

ICT impact on development: a Latin American perspective on meeting the economic challenges

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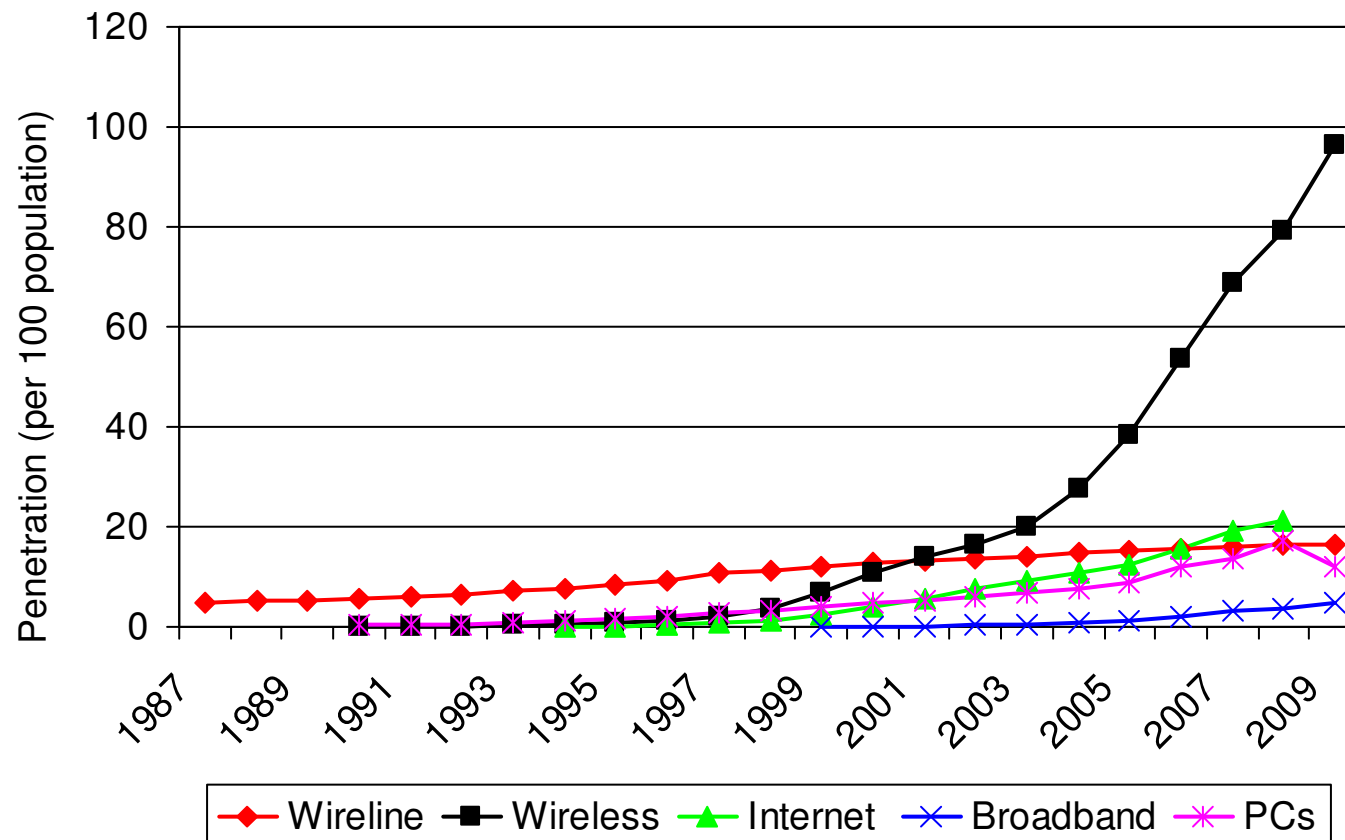
June 14, 2010

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- 1. The progress and success in Latin American ICT deployment to date**
- 2. Forward looking opportunities**
- 3. The counter-cyclical value of ICT**
- 4. The role of public policy**

ICT adoption in Latin America, particularly wireless and internet, has been proceeding at a very fast pace in the past ten years

LATIN AMERICA: ICT ADOPTION (1987-2009)

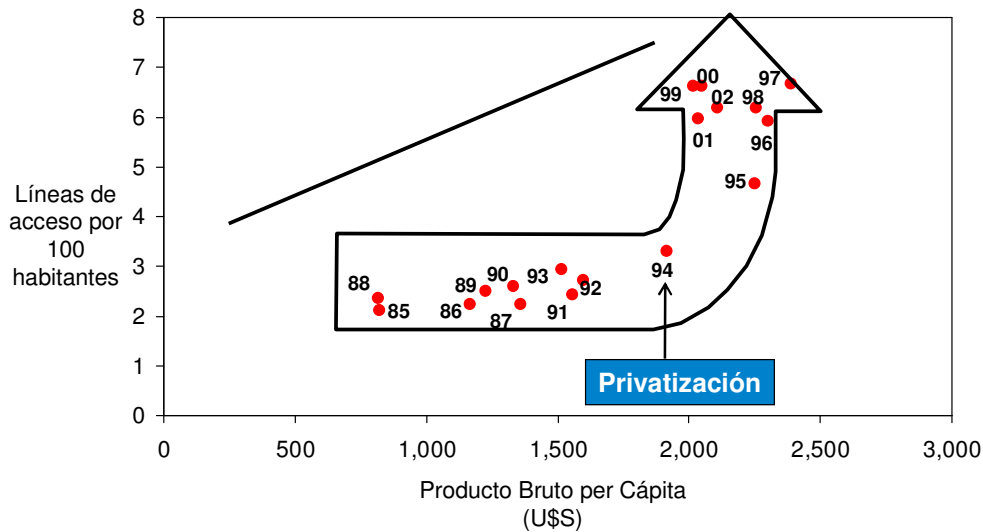


Sources: ITU; Wireless Intelligence; Regulatory authorities

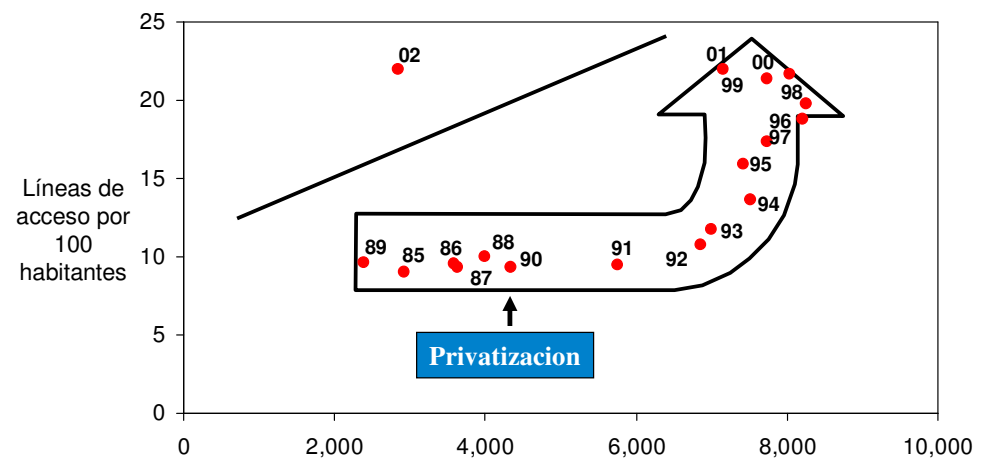
Initially, the privatization of incumbents contributed to closing the voice telephony gap

WIRELINE TELEDENSITY AND ECONOMIC DEVELOPMENT (1989-2002)

PERU



ARGENTINA

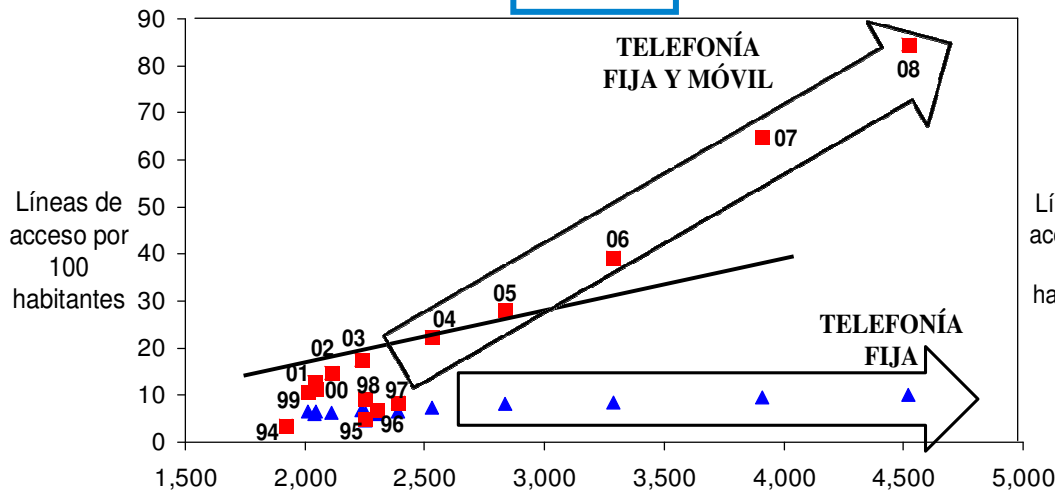


Sources: ITU; CNC; Osiptel; World Bank; analysis by the author

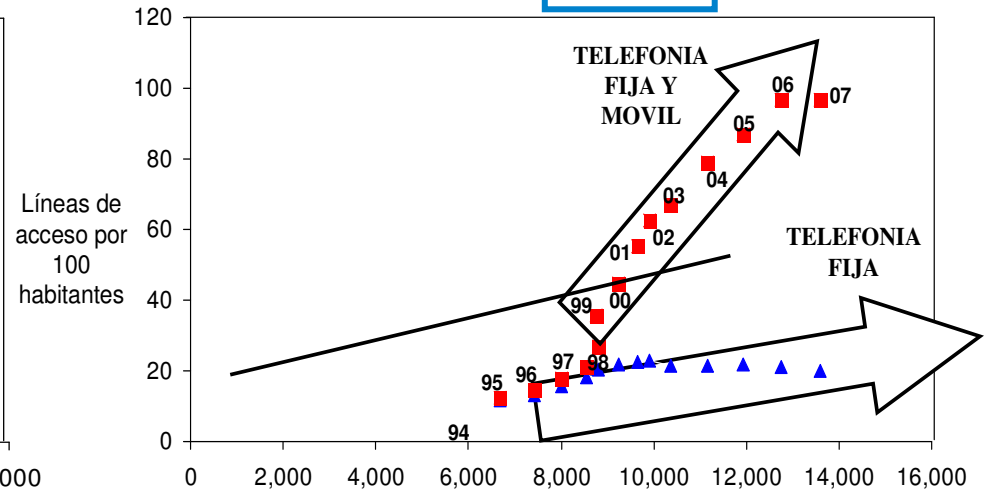
Later on, wireless telephony allowed to reach high levels of technology adoption

WIRELINE / WIRELESS TELEDENSITY AND ECONOMIC DEVELOPMENT (1987-2008)

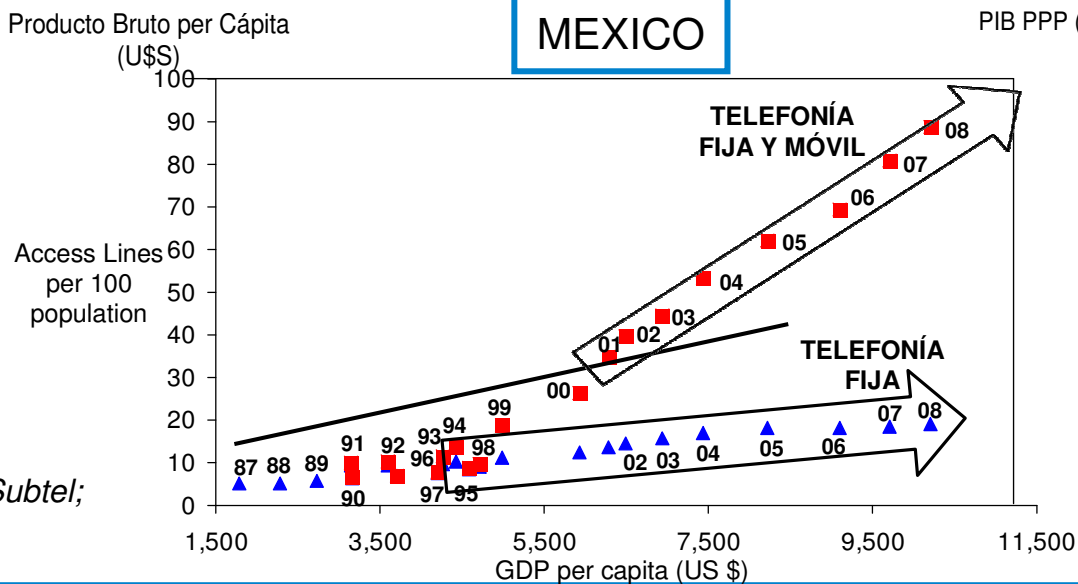
PERU



CHILE



MEXICO



Sources: ITU; World Bank; Subtel; analysis by the author

Furthermore, wireless telephony is contributing to closing the technology gap

ESTIMATED WIRELESS PENETRATION BY SOCIO-DEMOGRAPHIC SEGMENT(2009)

| COUNTRY | PENETRATION | | |
|-----------|-------------|--------------------|-----------------------|
| | TOTAL | TOP OF THE PYRAMID | BOTTOM OF THE PYRAMID |
| Argentina | 127 % | 110 % | 77 % |
| Brazil | 91 % | 96 % | 70 % |
| Bolivia | 50 % | 87 % | 14 % |
| Chile | 97 % | 103 % | 63 % |
| Colombia | 84 % | 94 % | 51 % |
| Ecuador | 86 % | 90 % | 28 % |
| Mexico | 80 % | 93 % | 61 % |
| Peru | 74 % | 88 % | 16 % |
| Venezuela | 104 % | 111 % | 23 % |

Sources: Euromonitor; ITU; analysis by the author

Looking forward, the objective is to replicate the success of wireless voice in four areas

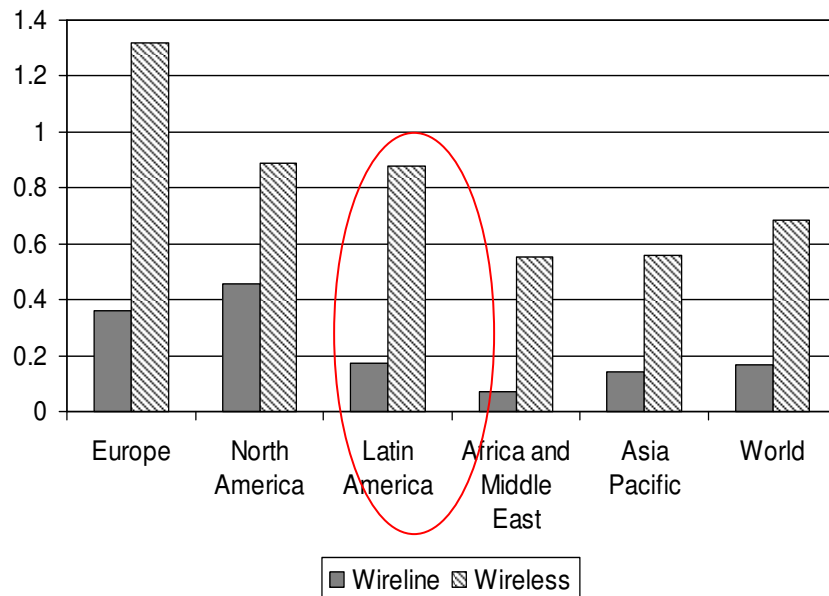
- Increase qualitatively and quantitatively broadband deployment
- Develop the technology infrastructure of the most economically advanced areas of Latin America to the level of industrialized countries
- Accelerate the ICT adoption level in the small and medium enterprises
- Complete the service coverage in rural zones and disadvantaged segments

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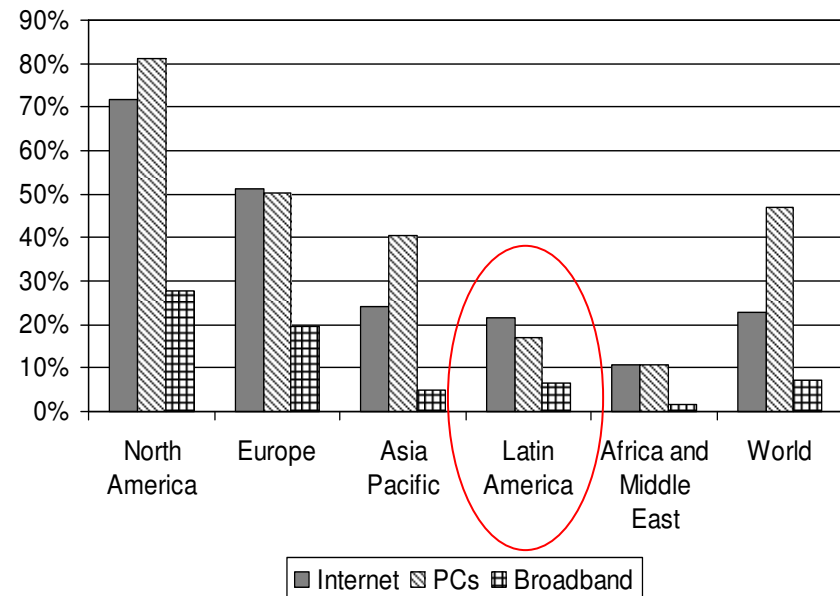
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Latin America is underdeveloped with regards to broadband adoption

VOICE TELEPHONY (2009)



INTERNET, PC AND BROADBAND ADOPTION (2009)*

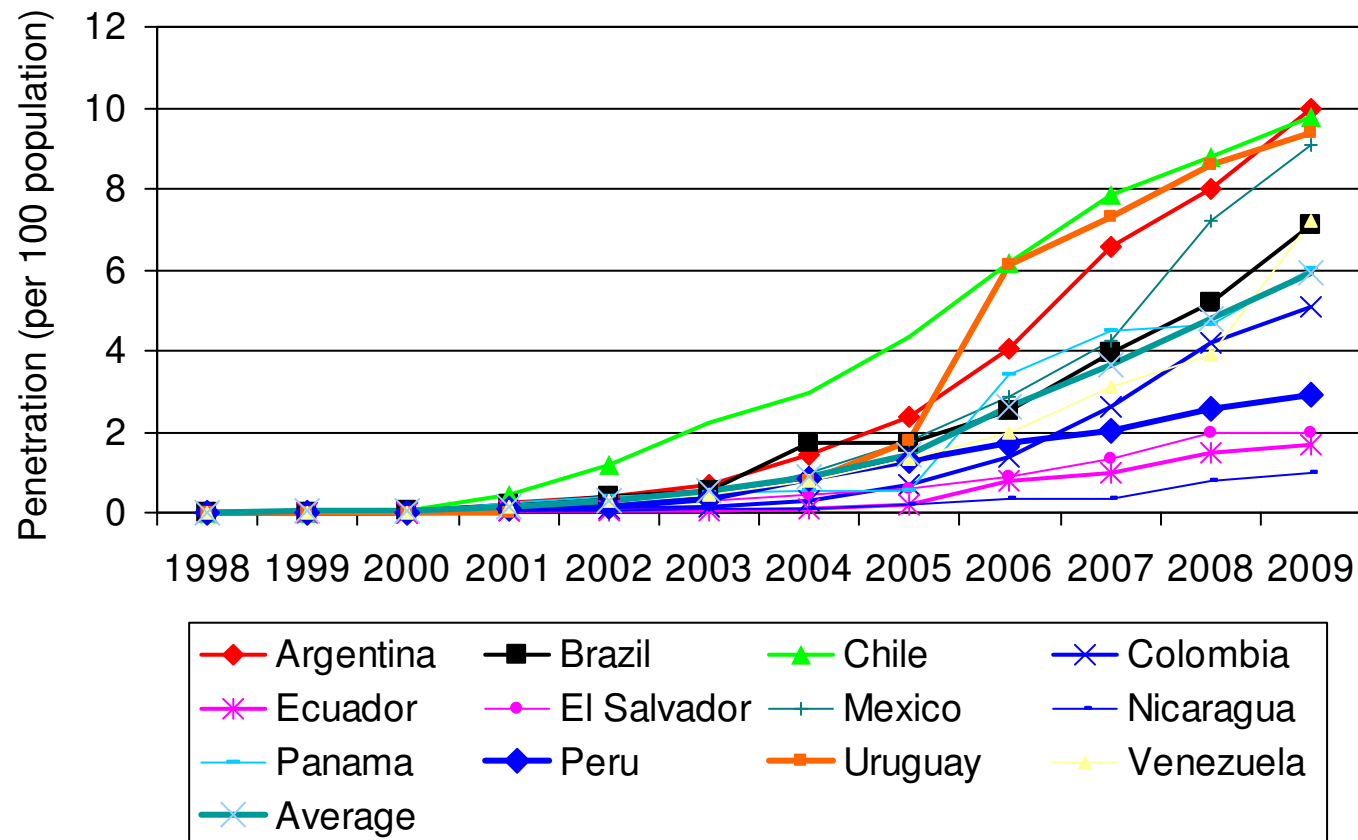


* Internet and PCs (2008)

Sources: ITU; Regulatory authorities; compiled by the author

Broadband growth year-to-year has been explosive since 2007, indicating the existence of unmet demand

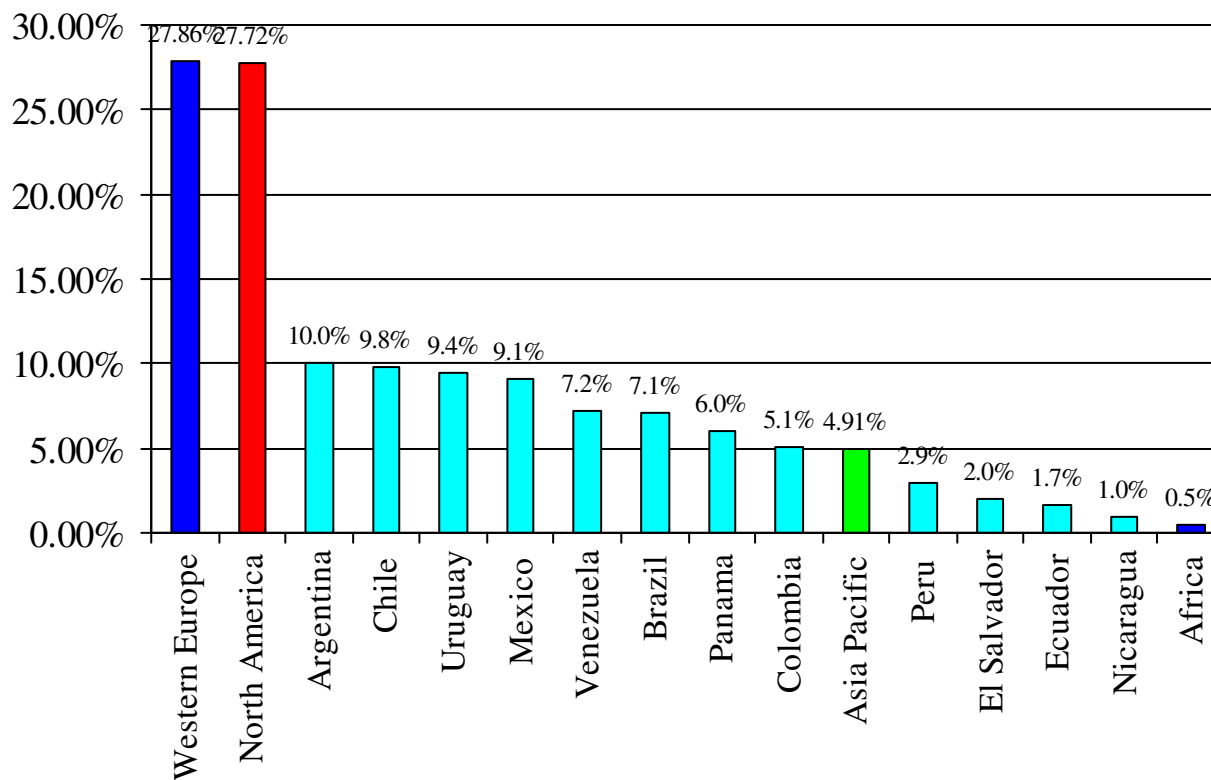
LATIN AMERICA LATINA: BROADBAND DIFFUSION (1998-2009)



Sources: ITU; regulatory authorities

However, broadband still needs to increase its penetration to reach the level of adoption that corresponds to the economic development of the region

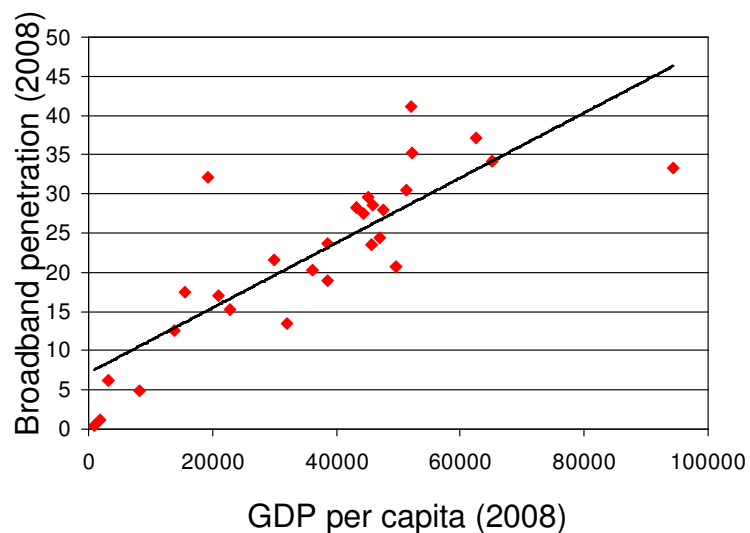
**BROADBAND COMPARATIVE PENETRATION (2009)
(PER 100 POPULATION)**



Sources: IDC; UBS; ITU; OECD; analysis by the author

The broadband demand gap requires an increase in 17 million lines in order to meet the needs of the Latin American economy

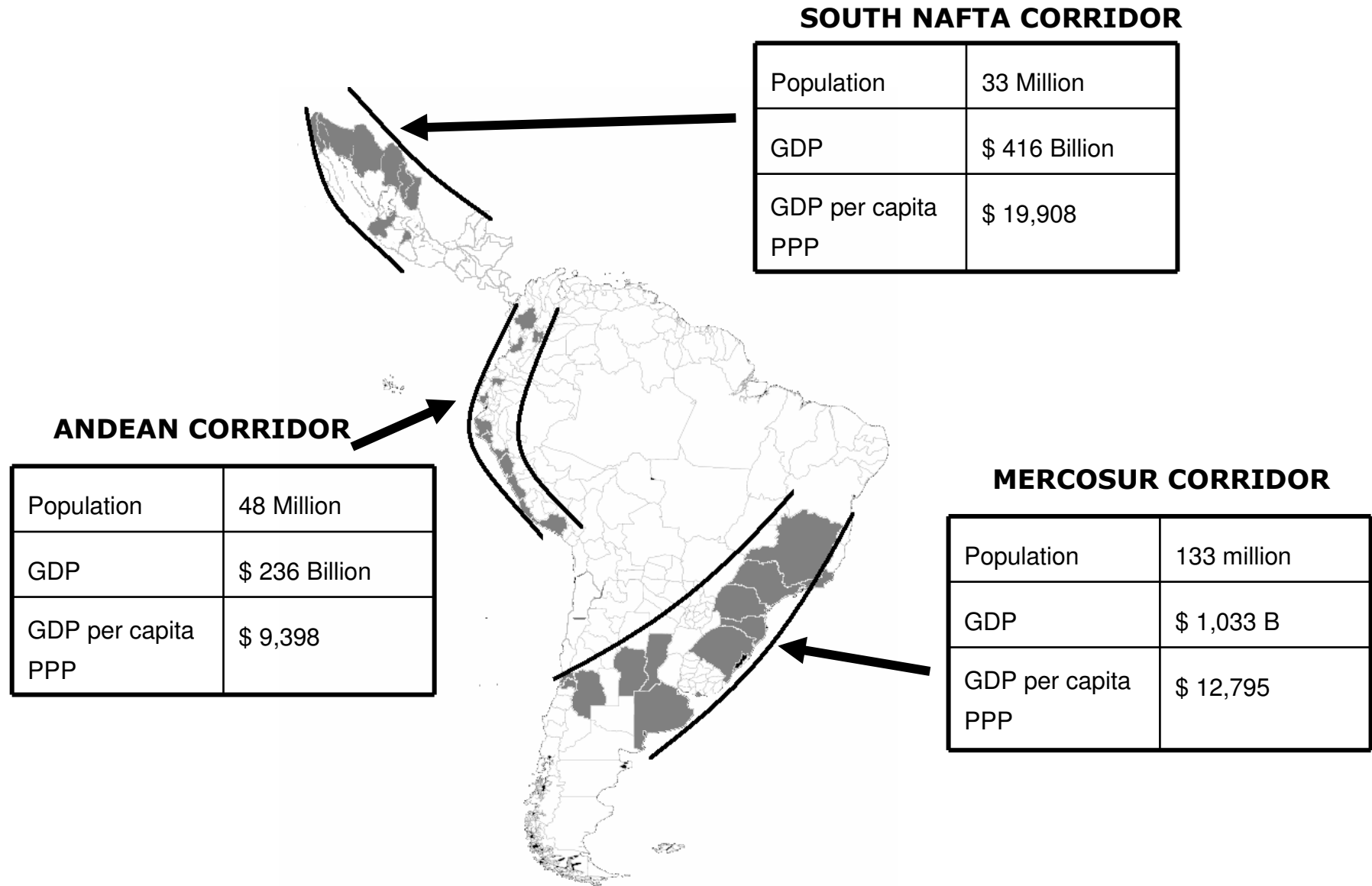
LATIN AMERICA: BROADBAND SUPPLY- DEMAND GAP



Sources: UBS; IDC; World Bank; Telegeography;
analysis by the author

| COUNTRY | NUMBER OF LINES (2009) | LINES DEMAND | GAP 2009 |
|---------------|------------------------|--------------|------------|
| Argentina | 4,256,194 | 4,411,047 | 154,853 |
| Bolivia | 113,750 | 721,520 | 607,770 |
| Brazil | 11,460,960 | 17,060,659 | 5,599,699 |
| Chile | 1,665,059 | 1,887,662 | 222,603 |
| Colombia | 2,240,000 | 4,071,423 | 1,831,423 |
| Costa Rica | 250,000 | 461,856 | 211,856 |
| Ecuador | 295,000 | 1,534,585 | 1,239,585 |
| El Salvador | 120,637 | 531,375 | 410,738 |
| Guatemala (e) | 35,000 | 1,130,304 | 1,095,304 |
| Honduras (e) | 1,000 | 573,431 | 572,431 |
| Mexico | 9,375,000 | 10,851,798 | 1,476,798 |
| Nicaragua | 55,000 | 429,739 | 374,739 |
| Panama | 204,335 | 343,583 | 139,248 |
| Paraguay | 103,000 | 506,060 | 403,060 |
| Peru | 813,200 | 2,514,315 | 1,701,115 |
| Uruguay | 317,010 | 373,288 | 56,278 |
| Venezuela | 1,860,730 | 3,105,228 | 1,244,498 |
| Total | 33,165,875 | 50,507,873 | 17,341,998 |

In addition, there is a need to deploy technology in the most advanced geographic centers in order for them to reach the levels of industrialized countries

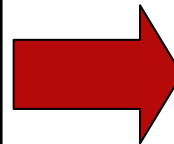


Finally, there is a need to accelerate ICT adoption among small and medium enterprises

The SMEs are the continent's economic engine...

...and they are still underserved by ICT

| | Contribution to: | | |
|-------------|------------------|------|---------|
| | Employment | GDP | Exports |
| Argentina | 75 % | 60 % | 25 % |
| Brazil | 67 % | 28 % | 23 % |
| Chile | 80 % | 17 % | 12 % |
| Colombia | 50 % | 40 % | 20 % |
| Ecuador | 60 % | 50 % | 25 % |
| El Salvador | 66 % | 44 % | ... |
| Mexico | 75 % | 52 % | 26 % |
| Peru | 70 % | 40 % | 25 % |



| | PCs | Internet | Broadband |
|-------------|------|----------|-----------|
| Argentina | 43 % | 97 % | 75 % |
| Brazil | 69 % | 54 % | 8.3 % |
| Chile | 74 % | 66 % | 60 % |
| Colombia | 37 % | 88 % | 17 % |
| Ecuador | 30 % | 47% | |
| El Salvador | 47 % | 36 % | 50 % |
| Mexico | 87 % | 73 % | 45 % |
| Peru (*) | 27 % | 23 % | 15 % |

(*) Includes microenterprises

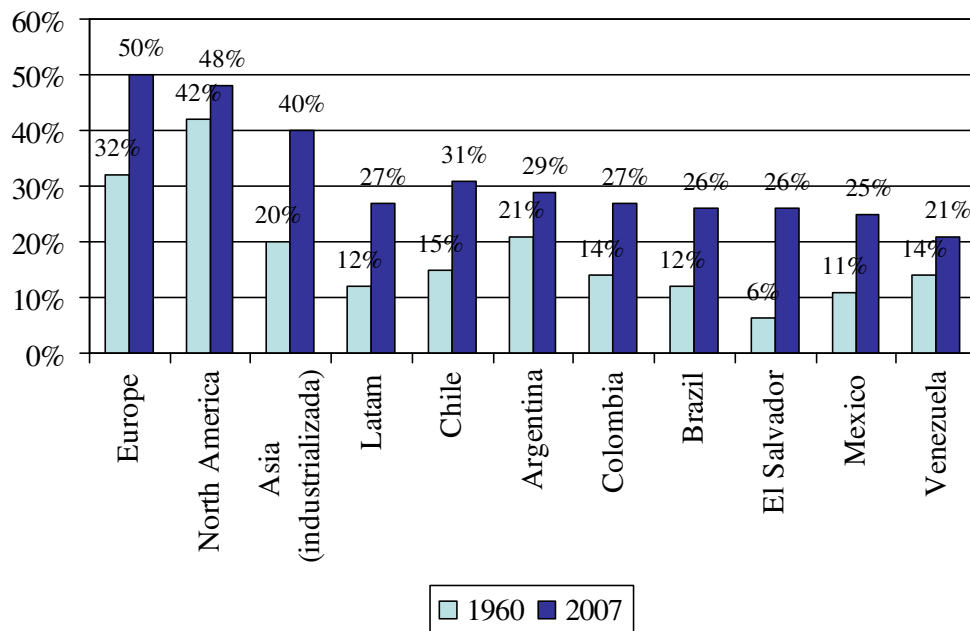
Source: Katz (2009)

This quantitative and qualitative leap is critical to meet three economic imperatives

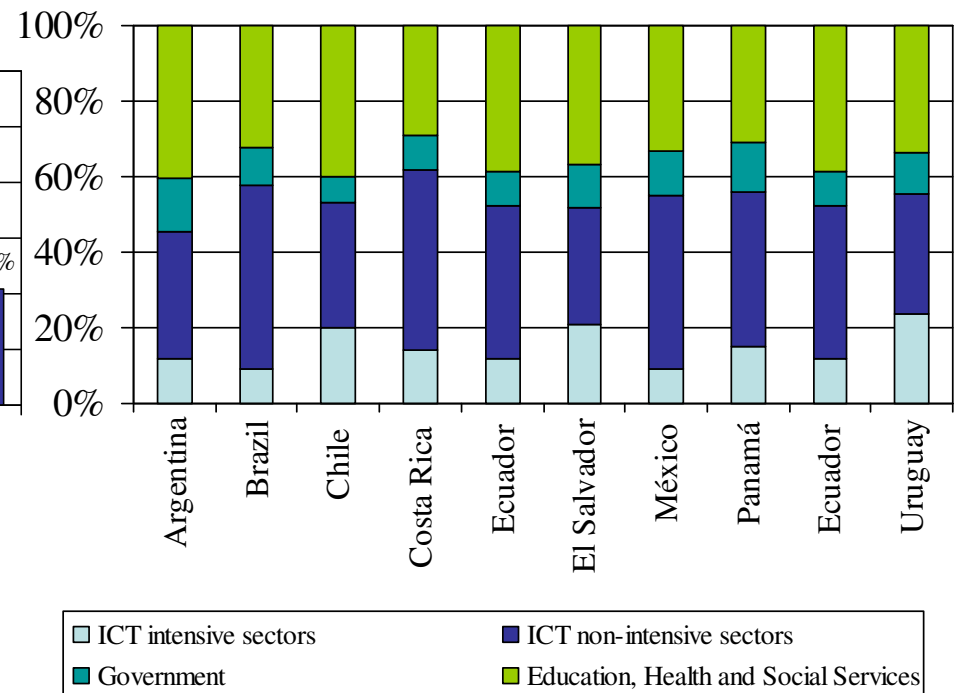
- The Latin American economies are becoming more information-intensive
- ICT represent a critical factor to increase the added value of small and medium enterprises
- ICT, particularly broadband, have been identified as a key factor in employment creation

The information sector of Latin American economies has grown substantially in the last decades

Latin America: Information workers as a percentage of the economically active population (1960-2007)



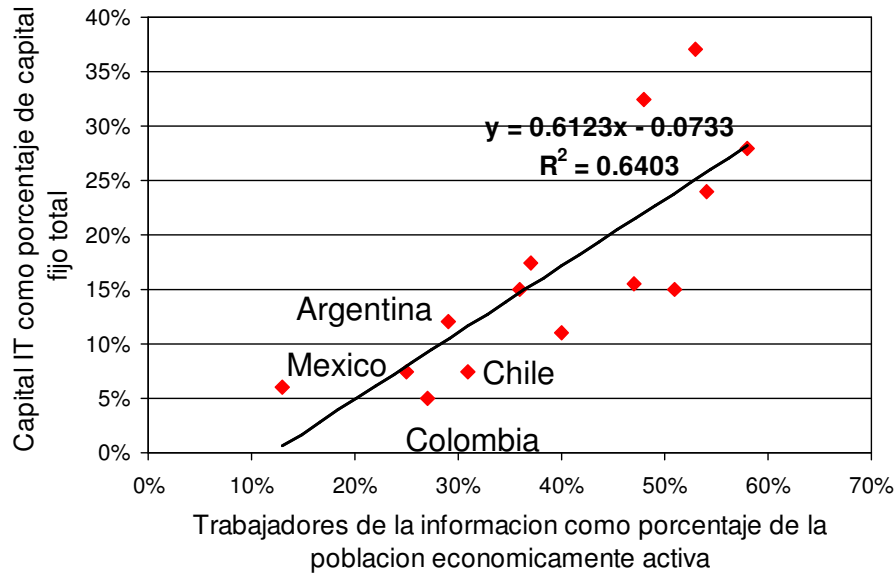
Latin America: Composition of Information Workforce (2007)



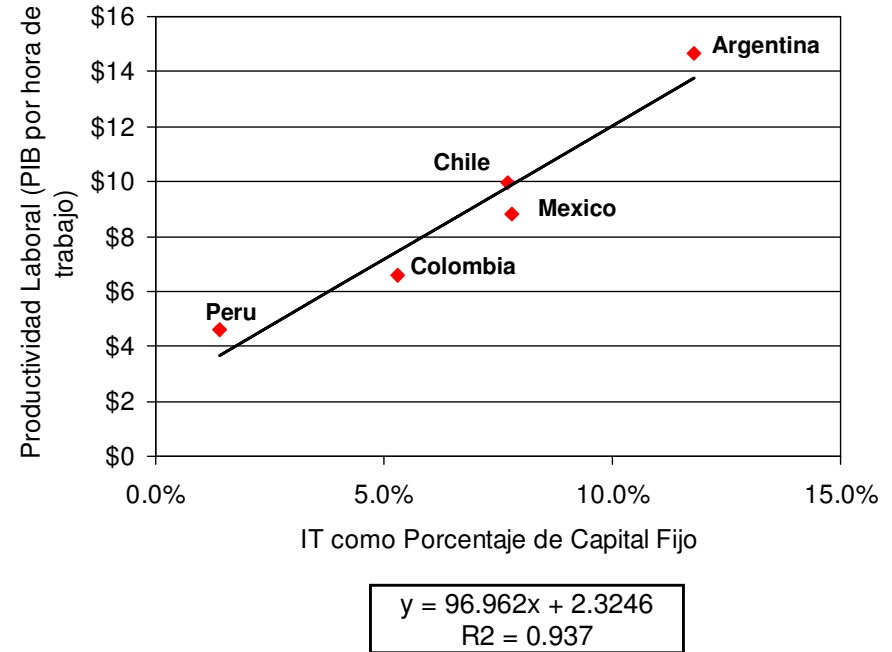
Sources: ILO Laborsta; analysis by the author

The size of the information workforce in Latin America is driving the direct relationship between ICT investment and labor productivity

América Latina: Sector Información e Inversión en Tecnologías de Información (2007)



América Latina: Relación entre Inversión de Capital TI(*) y Productividad (2001)



ICT capital investment contributed to 0.62 % of Chilean economic growth between 1990 and 2004 and 0.21% of economic growth in Brazil between 1995 and 2004

To sum up, the Latin American challenge is to increase broadband penetration combined with all other ICT platforms to promote economic growth and enhance productivity

- Latin America lags in the diffusion of broadband relative to its level of economic development
- High level estimates indicate a gap amounting to 17 million broadband lines
- The challenge remains to increase adoption of broadband not only in the aggregate but also in those regions and sectors that are the continent's economic engines (key geographic corridors, small and medium enterprises)
- Achieving this objective is not discretionary given the structural transformation undergoing Latin American economies: a transition to information intensive production contexts

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1. **The progress and success in Latin American ICT deployment to date**
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4. **The role of public policy**

The counter-cyclical value of ICT works at two levels

INFRASTRUCTURE DEPLOYMENT EFFECTS

- **Direct effects:** employment (construction, telecommunications and engineering) and output generated in the short term due to deployment of networks
- **Indirect effects:** employment (steel, electrical equipment, professional services) and output generated by indirect spending triggered by direct effects as a result of sector interrelationships
- **Induced effects:** employment (consumer electronics, retailing) and output generated by household spending as a result of income triggered by direct and indirect effects

POSITIVE EXTERNALITIES

- **Productivity:** diffusion of more efficient business processes (supply chain optimization, marketing of excess inventories) enabled by adoption of ICT platforms
- **Innovation:** acceleration of innovation rate resulting from the adoption of applications and broadband services (e-commerce, distance learning, social networks, mobile payment systems)
- **Value chain recomposition:** attraction of employment from other regions as a result of enhancing the capacity of processing information and providing remote services (outsourcing, call centers, development zones)

Network construction effects and multipliers are significant

NETWORK CONSTRUCTION EFFECT OF BROADBAND

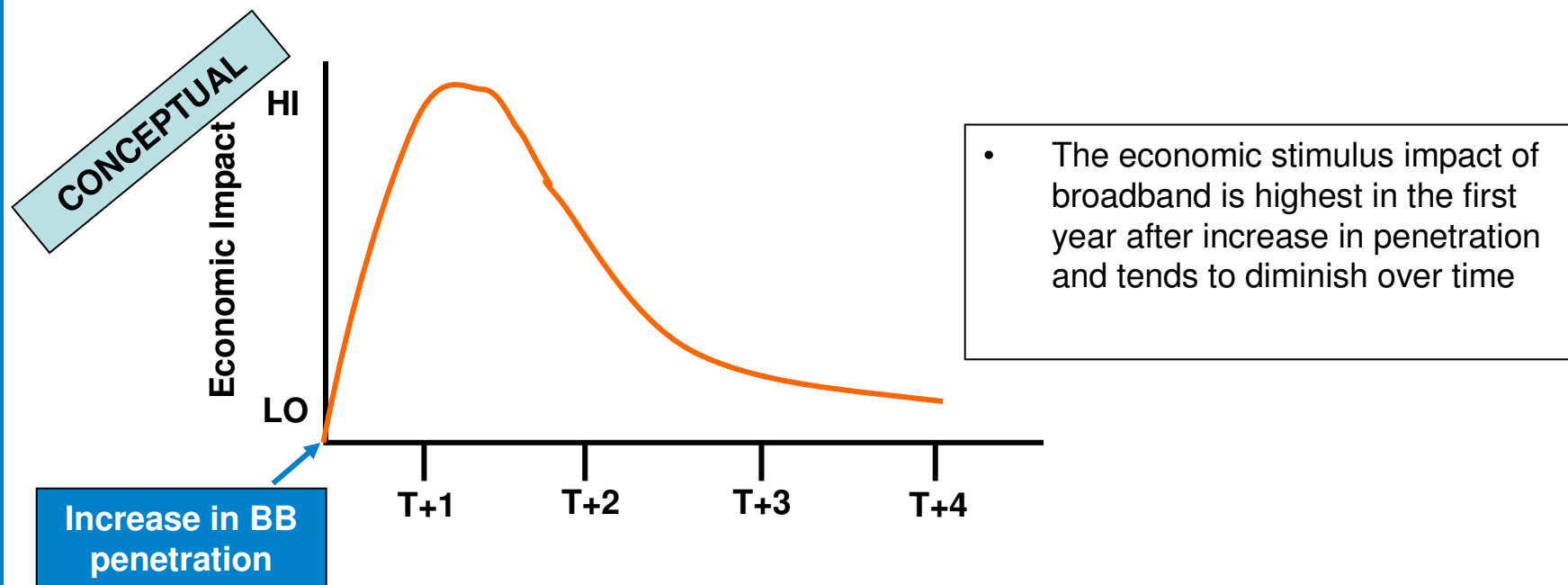
| COUNTRY | STIMULUS INVESTMENT (USD billion) | NETWORK DEPLOYMENT JOBS ESTIMATE | | | | MULTIPLIERS | |
|----------------|-----------------------------------|----------------------------------|----------|---------|----------|-------------|--------------|
| | | DIRECT | INDIRECT | INDUCED | TOTAL | TYPE I (*) | TYPE II (**) |
| UNITED STATES | \$ 6,390 | 37,000 | 31,000 | 60,000 | 128,000 | 1.83 | 3.42 |
| SWITZERLAND | ~\$ 10,000 | ~80,000 | ~30,000 | N.A. | ~110,000 | 1.38 | N.A. |
| GERMANY | \$ 47,660 | 281,000 | 126,000 | 135,000 | 542,000 | 1.45 | 1.94 |
| UNITED KINGDOM | \$ 7,463 | 76,500 | 134,500 | | 211,000 | | 2.76 |
| AUSTRALIA | \$ 31,340 | | | | ~200,000 | | |

Sources: Katz, R. and Suter, S. (2009). *Estimating the economic impact of the US broadband stimulus plan*, Columbia Institute for Tele-Information working paper; Katz, R., P. Zenhäusern, S. Suter, P. Mahler and S. Vaterlaus (2008). *Economic Modeling of the Investment in FTTH in Switzerland*, unpublished report; Libenau, J., Atkinson, R. (2009) *The UK's digital road to recovery. LSE and ITIF*; Australian government. Katz, R., S. Vaterlaus, P. Zenhäusern, S. Suter and P. Mahler (2009). *The Impact of Broadband on Jobs and the German Economy*; Columbia Institute for tele-Information working paper

(*) (Direct + indirect)/direct
 (**) (Direct + indirect + induced)/direct

In addition, the economic impact of broadband in terms of network externalities has also been found to be significant

- Our analysis for industrialized countries (e.g. Germany) estimates the impact of increase in broadband penetration on rate of economic growth
 - Due to the effect of high broadband penetration growth in 2001, time intervals were calculated for three stages: 2000-1, 2001-2, 2002-3
 - In addition, GDP and employment data was adjusted through an Hodrick-Prescott filter to time series in order to normalize for trends and business cycle effects
- Aggregate results for the whole nation indicate that broadband penetration has a significant short-term effect on economic growth



In Latin America, when controlling for educational level and starting point of development, 1% increase in broadband penetration yields 0.0178 point contribution to GDP growth

BROADBAND IMPACT ON ECONOMIC GROWTH IN LATIN AMERICA

Avrg GDP growth (04-08)= β_1 *GDP/Capita 2000 + β_2 *(Investment/GDP)04-08 + β_3 *Tertiary Education Lev. + β_4 *(Δ broadband)03-04

| GDP growth | Coefficient | Standard error | T-statistic | P>[t] | 95% Conf. interval |
|--------------------------|-------------|----------------|-------------|-------|--------------------|
| GDP per capita 2000 | -.0006045 | .0002142 | -2.82 | 0.011 | -.0010528 |
| Investment/GDP | -.0006496 | .108927 | -0.01 | 0.995 | -.2286365 |
| Tertiary education level | .1900042 | .0670932 | 2.83 | 0.011 | .0495766 |
| Broadband penetration | .0177989 | .0061606 | 2.89 | 0.009 | .0049046 |
| Constant | 7.989611 | 4.063328 | 1.97 | 0.064 | -.5150321 |

| | |
|------------------------|--------|
| Number of observations | 24 |
| F(4,14) | 14.34 |
| Prob>F | 0.0000 |
| R2 | 0.4311 |
| Root MSE | 4.7802 |

INTERPRETATION

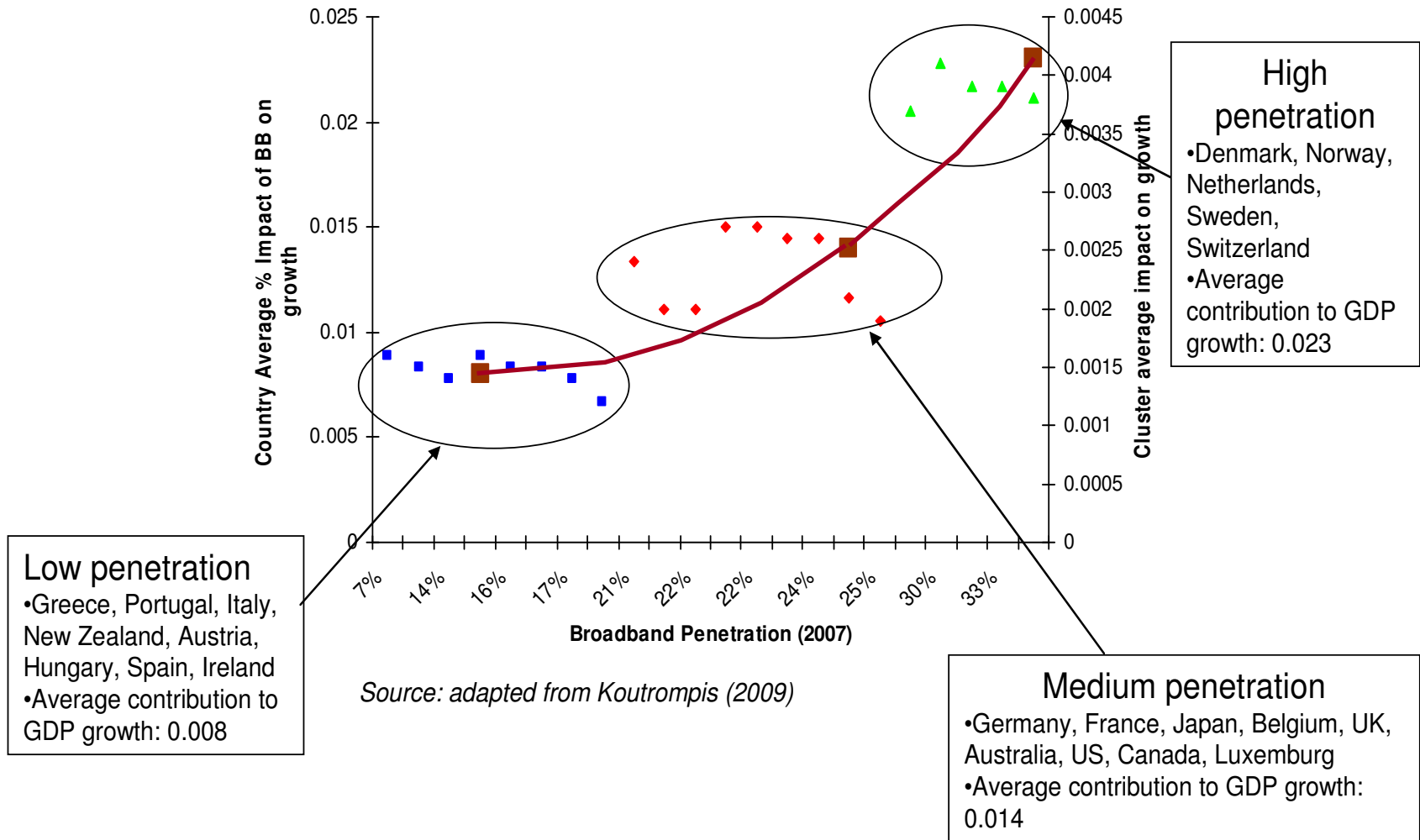
- The difference in impact with the World Bank study could be partially explained by the fact that this study includes countries with higher broadband penetration levels, which have reached higher impact
- The statistical relationship of investment is not significant because this has an impact with a longer time lag
- Tertiary education is used to explain country differences in terms of human capital

According to this model, broadband is contributing between \$6.7 and \$14.3 billion of the Latin American GDP

- The economic growth of Latin America and the Caribbean between 2009 and 2010 according to the IMF projections will be of 3.4%, generating a GDP of US 3,925 billion
- According to our model, the elasticity of broadband with regard to GDP growth is 0.017% for 1 % increase in penetration for a period without economic crises (2004-8)
- Assuming the possibility of bias (and given the lack of time series) we are inclined to consider as a lower bound the elasticity calculated by Koutrompis (2009) for countries with broadband penetration lower than 20%: 0.008 %
- According to these two estimates, broadband growth (at a prorated average of 37% in the last year) has contributed between \$ 6.7 billion and \$ 14.3 billion of GDP
- This impact includes direct effects (in the telecommunications industry) and indirect (spillover effects), including not only the incremental impact but also the preservation of economic growth

It is also expected that, based on the OECD experience, an increase in broadband penetration will accentuate the economic impact of broadband

ACCELERATING ECONOMIC IMPACT OF BROADBAND



We also estimated the impact of broadband on job creation in Chile

VARIABLES UTILIZED TO MEASURE BROADBAND IMPACT ON CHILEAN EMPLOYMENT

| Type of variable | Data set (by quarter) | Source | Rationale |
|---------------------------------------|---------------------------------------|----------------------------------|--------------------------------------|
| Occupation | Occupation rate (2002-9) | Regional Institute of Statistics | Dependent variable |
| Control for labor intensity of region | Economic activity index (2001-9) | Regional Institute of Statistics | Measure for starting point of growth |
| Broadband penetration growth | Broadband penetration growth (2002-9) | Subtel | Independent variable |

According to the model, 1 percentage point increase in broadband penetration results in an increase of 0.18 points in the occupation rate

BROADBAND IMPACT ON EMPLOYMENT IN CHILE (12 Regions 2002-9)

Employment Rate = β_1 * Economic activity index + β_2 * (Δ broadband penetration) + Constant

| Occupation Rate | Coefficient | Standard error | T-statistic | P>[t] | 95% Conf. interval |
|-----------------------------------|-------------|----------------|-------------|-------|--------------------|
| Economic activity index (-1) | 0.0003509 | 0.0000595 | 5.90 | 0.000 | .0002338 |
| Broadband penetration growth (-1) | 0.0018118 | 0.0004708 | 3.85 | 0.000 | .0008853 |
| Constant | 0.8682527 | 0.0079638 | 109.03 | 0.000 | .85258283 |

| Number of observations | |
|------------------------|--------|
| F(4,14) | 324 |
| Prob>F | 0.0000 |
| F(2,310) | 60.89 |
| R2 | 0.2820 |

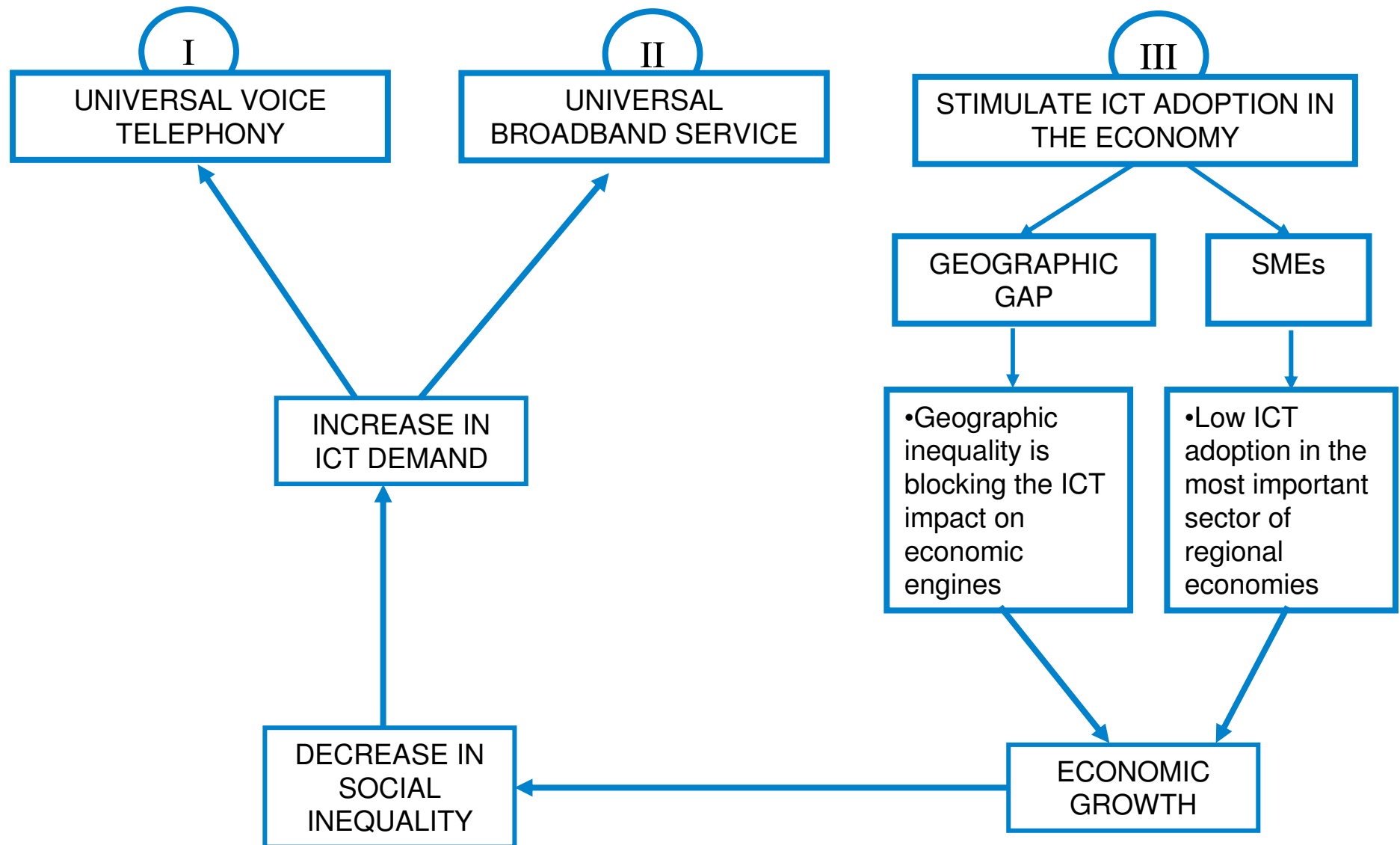
INTERPRETATION

- The data set includes quarterly indicators for the 12 regions of Chile between 2002 and 2009 (the Metropolitan Region is excluded because it does not provide quarterly data)
- The specific characteristics of each region have an impact on the labor market and are controlled by the fixed effects of the panel data

According to the Chilean model, broadband has contributed to the creation of 114,500 jobs in this country

- With an employment rate of 93%, the Chilean workforce amounts to 6,500,000 individuals
- From this percentage, broadband has contributed to 0.18 points in the occupation rate for each 1% incremental penetration
- Chile has reached a broadband penetration of 9.78%, which determines that, at the national level, broadband has contributed to 1.76 percentage points in the national employment rate
- This results in 114,500 jobs between direct and indirect jobs

In addition, addressing the economic penetration of ICT could achieve an important impact in tackling the equity challenge



To sum up, ICT have significant counter-cyclical impacts

- The deployment of networks have important direct, indirect and induced employment and output effects: multiplier effects range between 1.94 to 3.42 in industrialized countries
- Once deployed, broadband networks can achieve significant effects: in Latin America, we estimated that 1% increase in broadband penetration yields 0.0178 point contribution to GDP growth
- Furthermore, broadband can also contribute to employment creation: we estimated that in the case of Chile broadband has contributed to 0.18 points in the occupation rate for each 1% incremental penetration
- Finally, the diffusion of ICT will have additional social impact in contributing to tackle the economic inequality challenge

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To achieve economic impact, it is important to put in place six public policy initiatives (1/2)

| POLICY | DETAILS |
|--|---|
| 1. Development of comprehensive ICT promotion policies | <ul style="list-style-type: none"> • Develop national plans supported by a strategic vision for the sector • Clarify all strategies oriented to the development of the ICT production sector, considering the positive spillover effects on the economy as well as the potential negative impact on innovation • Recognize the role of the state not only as a regulator and planner, but also as an implementer of ICT promotion programs |
| 2. Implementation of ICT training programs | <ul style="list-style-type: none"> • Modify the ICT training paradigm with the consequent qualitative (type of education) and quantitative (volume of graduates) change • Implement training programs aimed at building awareness of policy makers around the economic impact of ICT • Create programs that promote the linkage between tertiary education, research and production |
| 3. Accelerate the deployment of basic infrastructure based on public-private partnerships | <ul style="list-style-type: none"> • Emphasize ICT deployment in economic corridors • Accelerate fixed and mobile broadband deployment • Ensure service coverage and network construction through public and private investment • Emphasize development of mobile platforms to address market failures in voice telephony |

To achieve economic impact, it is important to put in place six public policy initiatives (2/2)

| POLICY | DETAILS |
|--|---|
| 4. Development of systems and methodologies aimed at monitoring the economic impact of ICT | <ul style="list-style-type: none"> • Improve gathering and diffusion of information related to the economic impact of ICT • Create the necessary instruments to measure ICT economic impact • Normalize performance metrics to allow comparison of development levels and regional impact |
| 5. Leverage the spillover effect of governments as primary ICT users | <ul style="list-style-type: none"> • Establish a minimum level of adoption of tools and ICT platforms by state and municipal governments • Coordinate administrative decentralization policies with ICT adoption by municipal governments • Leverage the purchasing power of the State as a tool to stimulate ICT adoption by Small & Medium Enterprises |
| 6. Develop a program aimed at stimulating the adoption of ICT by Small and Medium Enterprises | <ul style="list-style-type: none"> • Adopt tax incentive policies to promote ICT adoption by SMEs • Promote consulting services to facilitate ICT adoption • Stimulate ICT suppliers to offer products and services tailored to the needs of SMEs |

