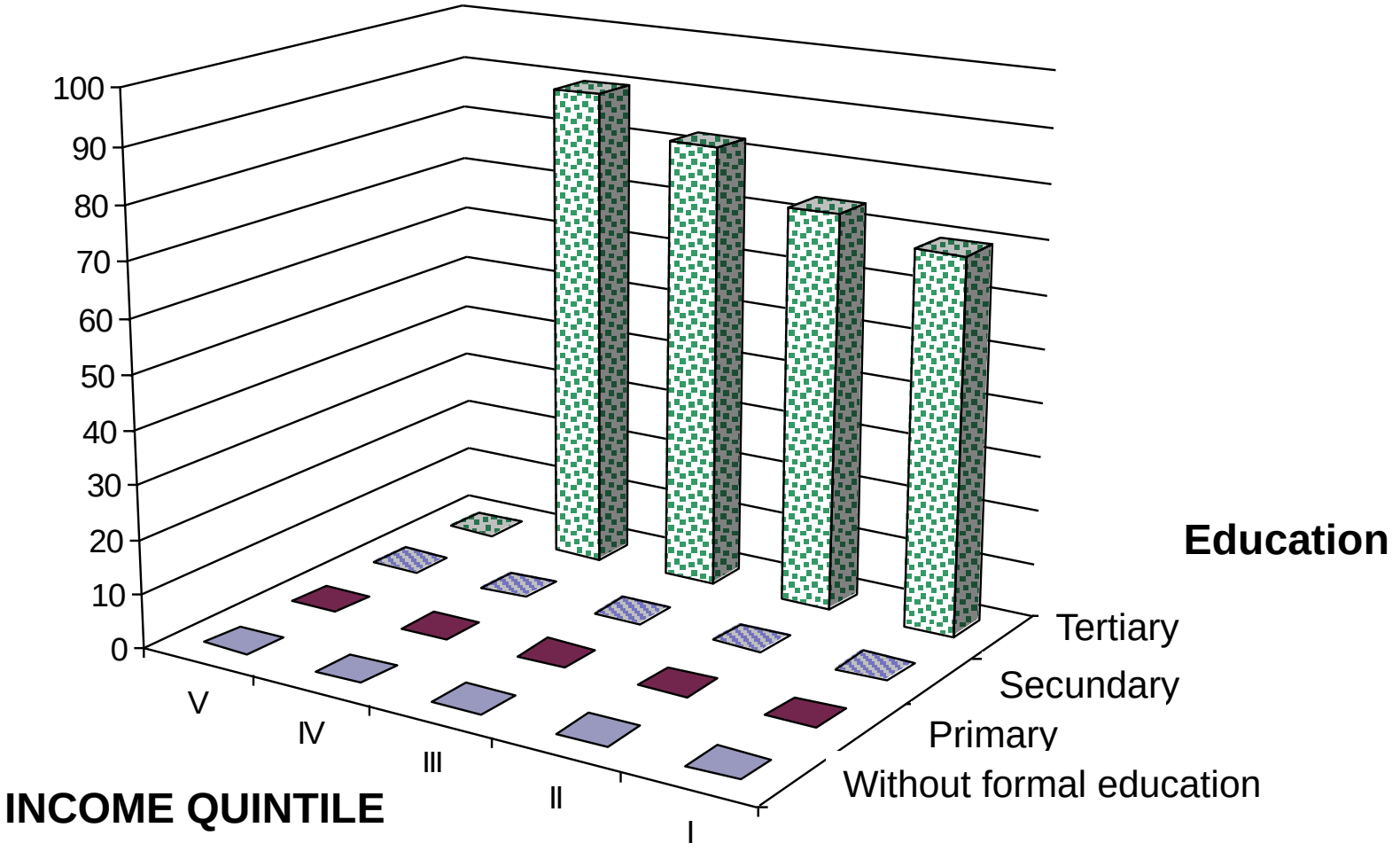

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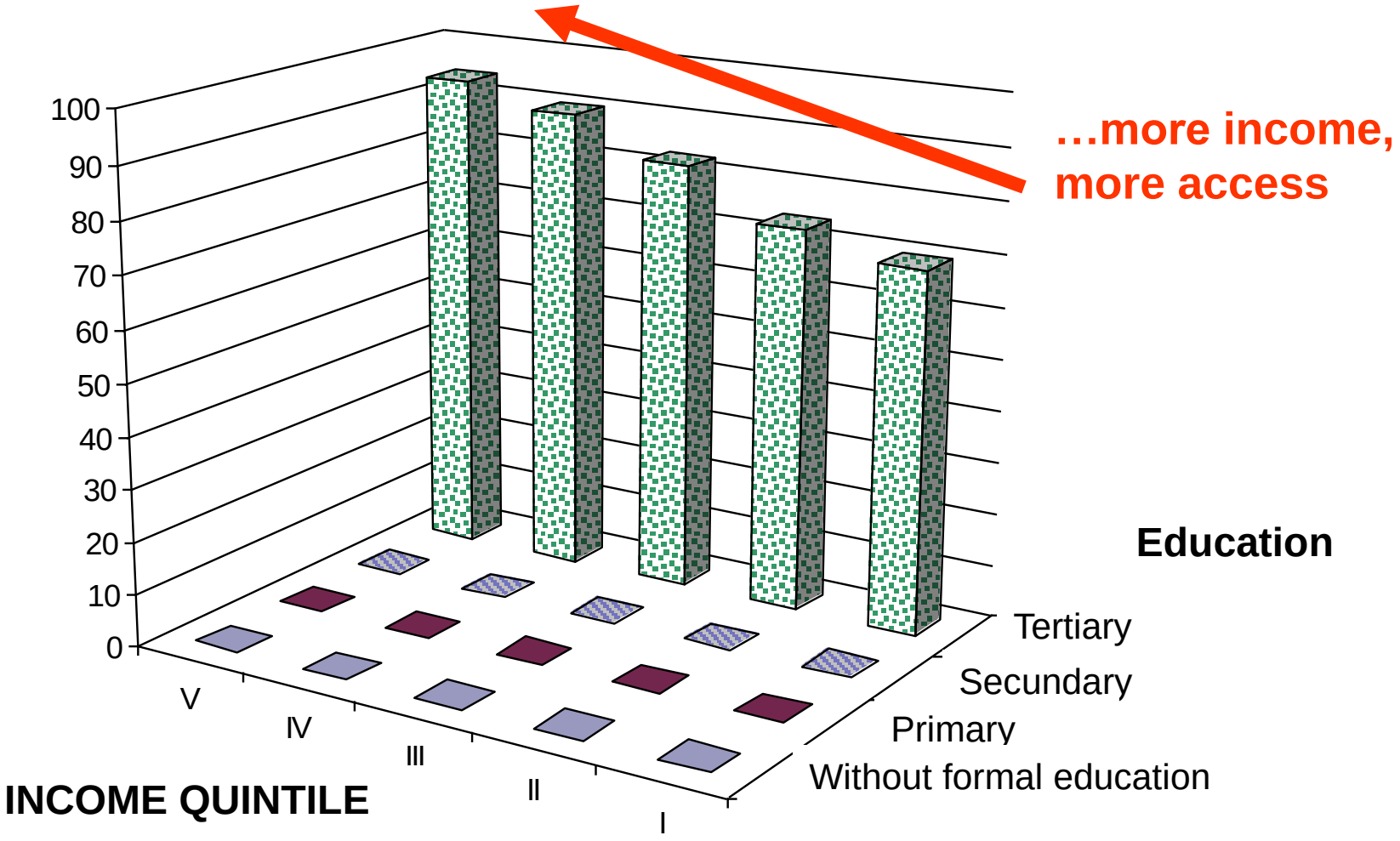

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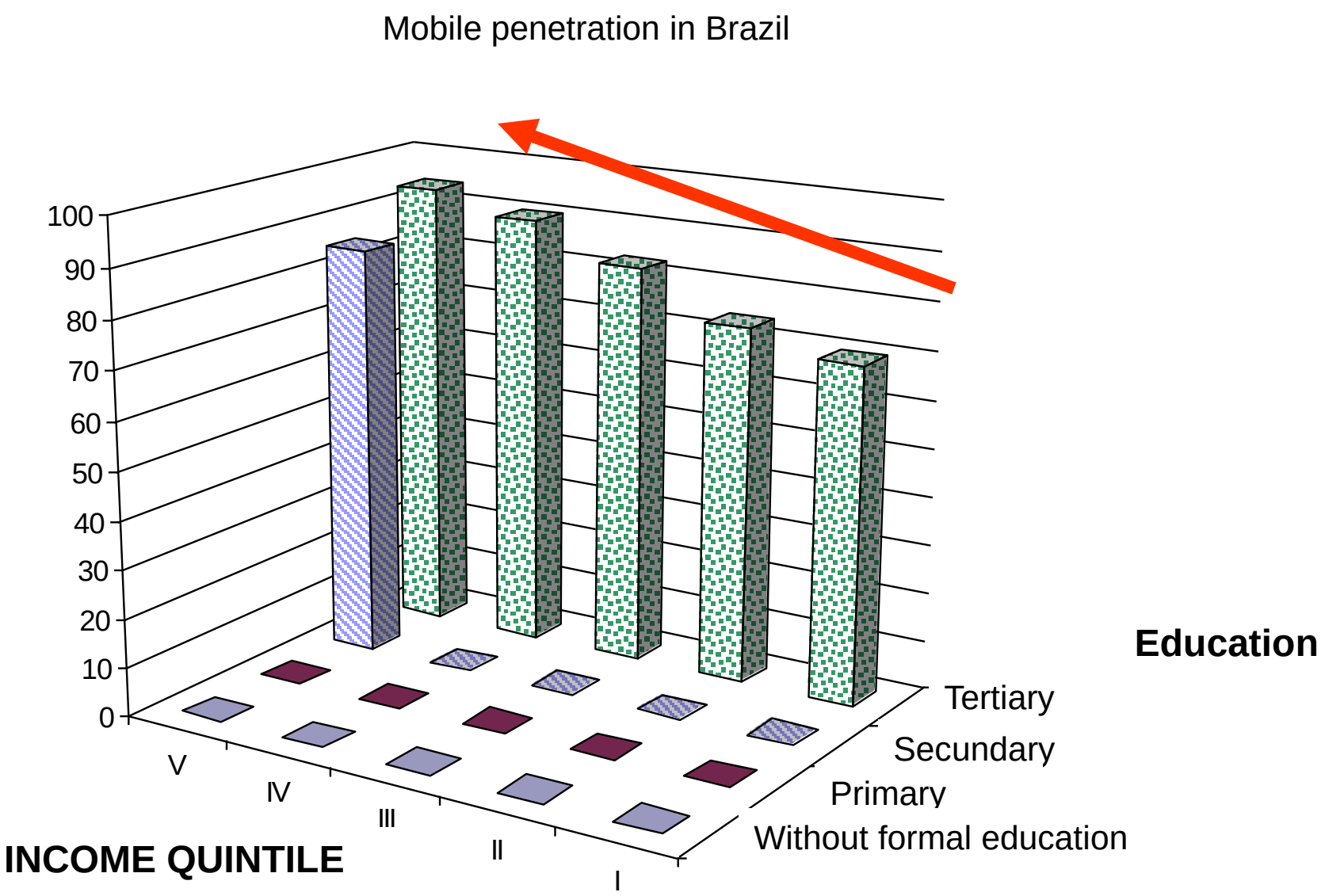

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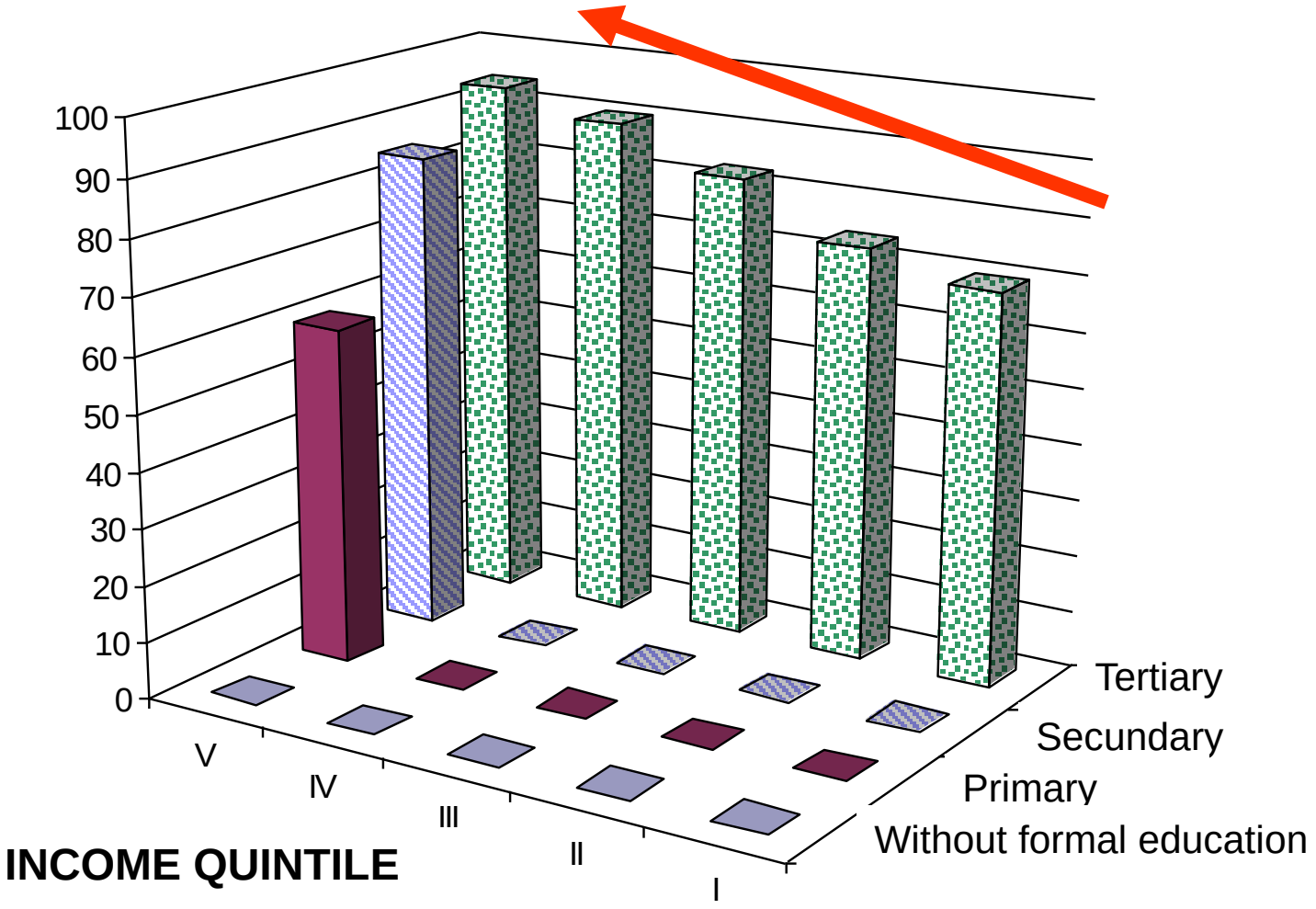

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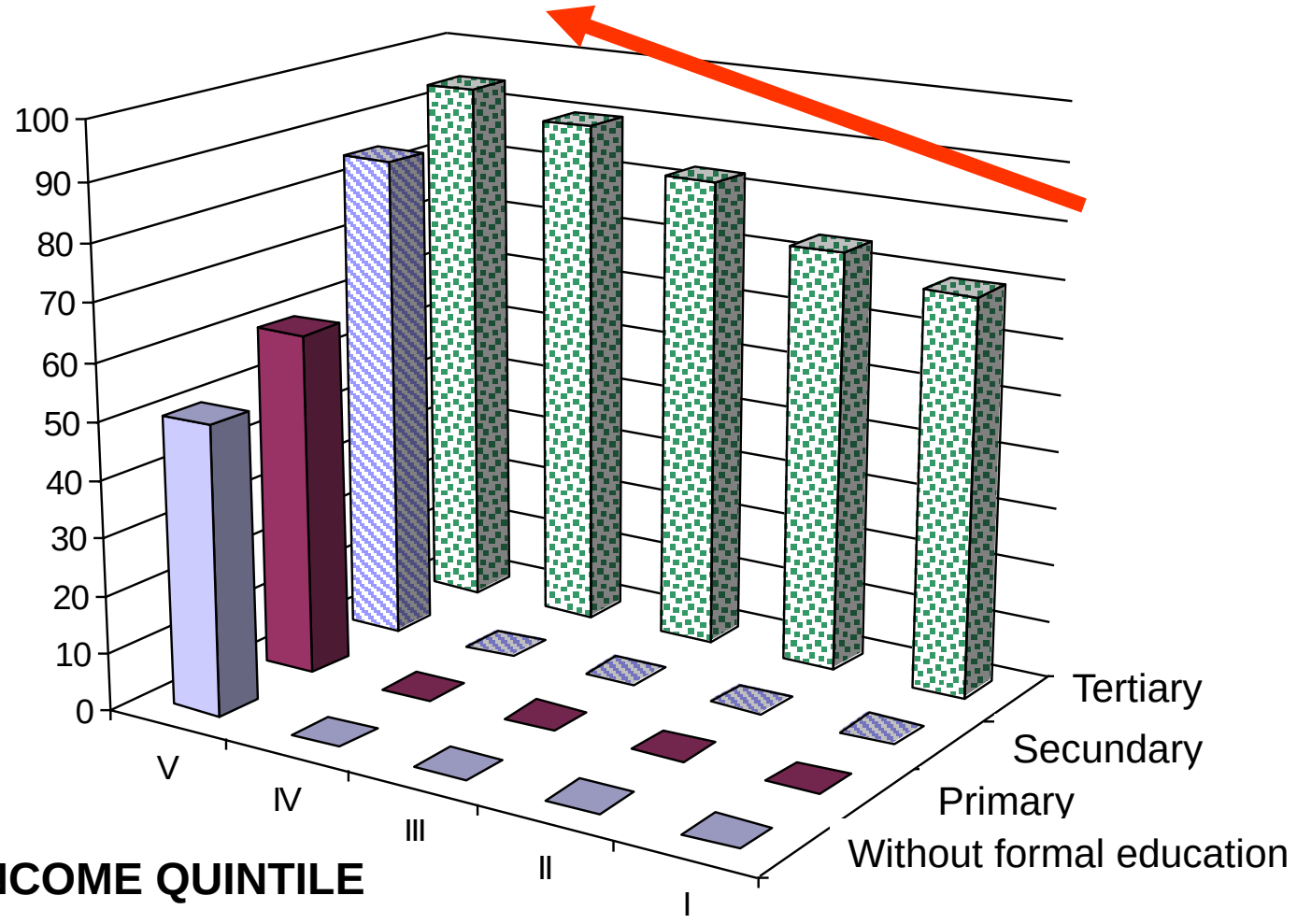

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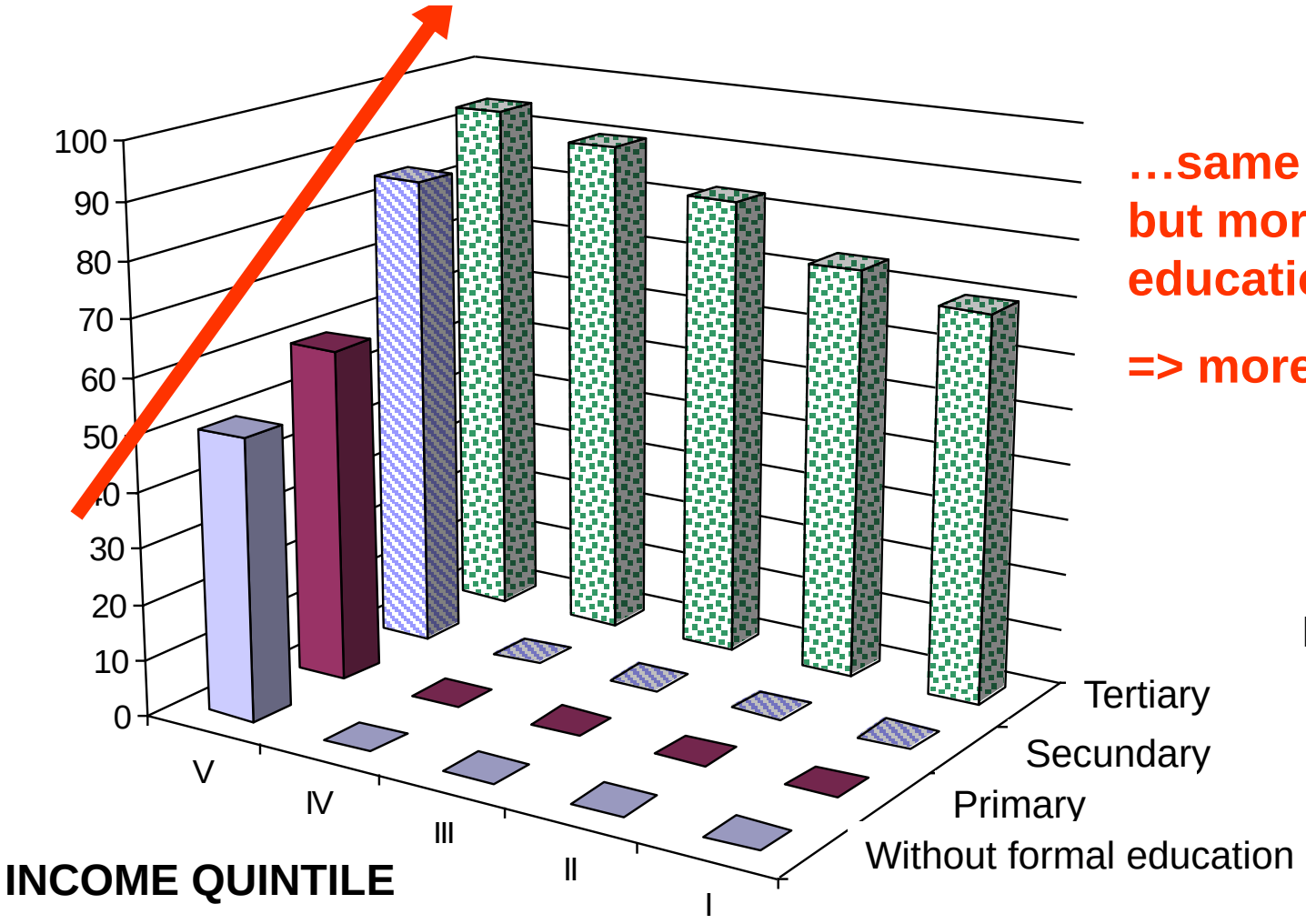


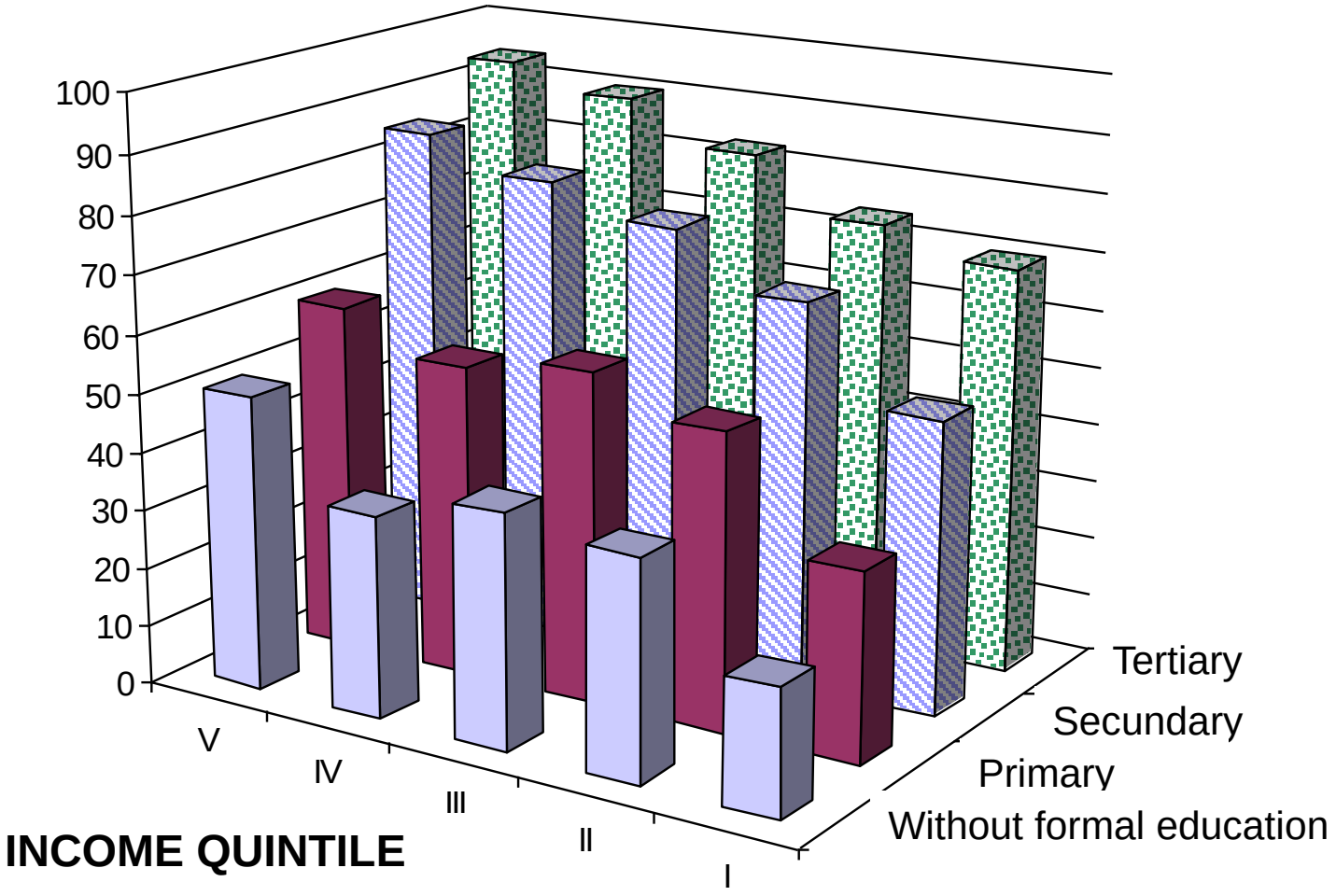
…same income, but more education

=> more access

Source: OSILAC, CEPAL, 2008.

Attributes of the network nodes: Independent effects

Mobile penetration in Brazil



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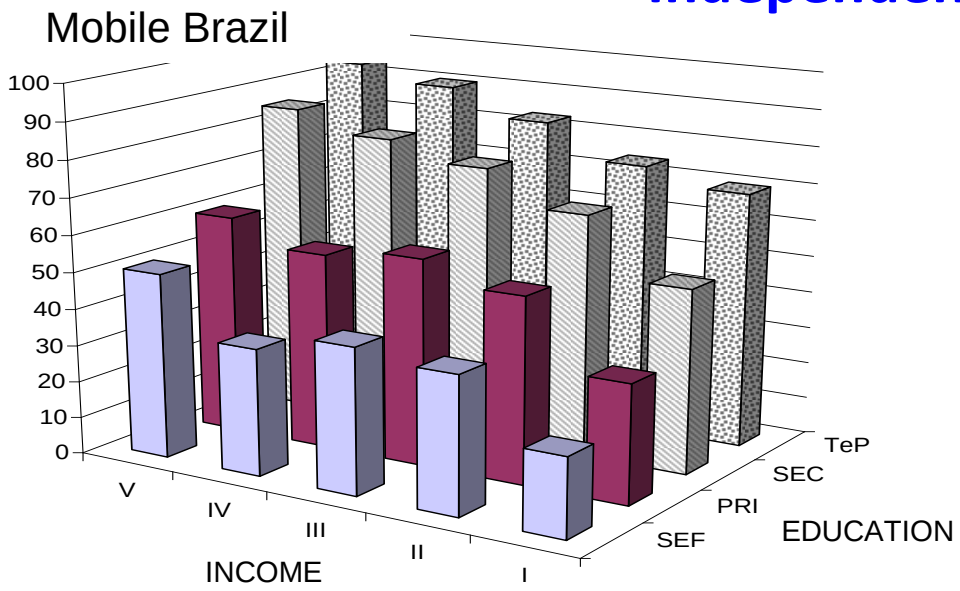
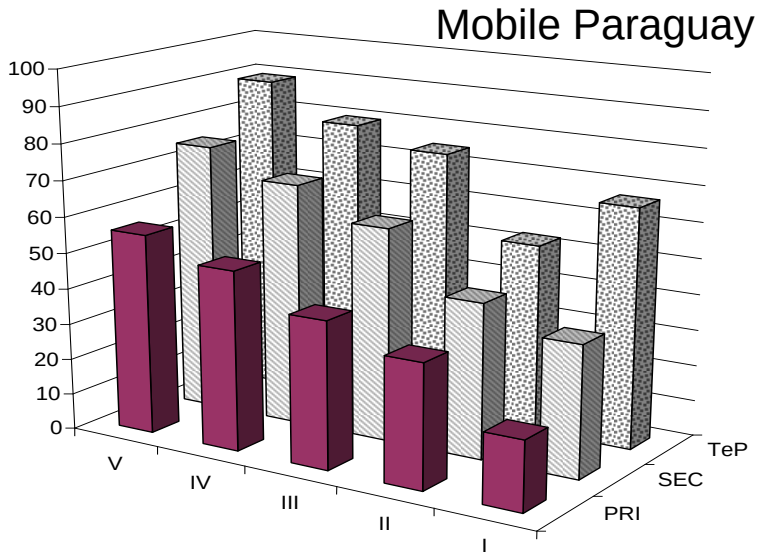
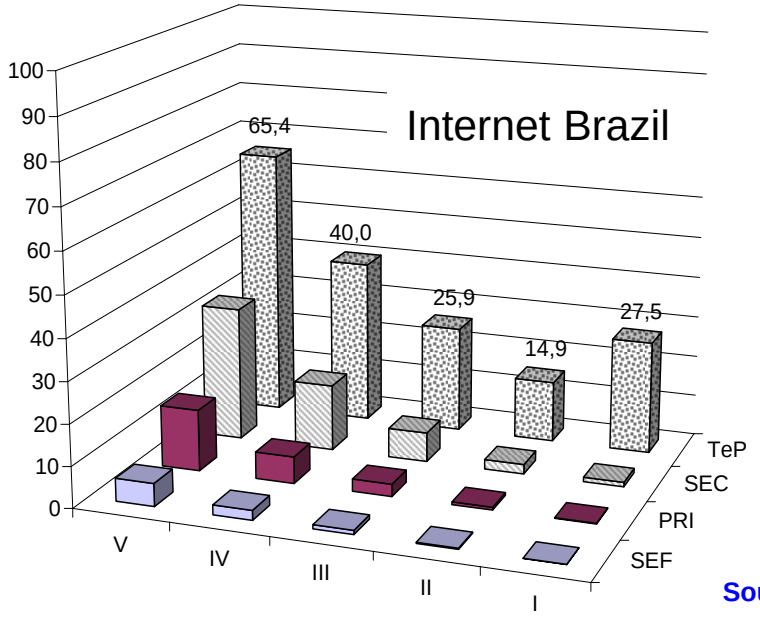
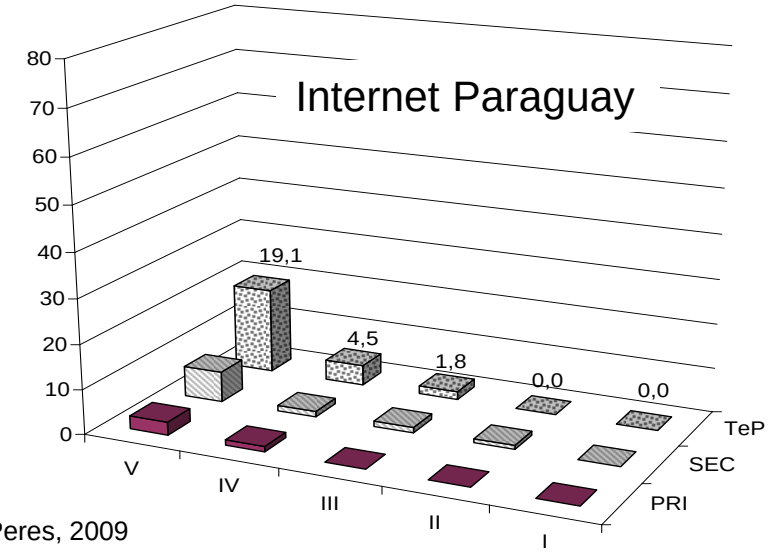




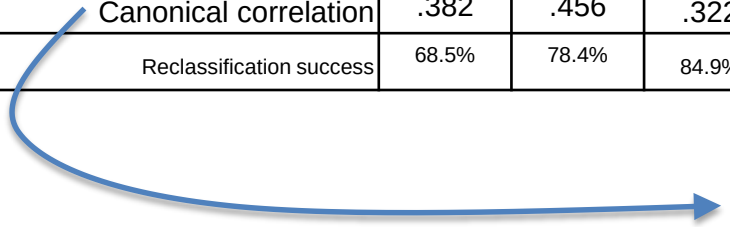




Source: OSILAC, in Hilbert and Peres, 2009

Attributes of the network nodes: Independent effects

	Standardized Canonical Discriminant Function Coefficients: with Internet use									
	Chile 2006	Mexico 2007	Paraguay 2007	El Salvador 2006	Nicaragua 2006	Costa Rica 2005	Uruguay 2005	Uruguay 2007	Brazil 2002	Brazil 2007
Education of person	**.591**	**.690**	**.716**	**.710**	**.802**	**.862**	.423	.464	.556	.416
Income per decile (p.c. of hh)	.551	.469	.634	.416	.475	.737	**.799**	**.755**	**.704**	**.753**
Household size (single/pair vs family)	.412	.209*	.245	.192*	.056*	.037	.431	.404	.249	.345
Age	.329	.348	.425	.277	.252	.090	.084	.094	.207	.131
Enrollment in school/education	.180	.247	.310	.245	.056	.230	.114	.122	.117	.115
Job category	.018	.107	.107	.038	.021	.394	.026	.050	.061	.113
Color TV in household	n.a.	.034^	.095^	.042^	.233	.178	.038	.028	.164	.060
Geographical region (urban/rural)	.189	.017	.122	.036	.002	.369	n.a	-.038	.048	-.073
Gender	.042	.037	.220	.220	.039	.057	-.027	-.038	-.021	-.023
Indigenous ethnicity	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a	n.a.	-.004	.008
	Strength of overall correlation									
Wilks lambda	.854	.792	.896	.884	.983	.808	.708	.696	.751	.682
Canonical correlation	.382	.456	.322	.340	.132	.438	.540	.522	.499	.564
Reclassification success	68.5%	78.4%	84.9%	85.7%	85.7%	78.1%	79.4%	79.2%	80.6%	78.5%



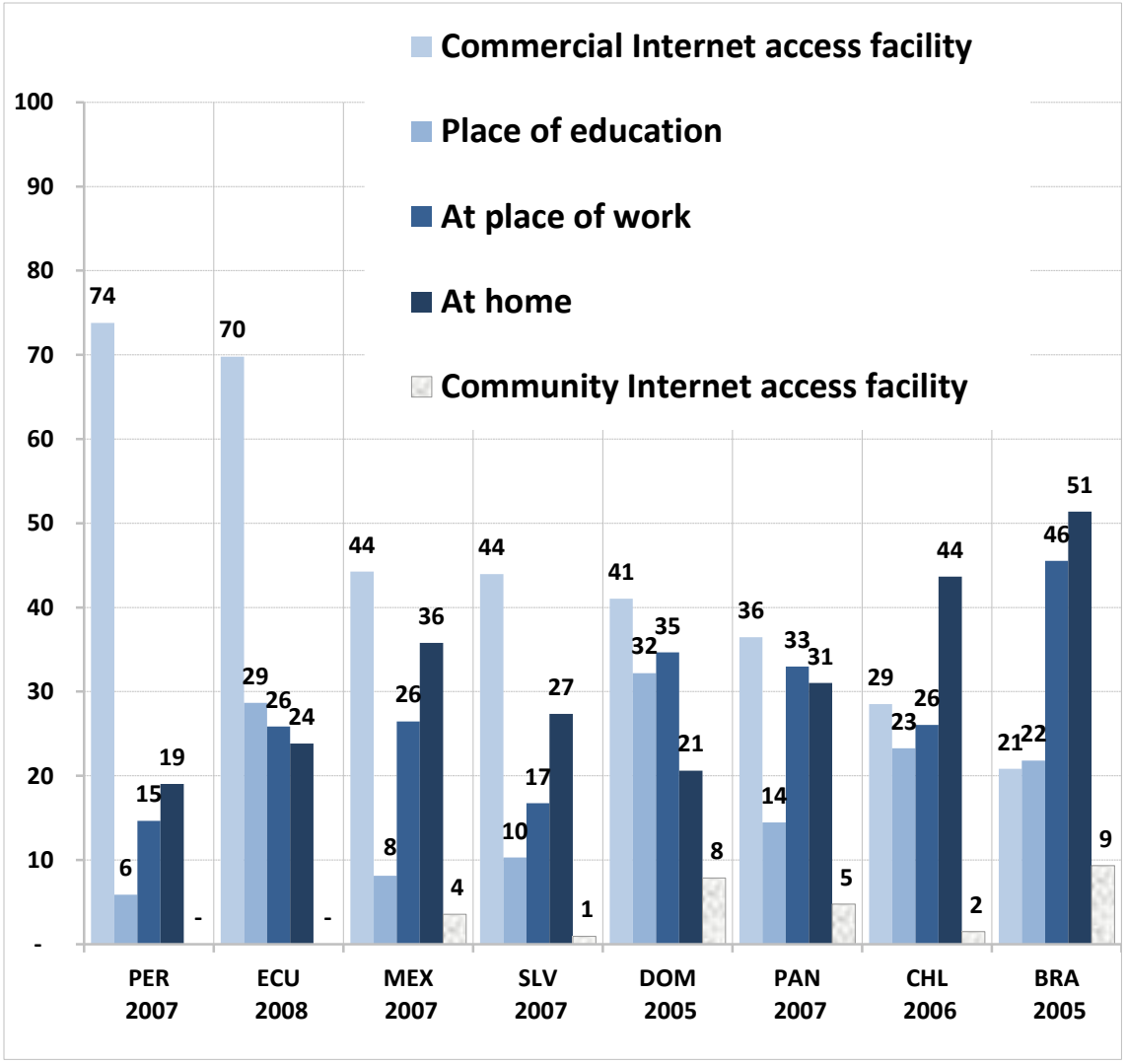
But attributes only account for +/- half of the story:
network ties (edges) are not considered here!

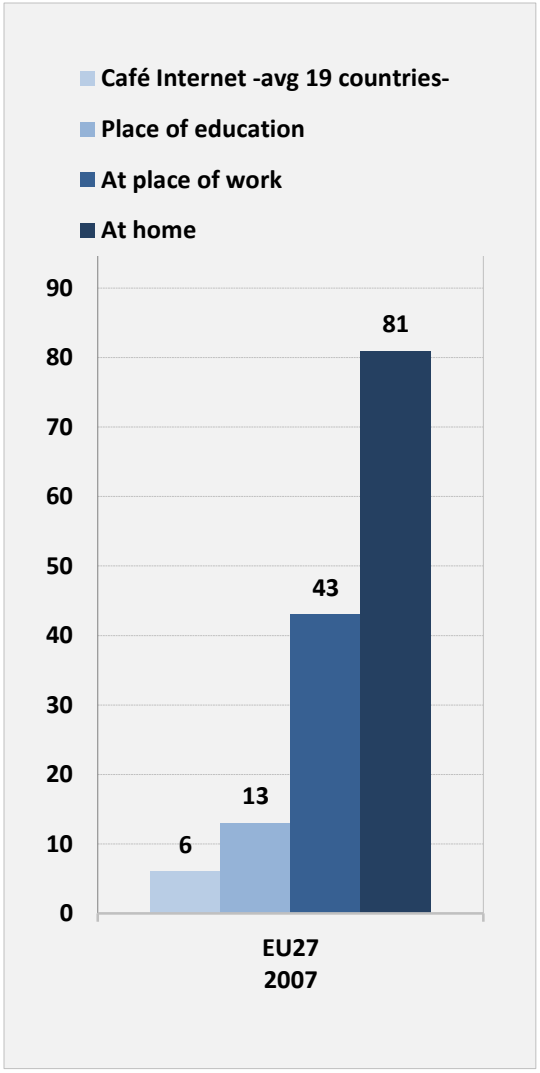
Source: Hilbert; based on OSILAC, CEPAL, 2009.

Different ways to analyze the digital divide

- Type of technology:
  - Fixed/mobile phones, computers, Internet, broadband, d-TV, etc
- Level of analysis:
  - Individuals vs. organizations/communities vs. societies/countries
- Attributes of nodes:
  - Individuals: income, education, geography, age, gender, etc
  - Organizations/communities: type of ownership, size, profitability, sector, geography, maturity, culture, etc
  - Societies/countries/regions: level of development, income, size, geography, ethnicity, etc
- Level of digital sophistication:
  - Access
  - Usage
  - Impact: cultural transformation/ modernization

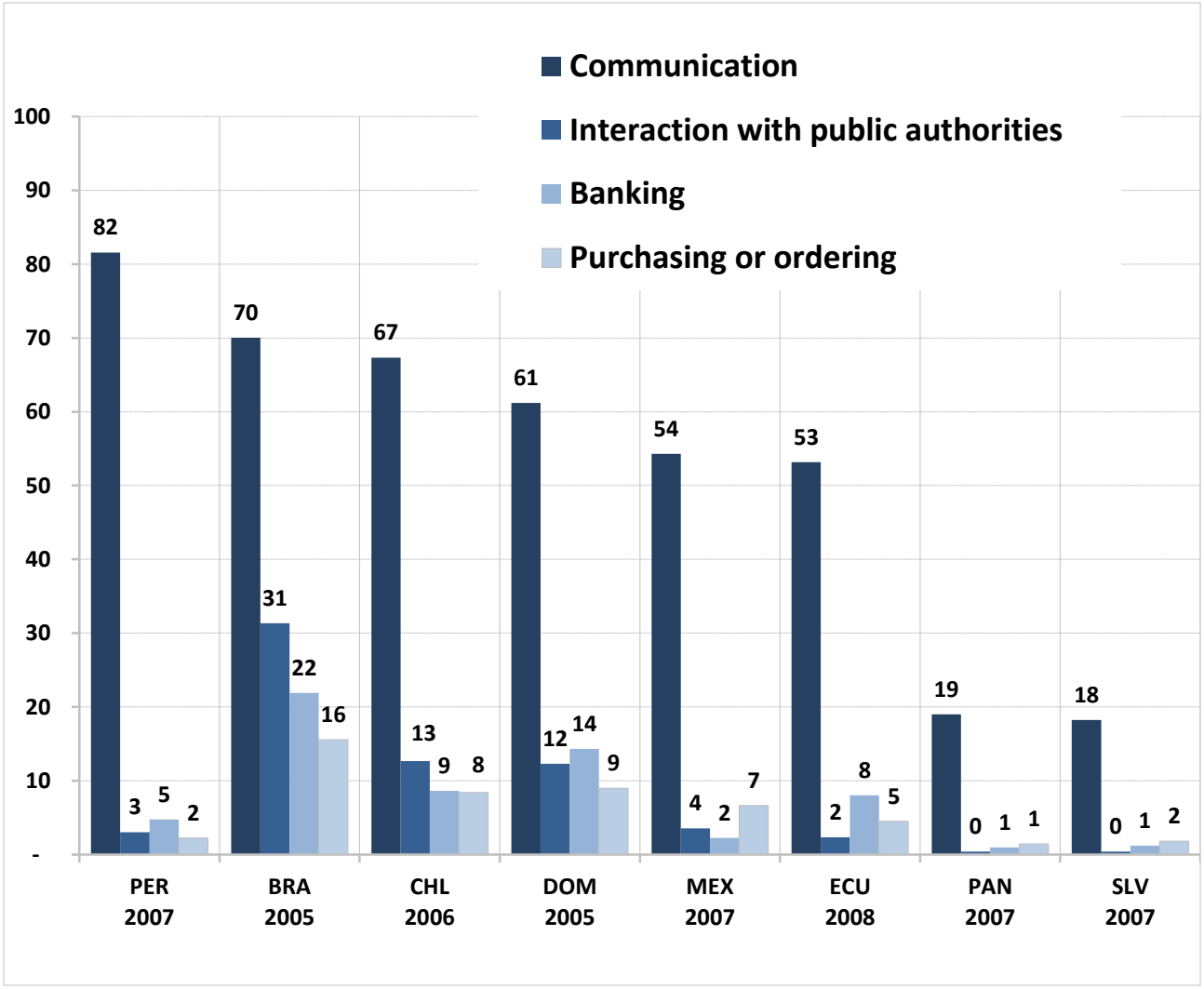
Levels of digital sophistication: Access

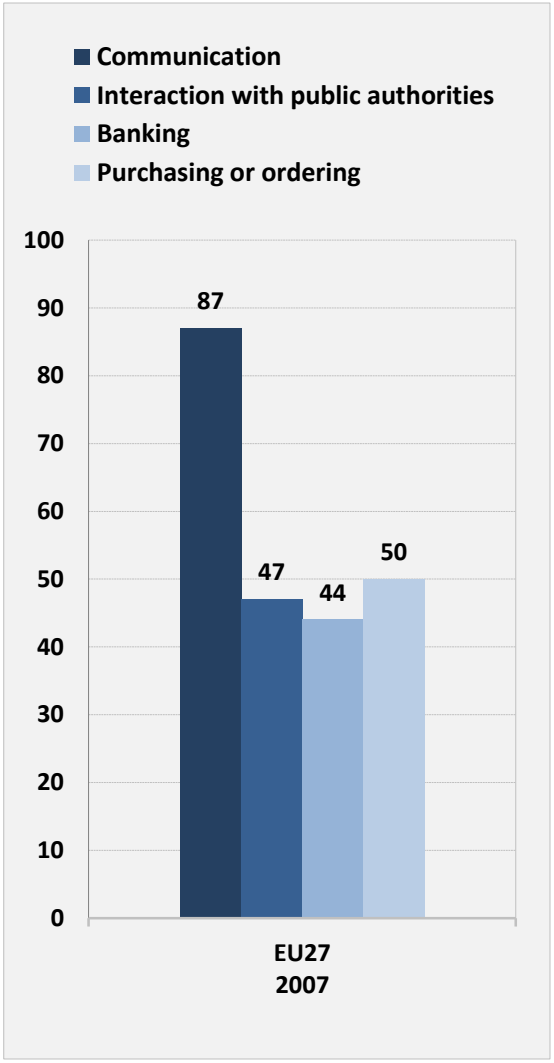




Source: OSILAC, in Hilbert and Peres, 2009

Levels of digital sophistication: Usage

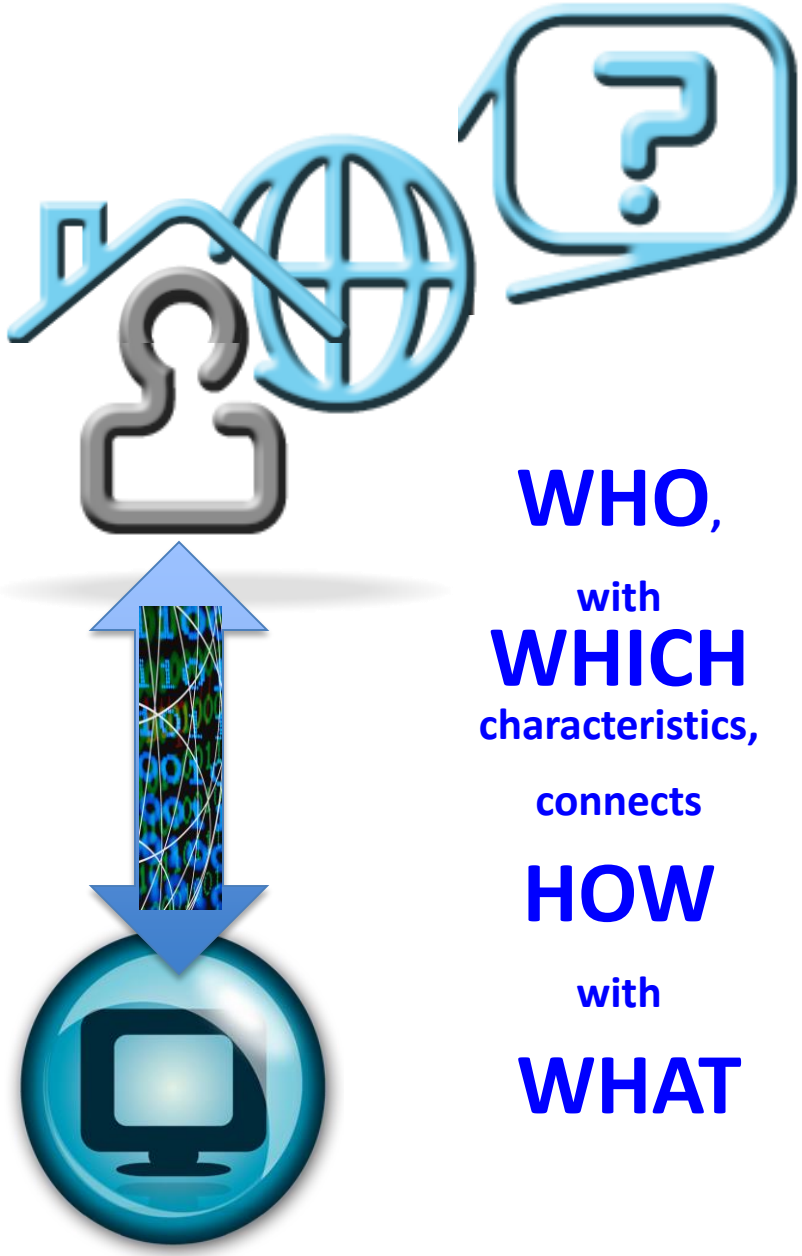




Source: OSILAC, in Hilbert and Peres, 2009

Different ways to analyze the digital divide

- Level of analysis
- Respective attributes
- Level of digital sophistication
- Type of technology



WHO, with **WHICH** characteristics, connects **HOW** with **WHAT**

Overview

I. Theoretical background: Diffusion of Innovations

II. Four Perspectives on the digital divide

- Type of technology
- Level of analysis
- Attributes of nodes and ties
- Level of digital sophistication

III. Policy responsibility: so who's in charge?

- Budgetary consequences: the case of Chile

Implications of different definitions

- Type of technology:
  - e.g. Telecom regulator and/or broadcast authority
- Level of analysis:
  - Global strategies (WSIS), regional (eEurope/eLAC), national, local, organization, etc.
- Attributes of nodes:
  - National averages or archipelagos of connectivity
  - Focus on urban-rural or on income or on education?
  - Is there a gender divide?
  - Is there an ethnic divide?
- Level of digital sophistication:
  - Enough to provide access?
  - Or foster effective usage?
  - Or even work on ensuring real impact: cultural transformation/ modernization?

Budgetary implications: the case of Chile

GOBIERNO DE CHILE
SUBSECRETARÍA DE TELECOMUNICACIONES

Fondo de Desarrollo de las Telecomunicaciones

In 2003 the Fund implemented a total of **US$ 4.86 million** assigned by two public contests.

205 / 4.86 = 42 times the funds or 2.3% of the total

TOTAL GOVERNMENT SPENDING (2003) US$ 205 million	Percentage
Ministry of Finance	15.2
Ministry of Education	14.9
Ministry of Defense	14.0
Ministry of Health	10.7
Ministry of Labor and Social Security	8.6
Ministry of Justice	7.3
Judicial Power	5.1
Ministry of Public	3.3
Ministry of Economy & Reconstruction	3.1
Ministry of Public Works	3.1
Ministry of Agriculture	2.8
Ministry of Interior	2.5
Ministry of Housing and Urban	2.0
Ministry of Planning and Cooperation	1.8
Ministry of General Secretary of Governm.	1.0
Ministry of General Secretary of President	0.9
General Accounting Office	0.9
Ministry of Exterior	0.8
Ministry of Mining	0.7
Ministry of Transport and Telecom	0.5
Presidency	0.4
Ministry of National Goods	0.4
Source: DIPRES, 2003	100.0

55%

Budgetary implications: the case of Chile

	General government, security & defense	Fiscal functions	Regulatory functions	Investment functions	Social functions	
Staff and salaries	8.9	5.2	1.5	0.8	4.0	**20.4%**
Computer and telecom services/leasing	23.9	7.4	3.5	2.0	15.6	**52.4%**
Investment and ICT purchases	8.0	2.1	1.6	1.1	2.9	**15.7%**
Development projects involv. ICT	10.2	0.1	1.0	0.0	0.2	**11.5%**
	51.0%	**14.7%**	**7.7%**	**3.9%**	**22.6%**	**100.0%**

22 times the US$ 4.86 million of the telecom fund

7 times the US$ 4.86 million of the telecom fund

5 times the US$ 4.86 million of the telecom fund

Conclusion: the power of definitions

John Maynard Keynes (1936):

“The ideas of economists and political philosophers both when they are right and when they are wrong, are more powerful than is commonly understood. Indeed the world is ruled by little else. Practical men, who believe themselves to be quite exempt from any intellectual influences, are usually the slaves of some defunct economist. Madmen in authority, who hear voices in the air, are distilling their frenzy from some academic scribbler of a few years back. I am sure the power of vested interests is vastly exaggerated compared with the gradual encroachment of ideas.”

(Keynes, The General Theory of Employment, Interest and Money, p. 351)