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# Measuring digital development for policy-making: Models, stages, characteristics and causes

## The role of the Government

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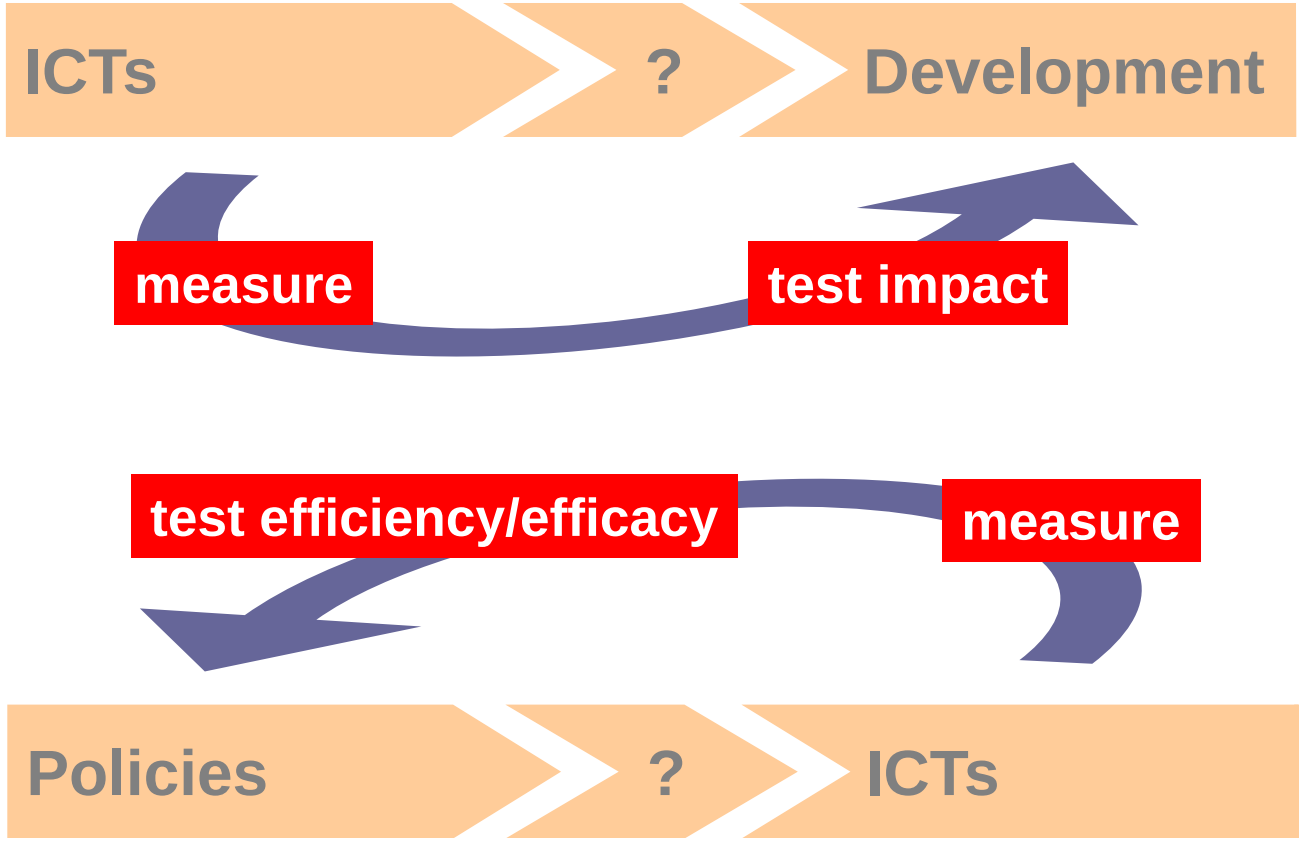
i2TIC Research Seminars Series
Barcelona, June 15th, 2009

# Introduction

# Fostering the information society?



## General hypothesis

**Institutional interests and lack of data lead to fragmented models to measure digital development that distort policy design. A comprehensive framework would improve such models and indicate in what ways the adoption of public policies would lead to higher stages of digital development**

# Working hypothesis I

**A lack of quality data leads to fragmented models of digital development that make it both difficult to measure policies that foster the Information Society and to measure the impact of those policies on digital development, an implication being that these policies could have a better design either by focusing on filling conceptual voids or including feedback from better measurement**

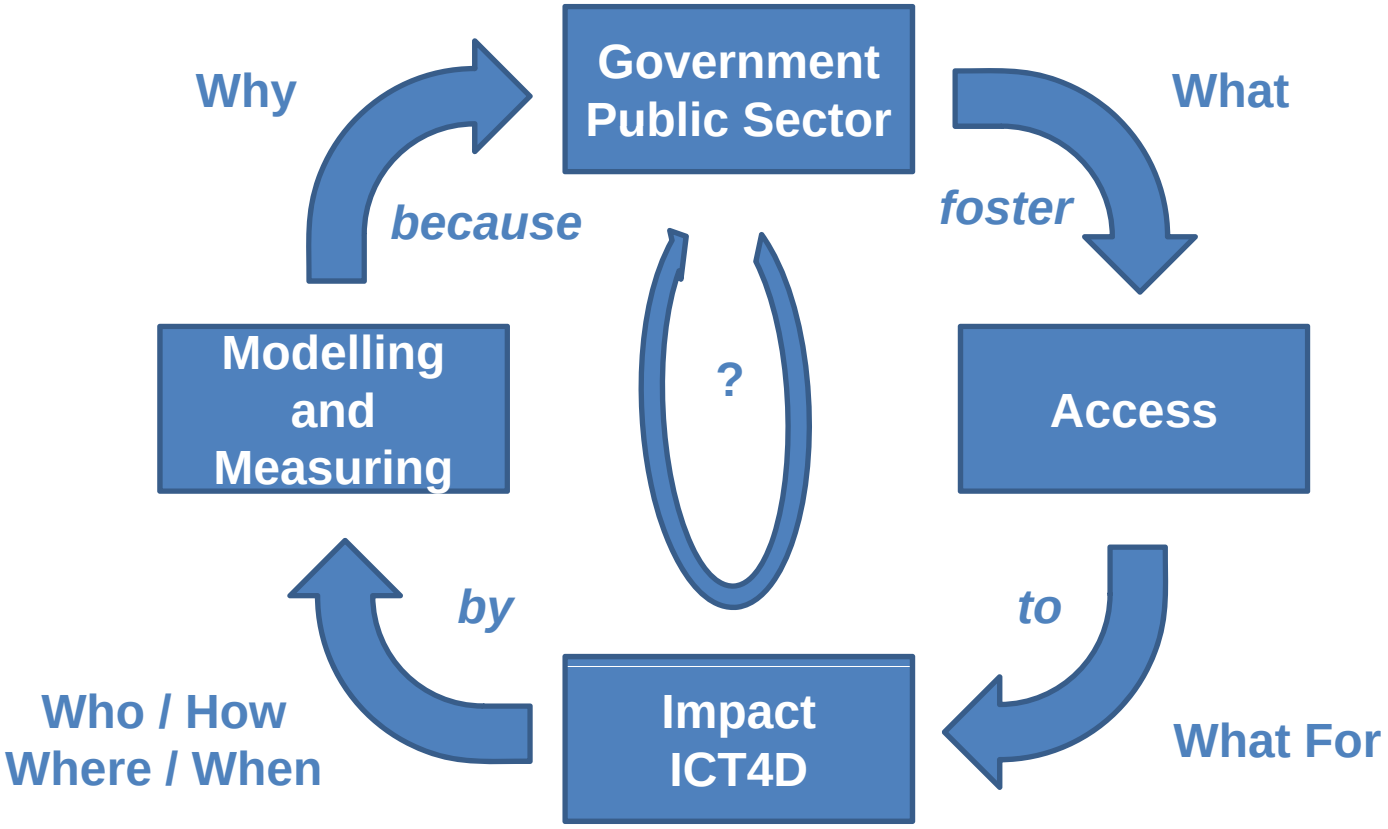
# Working hypothesis II

**A 360º digital framework approach shows that Infrastructure – Availability and Affordability –, the ICT Sector – the Industry and the skilled Workforce –, Digital Literacy – the level of Digital Literacy and Digital Literacy Training –, the Policy and Regulatory Framework – Regulation and Policies – and Content and Services – Availability and Intensity of Usage – are the key components of digital development and such a comprehensive framework for analysis could be applied in policy design**

# Working hypothesis III

**Higher levels of wealth and economic development, education and the existence of digital infrastructures almost always coincide with higher levels of digital development. Nevertheless, Governments can accelerate the process of digital development through the adoption of public policies that frame and foster the Information Society – such as Government prioritization of ICT and assigning a high importance to ICT in government vision of the future – and establishing an appropriate Economic Incentive Regime. This will raise the probability of a country of reaching higher stages of digital development**

# General approach of the research



# Goals of this presentation

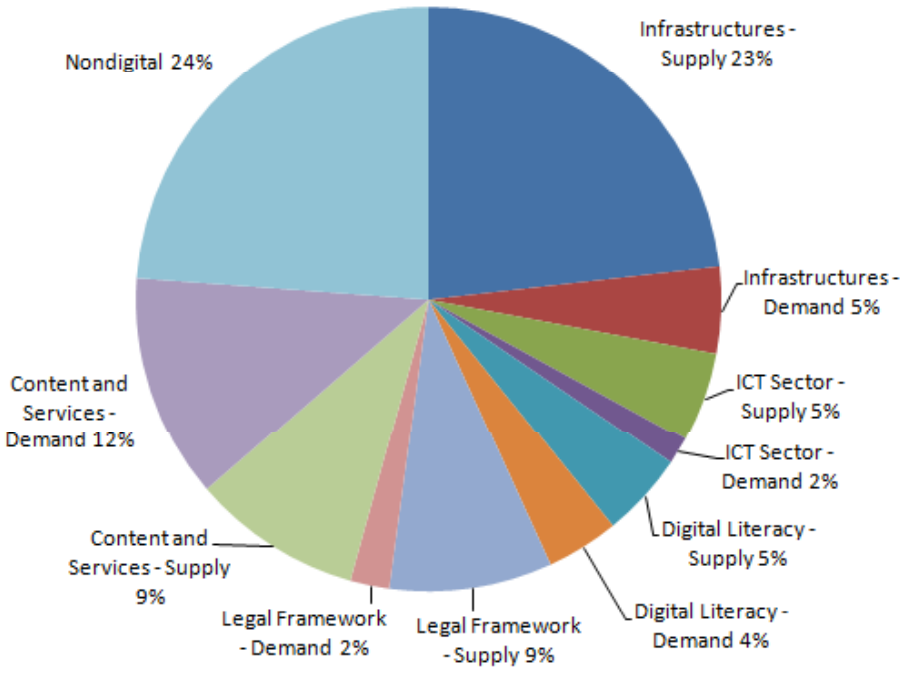
- **Present a 360º digital framework**
- **Identify stages of digital development (cluster analysis)**
- **Characterize digital development stages: indicators related with the government and the public sector at large (contingency tables)**
- **Find the determinants of digital development related with the government**
- **Advices for policy-making**

# Methodology

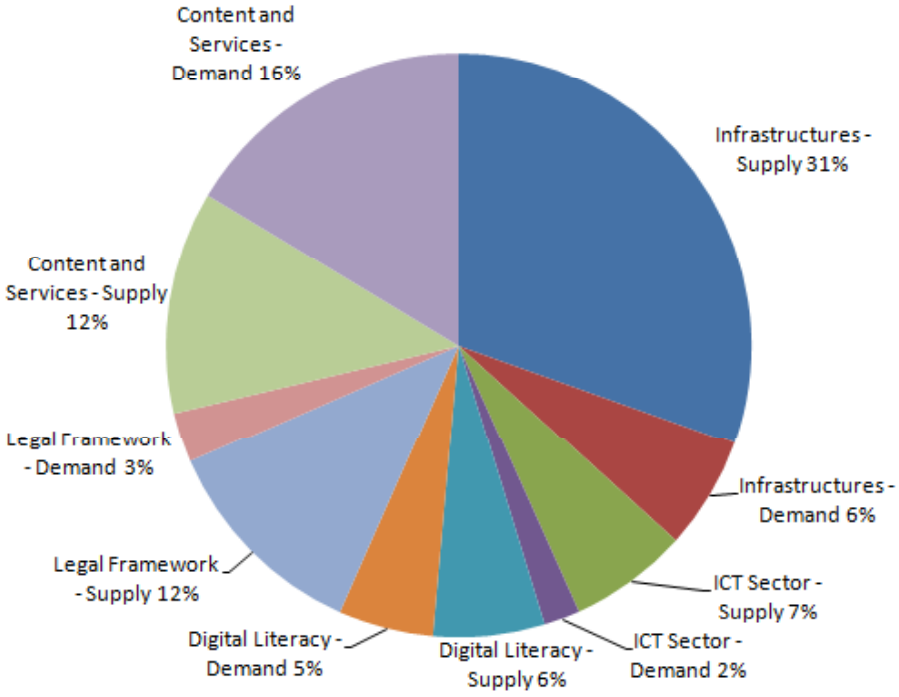
# Qualitative analysis (summary)

- **55 models of the Information Society**
- **Iterative methodology**

# The state of world indicators and indices (I)

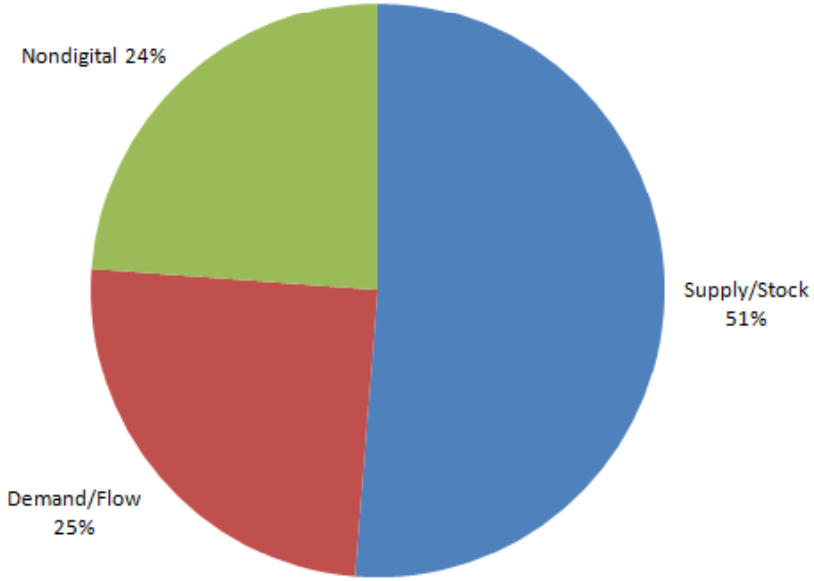



**Distribution of the extended aggregate categories – including analogue indicators**




**Distribution of the extended aggregate categories – excluding analogue indicators**

# The state of world indicators and indices (II)

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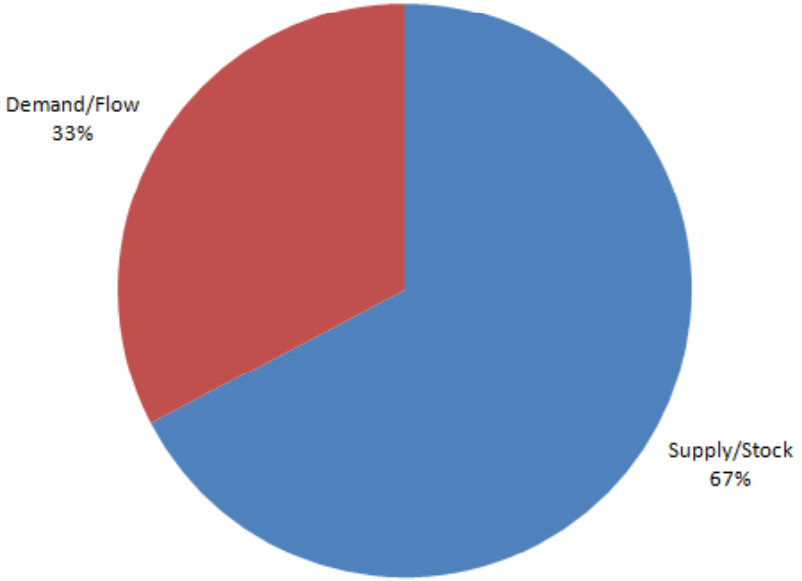
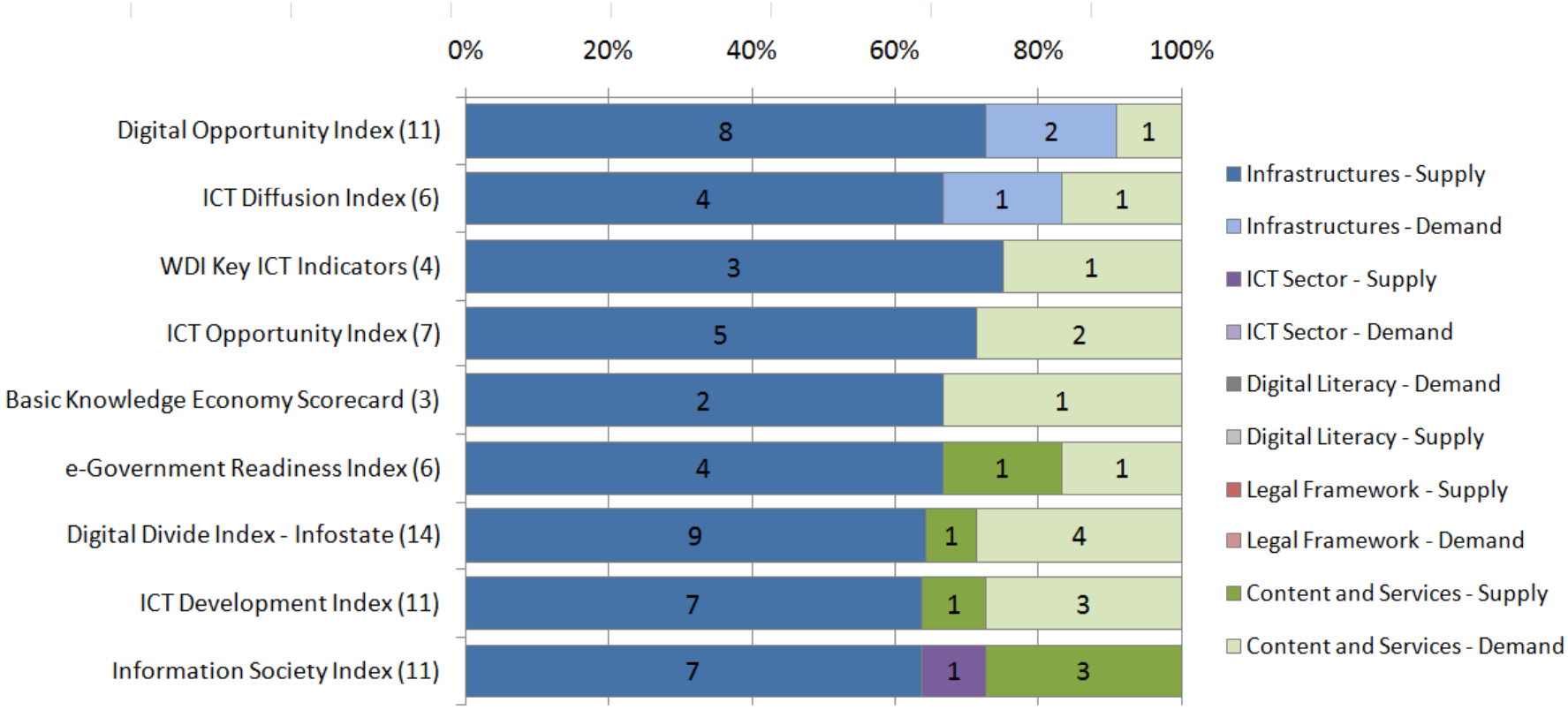



**Distribution of the aggregate categories – including analogue indicators**

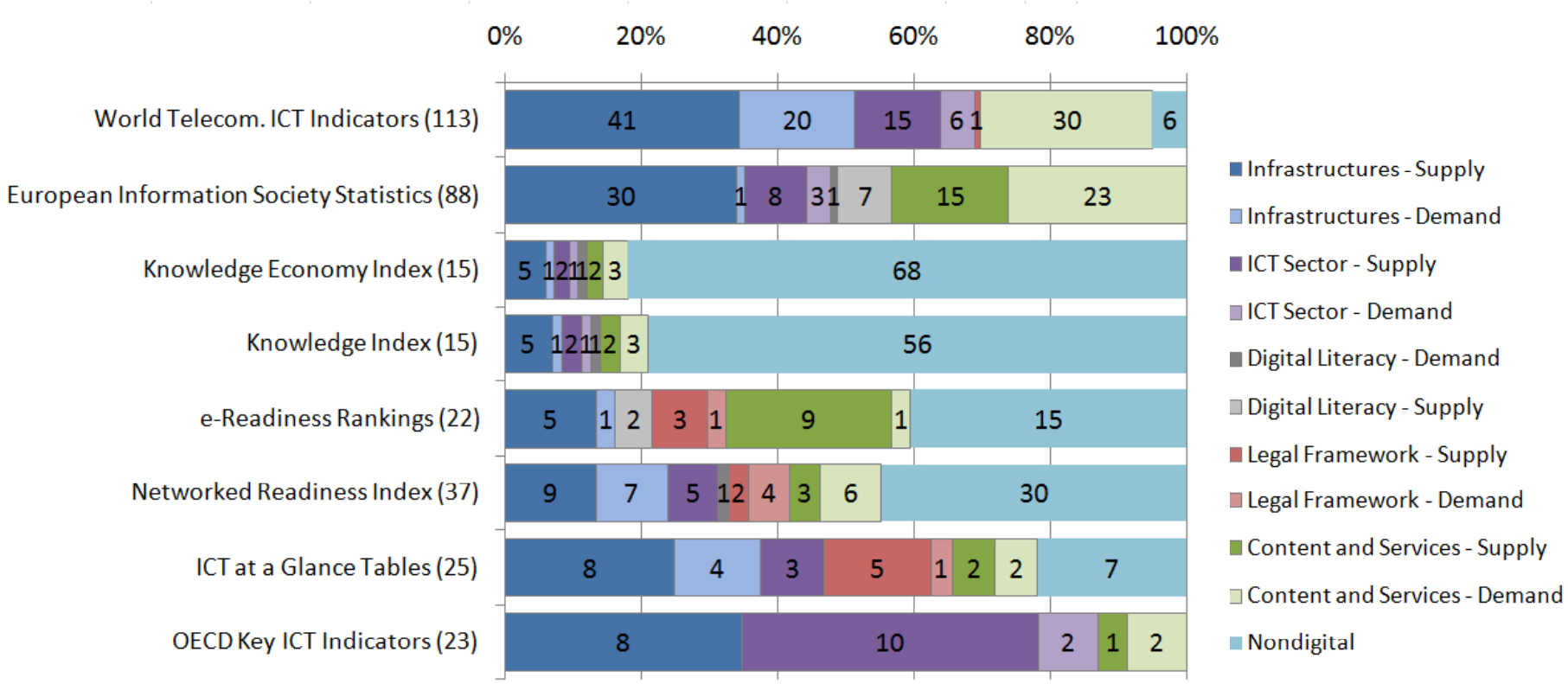
# The Telecom Approach




ICTs ? Development ✓

Policies ? ICTs ✗

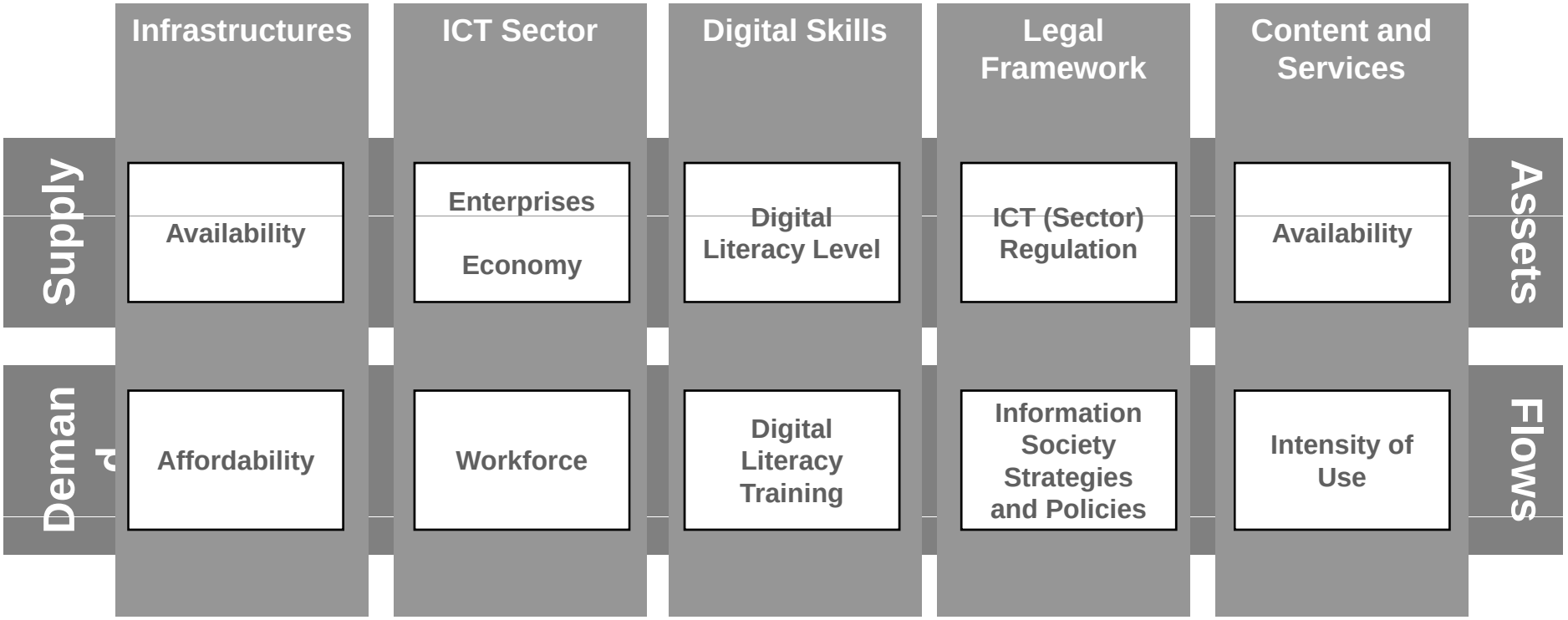
# The Broadcasting/e-Readiness approach



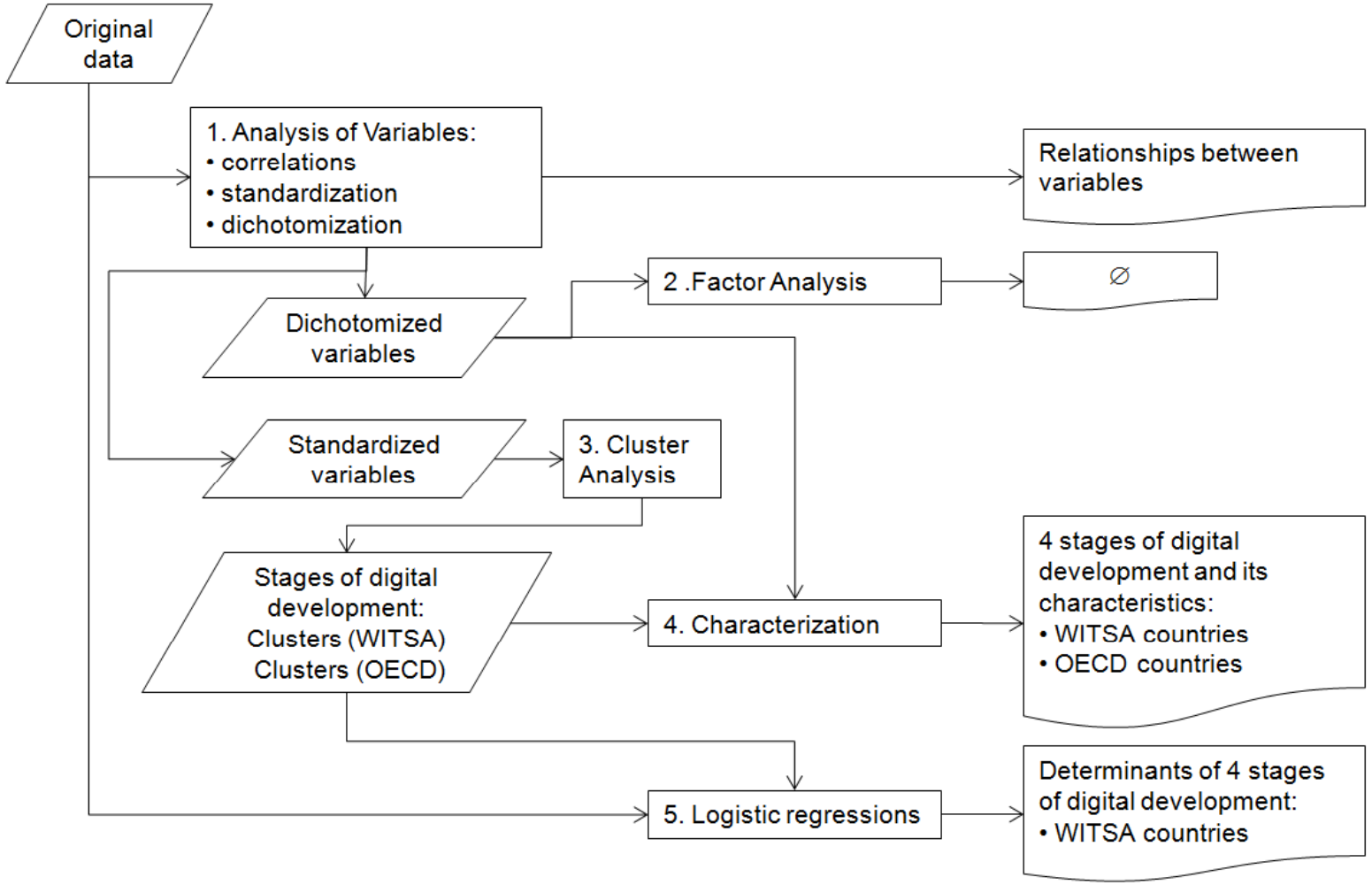

ICTs ? Development

Policies ? ICTs

# 360º Digital Framework



# Quantitative analysis: methodology



# Qualitative analysis: dataset

**Initial dataset**

- **14 databases**
- **157 variables**
- **257 countries**
- **1 series with values of year 2007 (some exceptions)**

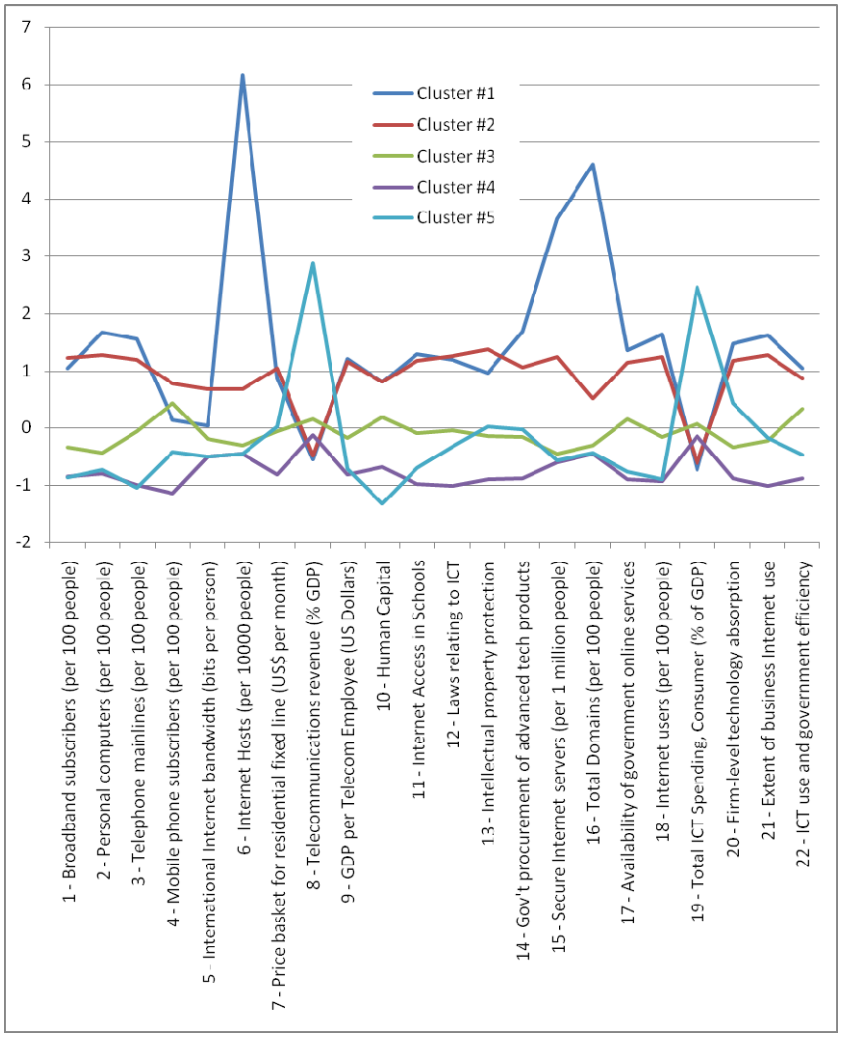
**Final dataset**

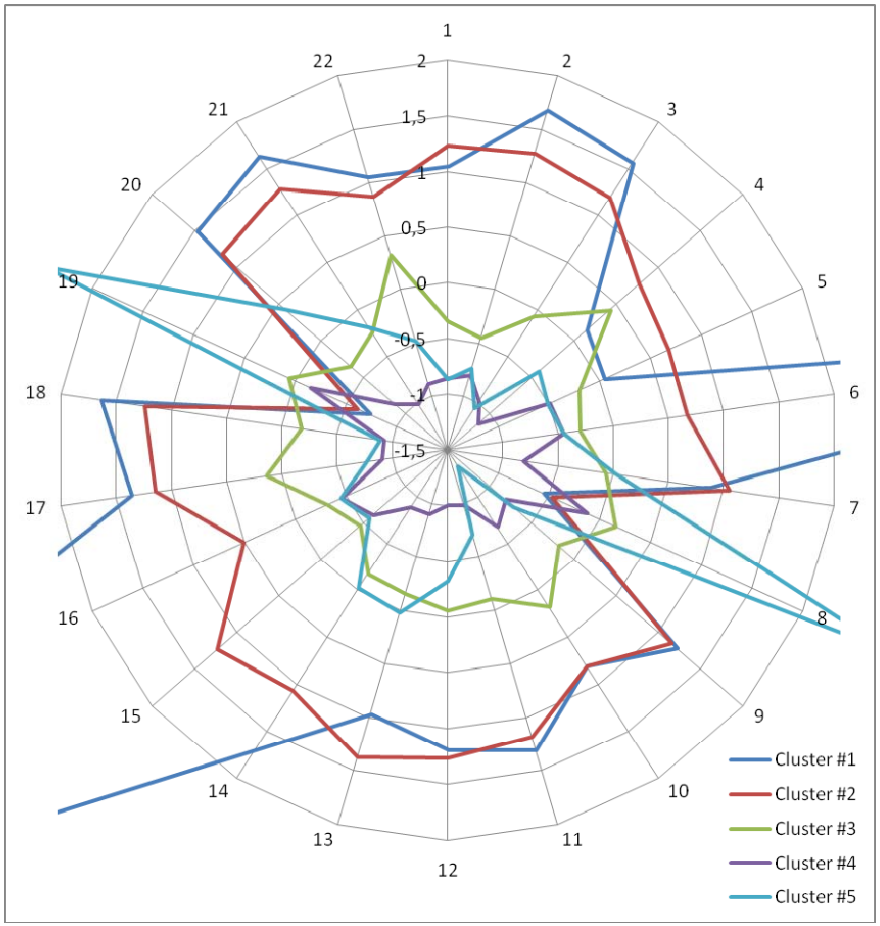
- **14 databases**
- **49 countries (WITSA dataset) / 28 countries (OECD dataset)**
- **cluster analysis: 22 variables (WITSA) / 17 variables (OECD)**
- **characterization: 65 variables (WITSA) / 53 variables (OECD)**

# Results

# Stages of digital development

# Stages of digital development (WITSA)




Cluster centre values for WITSA countries

# Stages of digital development (WITSA)

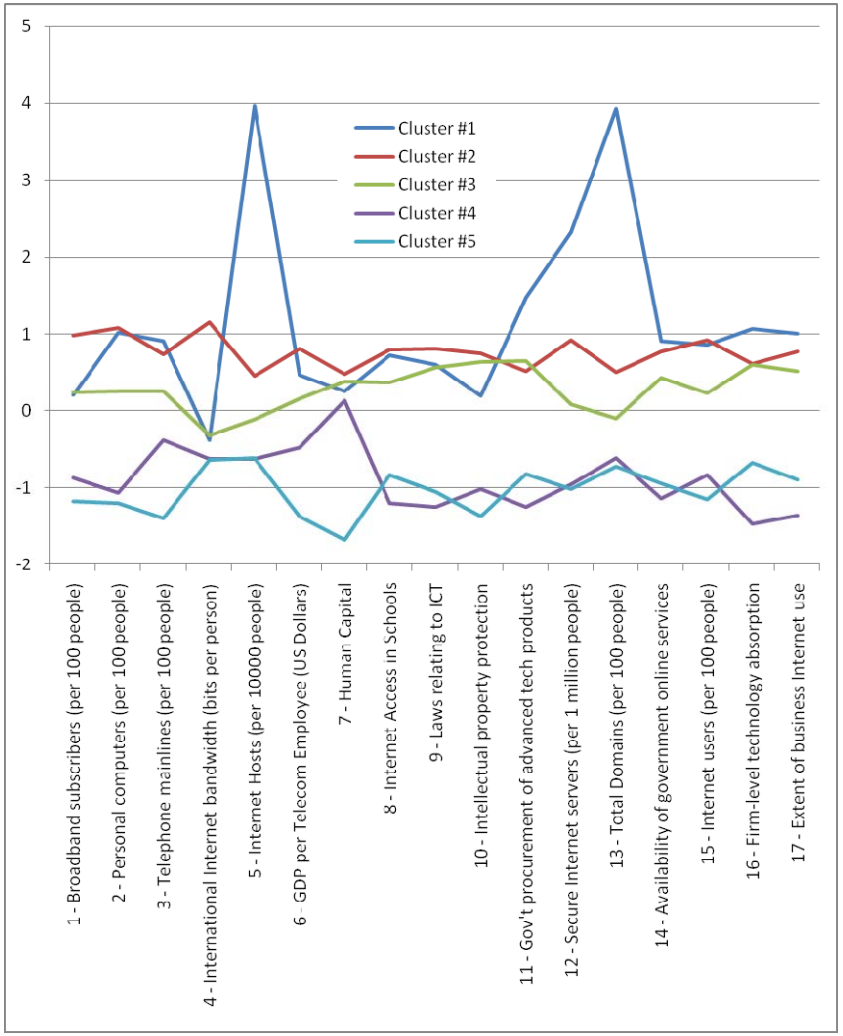
- **Digital leaders**: United States, Australia, Austria, Finland, France, Germany, Ireland, Japan, Rep. of Korea, New Zealand, Norway, Singapore, Sweden, Switzerland, United Kingdom

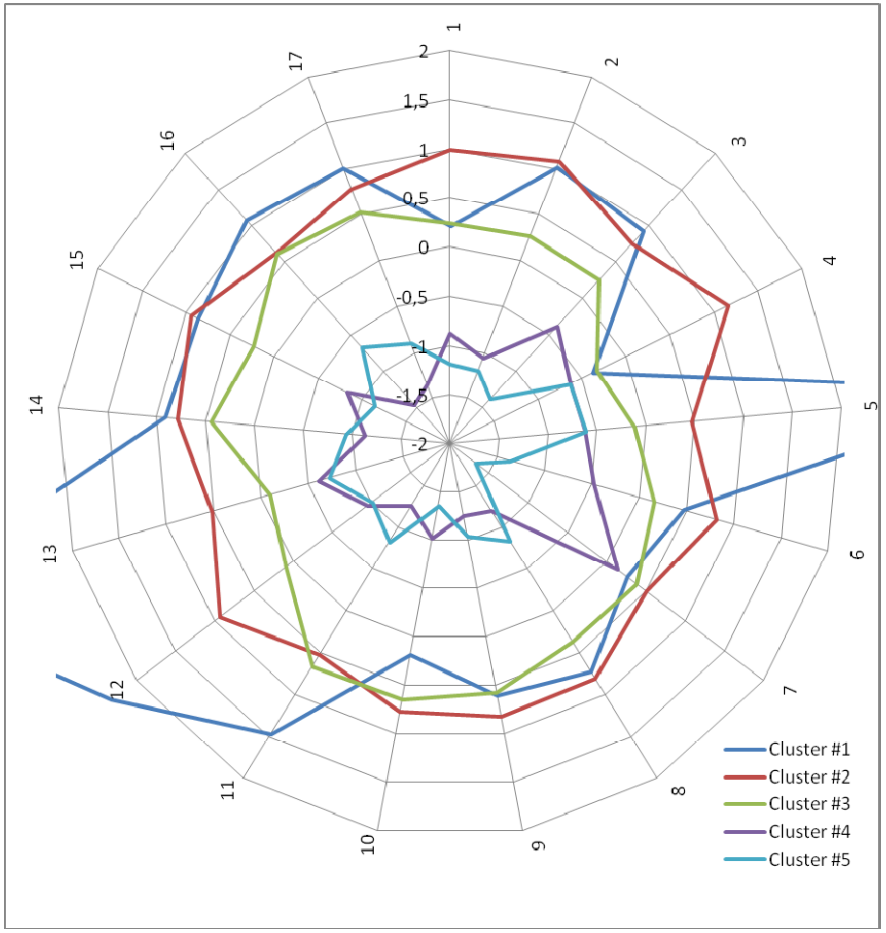
- **Digital strivers**: Brazil, Bulgaria, Chile, Greece, Hungary, Italy, Jamaica, Mexico, Panama, Portugal, Romania, Saudi Arabia, Spain, Thailand, Tunisia, Uruguay, United Arab Emirates

- **Digital laggards**: Argentina, Bolivia, Ecuador, Egypt, India, Indonesia, Pakistan, Peru, Philippines, Sri Lanka, Algeria, Cameroon, Vietnam, Zimbabwe

- **Digital leapfroggers**: Jordan, South Africa, Senegal

# Stages of digital development (OECD)




Cluster centre values for WITSA countries

# Stages of digital development (OECD)

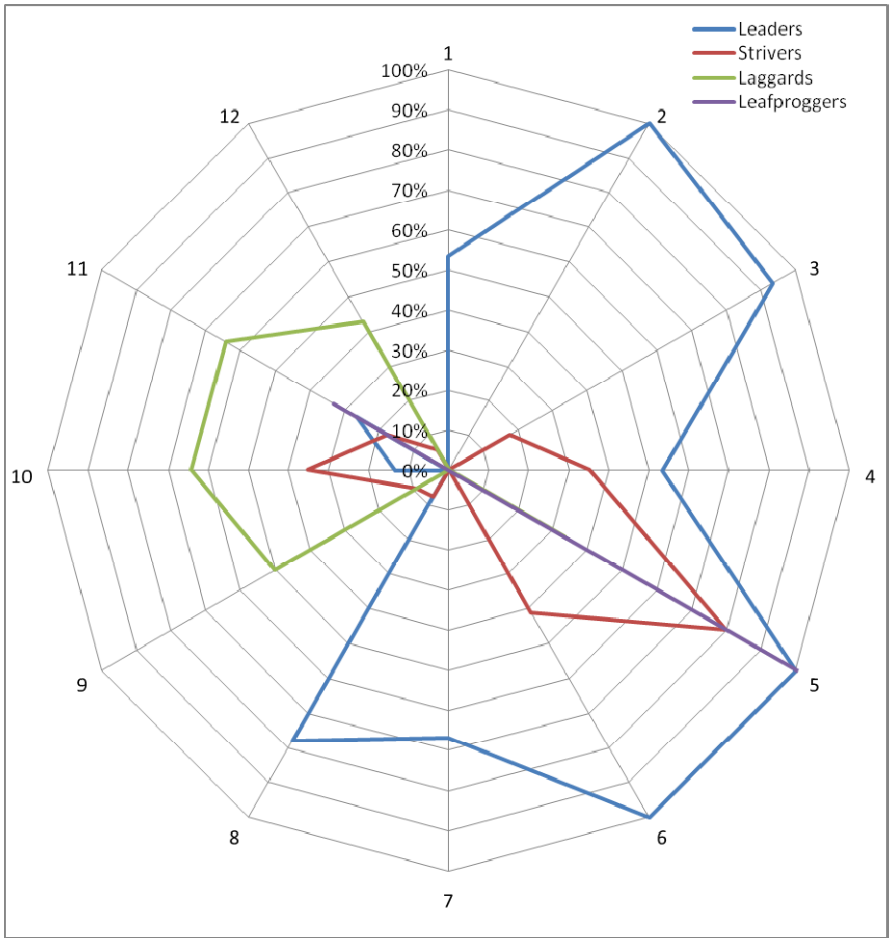
- **Primary digital leaders**: United States, Australia, Canada, Denmark, Netherlands, Norway, Sweden, Switzerland, United Kingdom
- **Secondary digital leaders**: Austria, Finland, France, Germany, Ireland, Japan, Rep. of Korea, New Zealand
- **Primary digital strivers**: Greece, Hungary, Italy, Poland, Spain
- **Secondary digital strivers**: Czech Republic, Mexico, Portugal, Slovak Republic, Turkey

# Results

# Characteristics of digital development

## (WITSA dataset)

# Infrastructures




1 - Broadband subscribers (per 100 people)

2 - Personal computers (per 100 people)

3 - Telephone mainlines (per 100 people)

4 - Mobile phone subscribers (per 100 people)

5 - Population covered by mobile telephony (%)

6 - International Internet bandwidth (bits per person)

7 - Internet Hosts (per 10000 people)

8 - Internet subscribers (per 100 inhabitants)

9 - Residential monthly telephone subscription (US$)

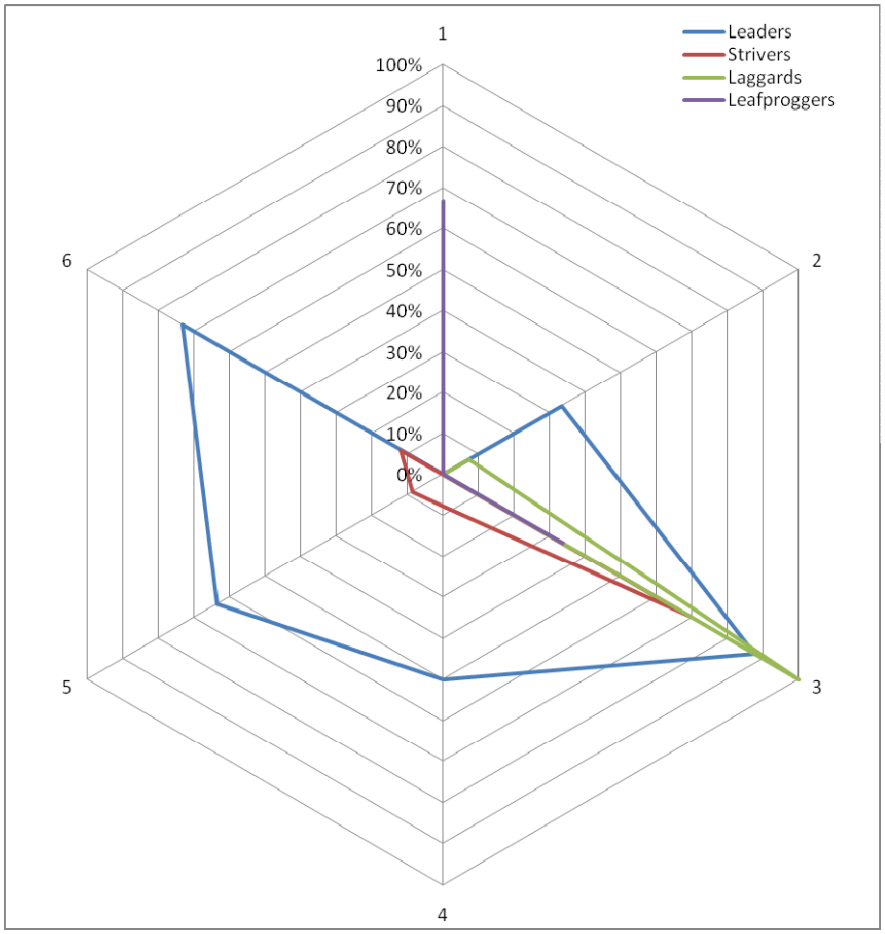
10 - Price basket for Internet (US$ per month)

11 - Price basket for mobile (US$ per month)

12 - Price basket for residential fixed line (US$ per month)

13 - Telephone average cost of call to US (US$ per three minutes)

# ICT Sector




1 - Telecommunications revenue (% GDP)

2 - High-technology exports (% of manufactured exports)

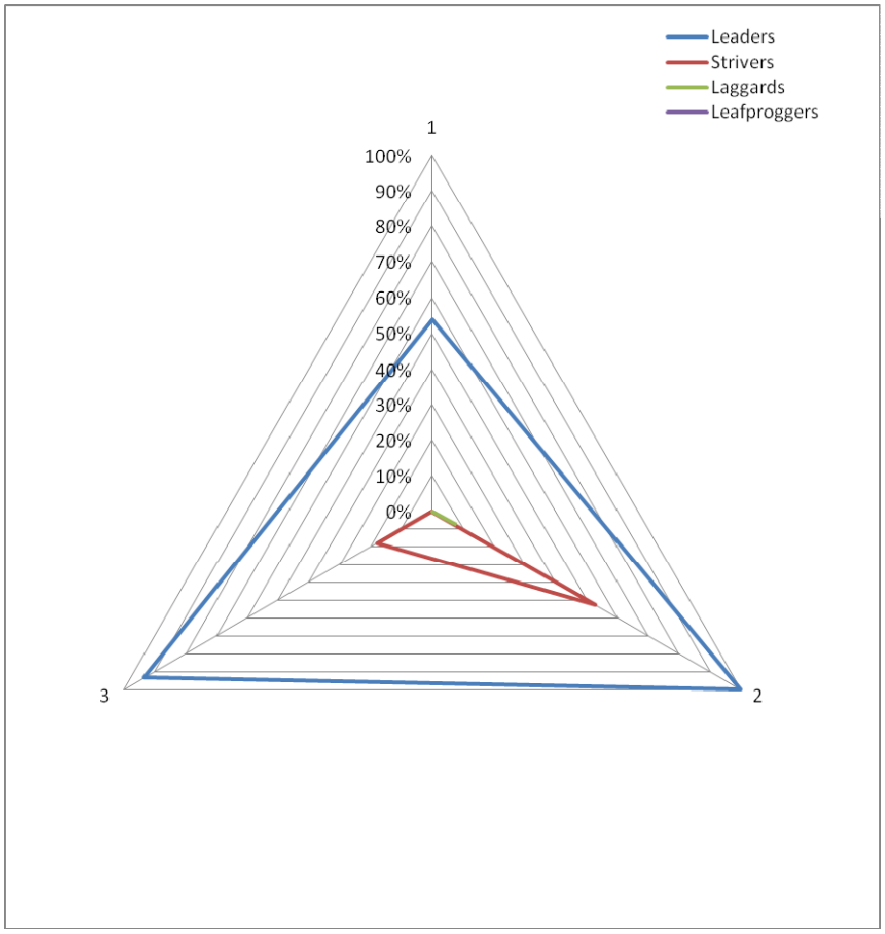
3 - Telephone subscribers per employee

4 - Telephone employees (per 100 people)

5 - Total full-time telecommunications staff (per 100 people)

6 - GDP per Telecom Employee (US Dollars

# Digital Literacy

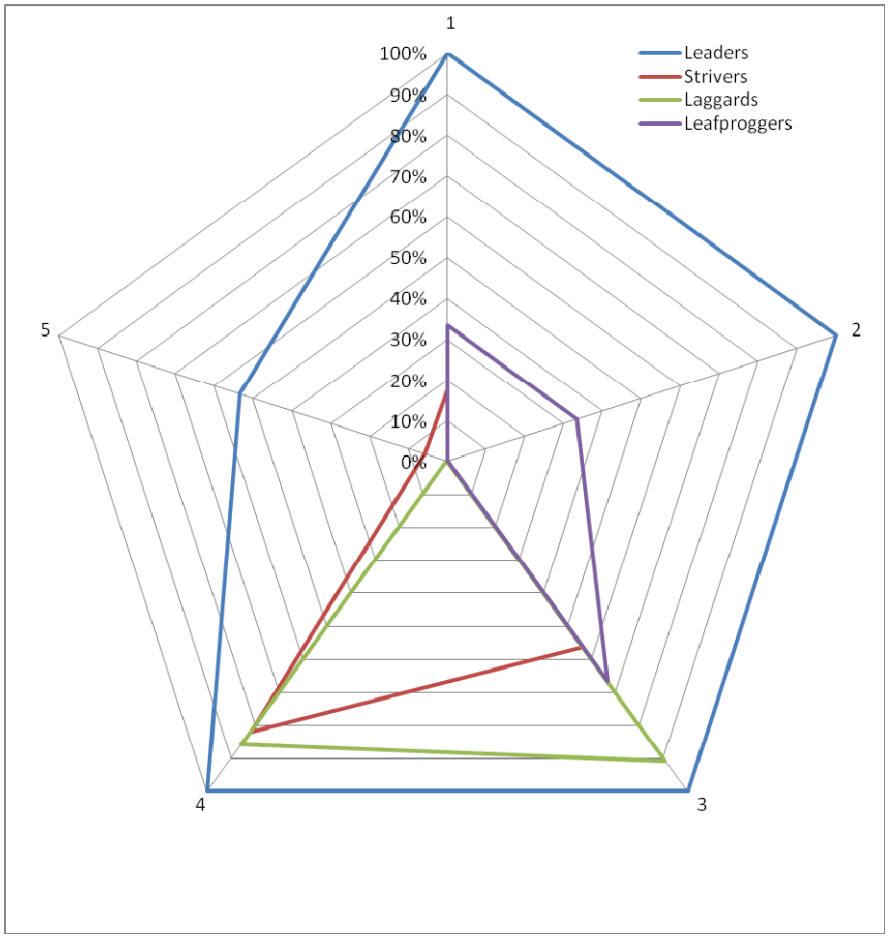



1 - Enrolment in science. Tertiary. (per 100 people)

2 - Human Capital

3 - Internet Access in Schools

# Policy and regulatory framework




1 - Laws relating to ICT

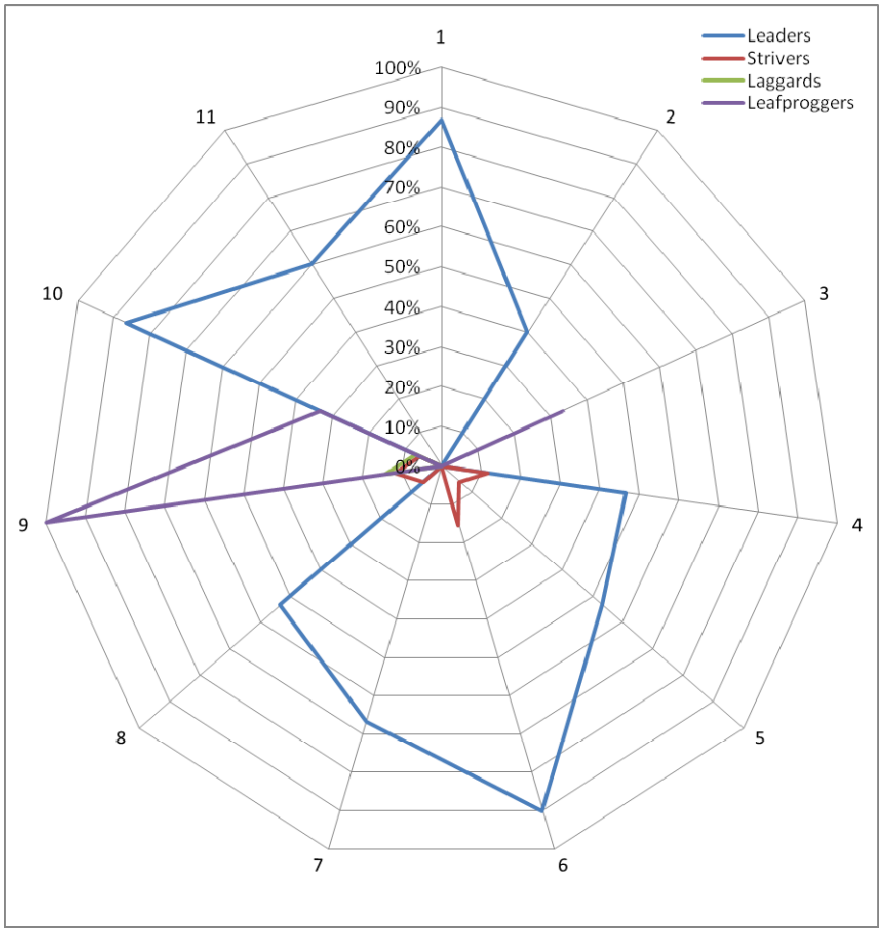
2 - Intellectual property protection

3 - Level of competition – DSL

4 - Level of competition – Cable modem

5 - Gov't procurement of advanced tech products

# Usage




1 - Secure Internet servers (per 1 million people)

2 - Total Domains (per 100 people)

3 - Total ICT Spending, Retail Trade (% of GDP)

4 - Web Measure

5 - Availability of government online services

6 - International outgoing telephone traffic (minutes) (per 100 people)

7 - Internet users (per 100 people)

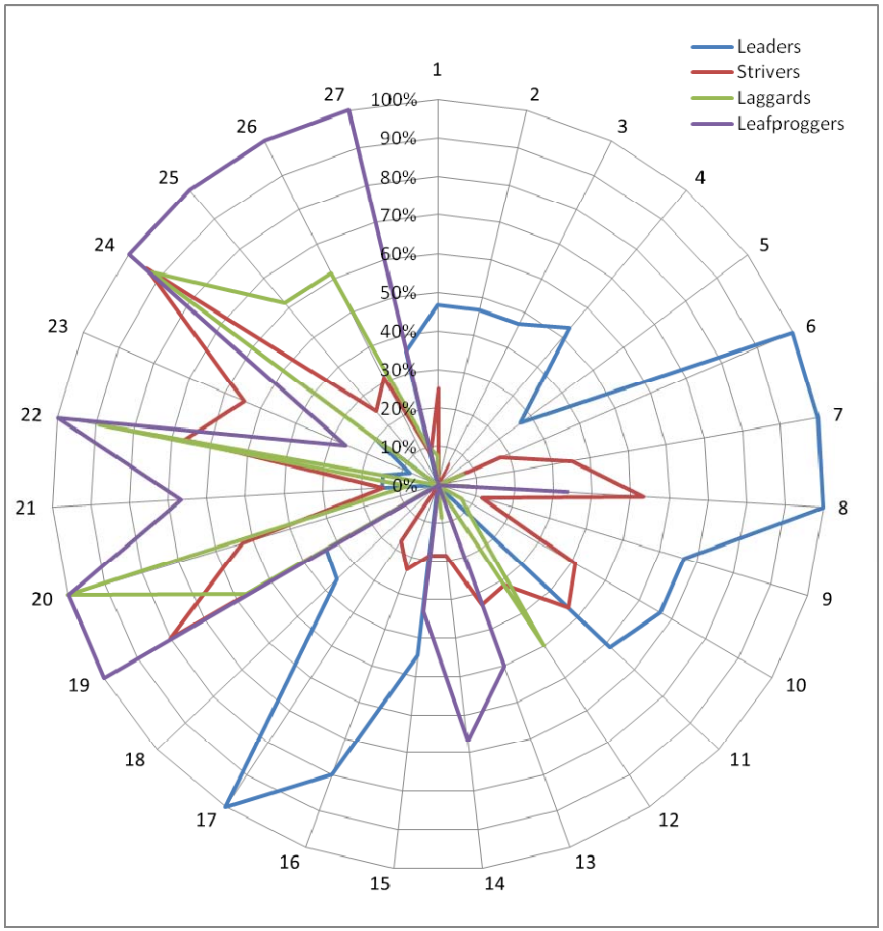
8 - E-Participation

9 - Total ICT Spending, Consumer (% of GDP)

10 - Firm-level technology absorption

11 - Extent of business Internet use

# Analogue indicators




1 - GDP
2 - GDP Capita
3 - GDP per capita, PPP (current international $)
4 - GNI per capita, Atlas method (current US$)
5 - GNI per capita, PPP (current international $)
6 - HDI
7 - Life expectancy at birth, total (years)
8 - Improved water source (% of population with access)
9 - Health Public Expenditure (% of govt. expenditure)
10 - Health Public Expenditure (% of total Health expenditure)
11 - School enrollment, primary (% net)
12 - School enrollment, primary (% gross)
13 - Education Public Expenditure (% of govt. expenditure)
14 - Gross National Expenditure (% of GDP)
15 - General Govt. final consumption expenditure (% of GDP)
16 - Economic Incentive Regime
17 - Innovation
18 - Population in urban agglomerations > 1 million (% of total population)
19 - Inequality-10
20 - Mortality rate, infant (per 1,000 live births)
21 - Population growth (annual %)
22 - Interest payments (% of GDP)
23 - Present value of debt (% of GNI)
24 - GDP deflator (base year varies by country)
25 - Inflation, consumer prices (annual %)
26 - Inflation, GDP deflator (annual %)
27 - Tax revenue (% of GDP)

# Results

# Derterminants of digital development

## (WITSA dataset)

# Determinants: digital leaders

Binary logistic regression with digital leaders (1 is a digital leader, 0 is not a digital leader) as the dependent variable.

| | B | S.E. | Wald | df | Sig. | Exp(B) |
|---|---|---|---|---|---|---|
| Life expectancy at birth, total (GEN30) | -.399 | .208 | 3.664 | 1 | .056 | .671 |
| Inequality-20 (GEN05) | -1.066 | .578 | 3.403 | 1 | .065 | .344 |
| Urban Population (%) (GEN07) | .138 | .079 | 3.030 | 1 | .082 | 1.148 |
| Economic Incentive Regime (GEN08) | 1.671 | .877 | 3.628 | 1 | .057 | 5.317 |
| Government prioritization of ICT (LEGAL_D_04) | 2.869 | 1.737 | 2.727 | 1 | .099 | 17.611 |

| | | | |
|---|---|---|---|
| N | 46 | | |
| Correctly predicted cases | 95.7% | 96.8% (leaders) | 93.3% (rest) |
| -2 Log likelihood | 15.970 | | |
| Cox & Snell R-square | .646 | | |
| Nagelkerke R-square | .862 | | |
| Chi-Square (sig) | 47.799 | (.000) | |
| Hosmer and Lemeshow Test Chi-Square (sig) | 1.546 | (.981) | |

# Determinants: digital laggards

Binary logistic regression with digital leaders (1 is a digital laggard, 0 is not a digital laggard) as the dependent variable.

| | B | S.E. | Wald | df | Sig. | Exp(B) |
|---|---|---|---|---|---|---|
| Constant | 38.214 | 16.958 | 5.078 | 1 | .024 | $3.945 \cdot 10^{16}$ |
| Inequality-10 (GEN06) | -.235 | .138 | 2.909 | 1 | .088 | .790 |
| Health Public Expenditure (% of total Health expenditure) (GEN14) | -.176 | .081 | 4.665 | 1 | .031 | .839 |
| Population covered by mobile telephony (%) (INF_S_06) | -.100 | .050 | 3.936 | 1 | .047 | .905 |
| Importance of ICT to government vision of the future (LEGAL_D_01) | -4.304 | 2.239 | 3.696 | 1 | .055 | .014 |

| | | | |
|---|---|---|---|
| N | 47 | | |
| Correctly predicted cases | 94.6% | 96.4% (laggards) | 88.9 % (rest) |
| -2 Log likelihood | 11.391 | | |
| Cox & Snell R-square | .551 | | |
| Nagelkerke R-square | .823 | | |
| Chi-Square (sig) | 29.663 | (.000) | |
| Hosmer and Lemeshow Test Chi-Square (sig) | 3.684 | (.815) | |

# Conclusions

# The role of the Government and advice for Policy-Making

# Policy-making and digital development

- Income, Health, Human Capital
- Economic **incentive regime & innovation**

→**Infrastructures + Real Economy** approach

- Strong Information Society **regulatory framework**
- **Direct intervention** (expenditure) does not make a difference — Keynesian or liberal is ok.
- **Demand** triggers digital development

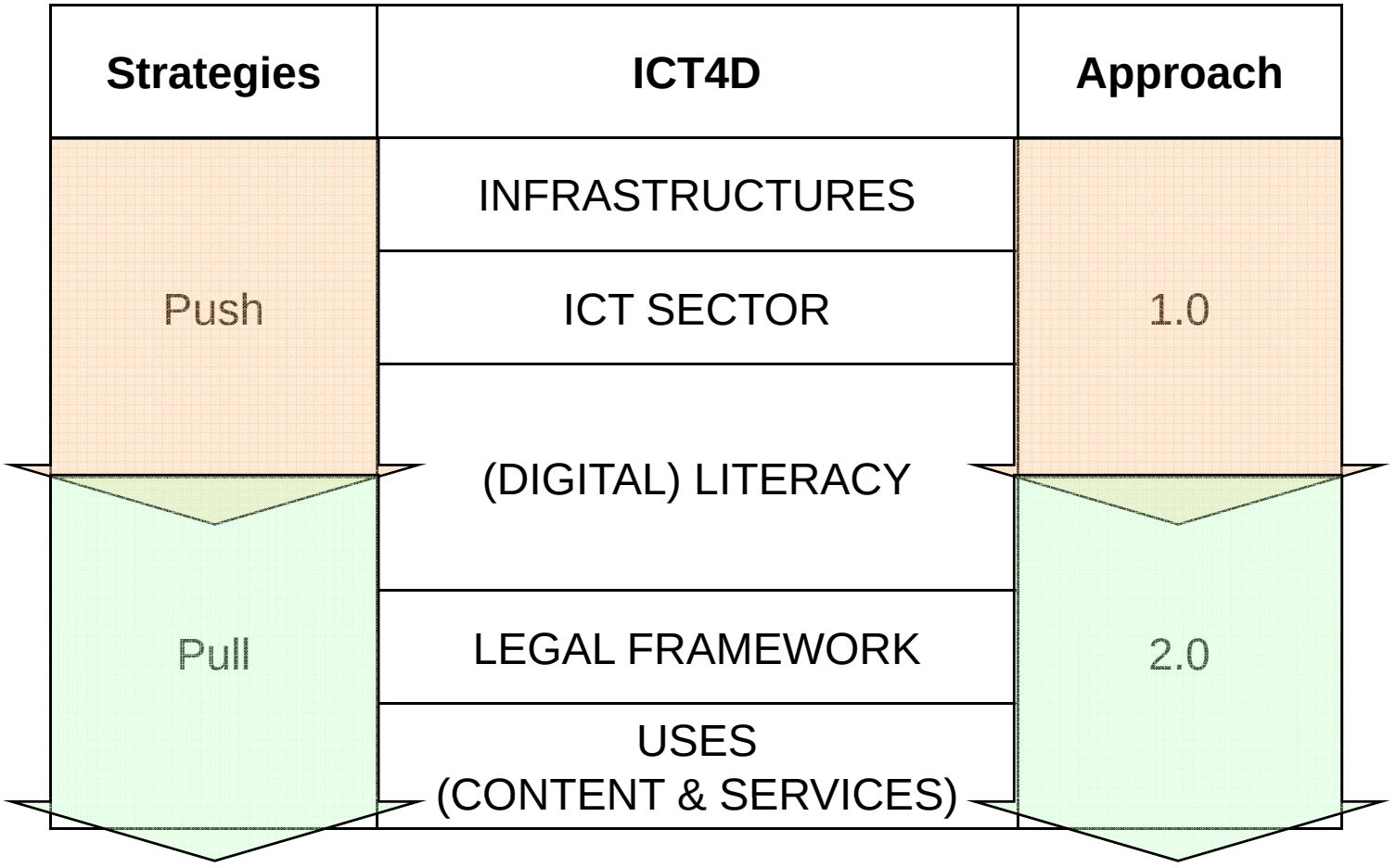
→ G2B, G2G, B2C, e-Commerce, e-Administration, e-Government, e-Health, e-Justice **pull** digital development

# A comment on leapfrogging

- Some evidence that leapfrogging is possible
- Based on
  - Human capital
  - ICT regulatory and policy framework
  - Strong, international-bound ICT Sector
- Dubious impact on domestic economy beyond most direct one

→ ICT Sector a locomotive for (nation-wide) development?

# Summing up: what policies?



Barcelona, June 15th, 2009. i2TIC Research Seminars Series

**To cite this work:**

Peña-López, Ismael. (2009) *Measuring digital development for policy-making: Models, stages, characteristics and causes. The role of the government.* Seminar imparted at the i2TIC Research Seminars Series. Barcelona, June 15th, 2009.
<http://ictlogy.net/presentations/20090615_ismael_pena-lopez_-_measuring_digital_development_role_of_government.pdf>

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