

World Telecommunication/ICT Indicators Meeting

Geneva, Switzerland, 10 – 11 February 2005

## Application of WT/ICT Indicators in Telecom Network Planning

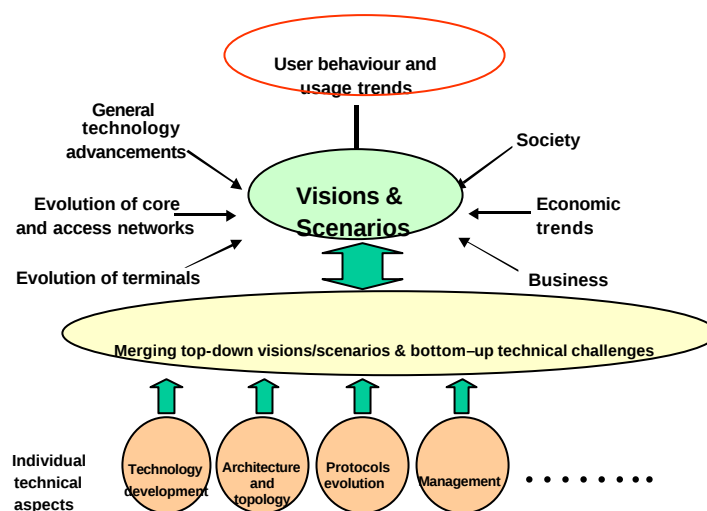
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International Teletraffic Congress – ITC  
Higher Collage of Telecommunications and Post, Bulgaria

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### Networks Evolution Factors



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## Application of the World Telecommunication/ ICT indicators in Telecom Network Planning

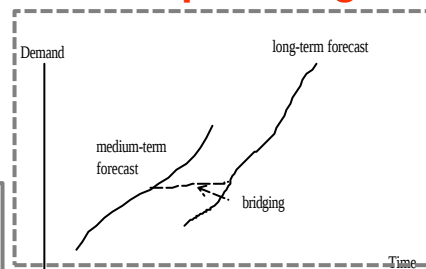
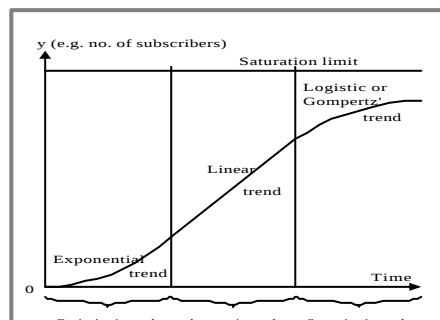
### To evaluate:

- user potential for Fixed and Cellular mobile network
- impact of the Cellular mobile network development on the Fixed network

applying data from ITU World Telecommunication Indicators Database

### Long term / strategic network planning :

Based on long-term forecasting - for urban, sub areas, populated places, etc.



Demand/service forecasting uses different methods, including trend methods based on saturation limit

Problem: how to define a saturation limit

## Fixed network users potential

Highly developed countries (close to saturation):

| Country                  | Population (in thousands) | Teledensity [%] | Average house-hold size | Teledensity per house-hold [%] | Percent of residential lines |
|--------------------------|---------------------------|-----------------|-------------------------|--------------------------------|------------------------------|
| Australia                | 19,157                    | 54,23           | 2,64                    | 97,0                           | 75,0                         |
| Canada                   | 30,750                    | 62,89           | 2,65                    | 97,0                           | 63,9                         |
| France                   | 58,892                    | 56,60           | 2,46                    | 97,0                           | 69,2                         |
| Germany                  | 82,260                    | 65,87           | 2,16                    | 98,5                           | 77,0                         |
| Italy                    | 57,298                    | 48,40           | 2,71                    | 96,9                           | 79,2                         |
| Japan                    | 126,919                   | 55,83           | 2,70                    | -                              | 76,1                         |
| New Zealand              | 3,831                     | 44,77           | 2,91                    | 96,0                           | 78,5                         |
| Republic of Korea        | 47,300                    | 47,24           | 3,04                    | 91,8                           | 74,1                         |
| Spain                    | 40,600                    | 42,91           | 3,25                    | 90,3                           | 83,5                         |
| Sweden                   | 8,881                     | 73,56           | 2,22                    | 100,0                          | 67,9                         |
| Switzerland              | 7,204                     | 74,42           | 2,39                    | 99,6                           | 68,0                         |
| United Kingdom           | 59,766                    | 59,08           | 2,38                    | 95,0                           | 71,0                         |
| United States of America | 275,130                   | 62,13           | 2,58                    | 95,3                           | 75,4                         |

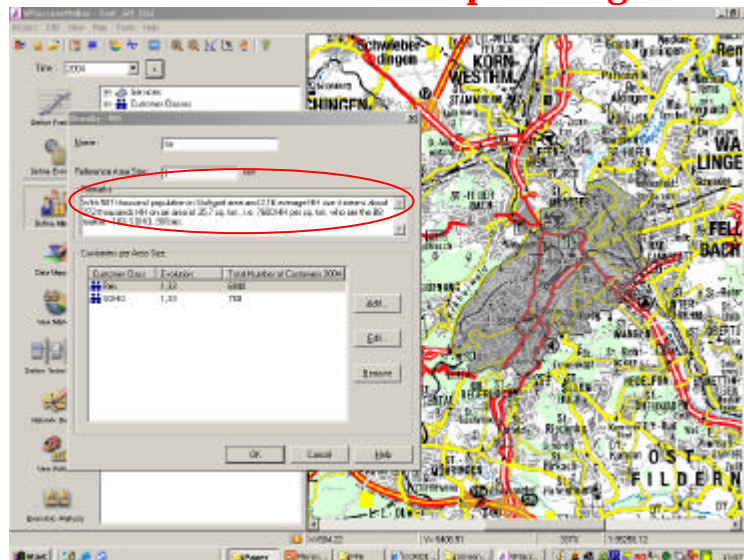
- teledensity per house-hold  
about 100%

- ratio residential to business  
from 2 / 1 to 3 / 1

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## Application of WT/ICT Indicators - NGN/BB access planning



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## Cellular mobile network users potential

Highly developed countries:

| Country           | Population<br>(in thousands) | Population<br>below 6 [%] | Population<br>above 80 [%] | Cellular mobile<br>Teledensity [%] |
|-------------------|------------------------------|---------------------------|----------------------------|------------------------------------|
| Australia         | 19,662                       | -                         | -                          | 71,9                               |
| Canada            | 31,414                       | -                         | -                          | 41,7                               |
| France            | 59,637                       | -                         | -                          | 69,60                              |
| Germany           | 82,537                       | -                         | -                          | 78,5                               |
| Italy             | 56,464                       | 4,5                       | 4,0                        | 101,8                              |
| Japan             | 127,440                      | -                         | -                          | 68,0                               |
| New Zealand       | 3,939                        | -                         | -                          | 64,8                               |
| Republic of Korea | 47,600                       | -                         | -                          | 69,4                               |
| Spain             | 40,683                       | 4,6                       | 3,8                        | 91,6                               |
| Sweden            | 8,943                        | 5,1                       | 5,0                        | 88,9                               |
| Switzerland       | 7,281                        | -                         | -                          | 84,3                               |
| United Kingdom    | 59,088                       | -                         | -                          | 84,1                               |
| United States     | 288,370                      | -                         | -                          | 54,3                               |

- teledensity above 90%, related to population brake down

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## Cellular mobile network users potential

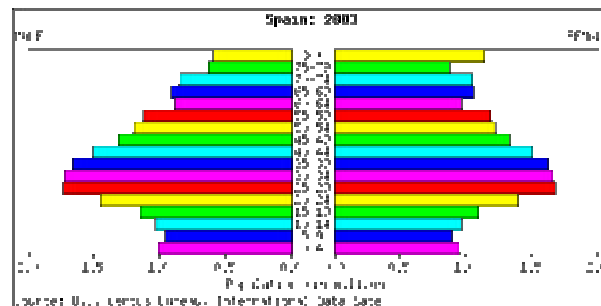
Case of Spain :

Cellular mobile teledensity from ITU database - 91.6 %

Correlation with  
population - brake  
down by age

4,6 % of population  
below 6

3,8 % of population  
above 80



- user potential of about 91,6 % expected

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## Application to evaluate users potential

### SUMMARY

#### Applied WT/ICT indicators:

- Main telephone lines per 100 inhabitants
- % of households with a telephone
- % residential main lines
- Cellular mobile telephone subscribers per 100 inhabitants
- Population
- Households

Evaluation of the users potential could be used to calculate saturation limits of trend methods for demand/service forecasting

## Impact of Cellular mobile on Fixed network - Fixed and Cellular mobile network growth

| Network growth<br>(compound annual growth<br>rate in %) | New telephone lines<br>added 1997-2002 | New mobile subscribers<br>added 1997-2002 |
|---------------------------------------------------------|----------------------------------------|-------------------------------------------|
| Low Income                                              | 12,5                                   | 76,5                                      |
| Lower Middle Income                                     | 14,4                                   | 67,6                                      |
| Upper Middle Income                                     | 4,4                                    | 57,4                                      |
| High Income                                             | 1,2                                    | 29,9                                      |
| Africa                                                  | 6,0                                    | 74,9                                      |
| Americas                                                | 2,3                                    | 28,7                                      |
| Asia                                                    | 11,8                                   | 43,3                                      |
| Europe                                                  | 2,6                                    | 46,3                                      |
| Oceania                                                 | 0,4                                    | 24,3                                      |
| WORLD                                                   | 5,3                                    | 40,2                                      |

CAGR is computed by  
the formula:

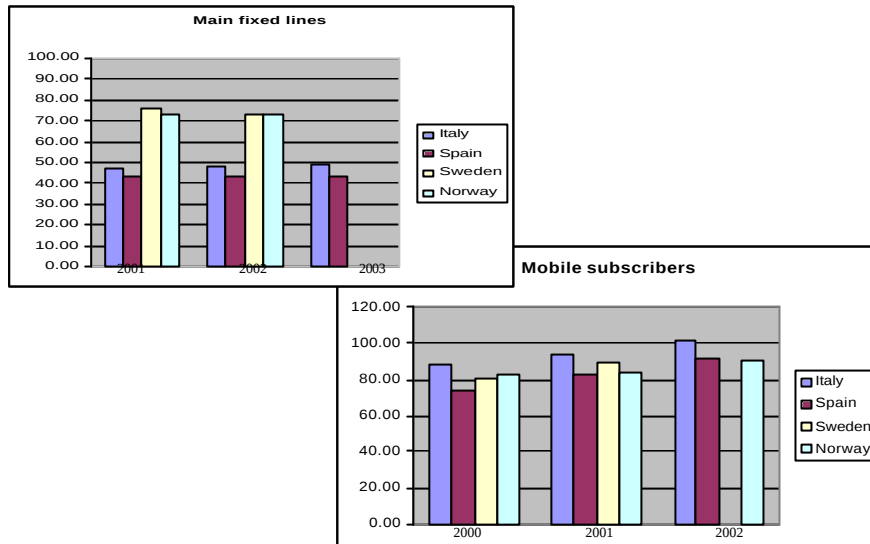
$$[(P_v / P_0)^{(1/n)}] - 1$$

Pv = Present value

P0 = Beginning value

n = Number of periods

## Fixed and mobile users growth (high income) :



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## Impact of Cellular mobile on Fixed network

Case of Italy:

1,4 % CAGR for fixed network ,  
35,2 % CAGR for mobile network  
for 1997-2002

Year 1997: fixed network teledensity 44,79 % ,  
residential lines 76,5 %  
cellular mobile teledensity 20.46 %

Year 2003: fixed network teledensity 48,40 % ,  
residential lines 79,2 % (2001)  
cellular mobile teledensity 101.76 %

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## **Impact of Cellular mobile on Fixed network :**

### **SUMMARY**

#### **Applied WT/ICT indicators:**

- **Main telephone lines per 100 inhabitants**
- **Cellular mobile telephone subscribers per 100 inhabitants**
- **% residential main lines**
- **compound annual growth rate CAGR**

**Both Fixed Network and Cellular mobile continue to expand, although with different pace, which confirms necessity of careful network planning**

## **Other possible applications of the WT/ ICT indicators in Telecom Network Planning**

#### **To evaluate:**

- **rural network evolution in developing countries/regions**
- **different new services possible with the NGN and their penetration**

**based on data for additional indicators in ITU World Telecommunication Indicators Database**

## Teledensity statistics for largest cities

|                     | Population as % of total | Large city teledensity [%] | Rest of country teledensity [%] | Overall teledensity [%] |
|---------------------|--------------------------|----------------------------|---------------------------------|-------------------------|
| Low Income          | 6,0                      | 9,26                       | 2,15                            | 2,54                    |
| Lower Middle Income | 5,8                      | 24,84                      | 7,30                            | 8,77                    |
| Upper Middle Income | 16,1                     | 30,77                      | 21,10                           | 22,94                   |
| High Income         | 10,8                     | 57,49                      | 54,83                           | 55,21                   |
| Africa              | 12                       | 6,42                       | 1,39                            | 1,99                    |
| Americas            | 13,6                     | 34,8                       | 21,72                           | 11,39                   |
| Asia                | 4,8                      | 25,97                      | 6,94                            | 7,84                    |
| Europe              | 10,9                     | 48,24                      | 30,19                           | 31,98                   |
| Oceania             | 17,8                     | 45,97                      | 36,77                           | 38,38                   |
| WORLD               | 7,7                      | 17,4                       | 25,25                           | 9,20                    |

1 : 4,3

1 : 3,4

1 : 1,5

1 : 1,05

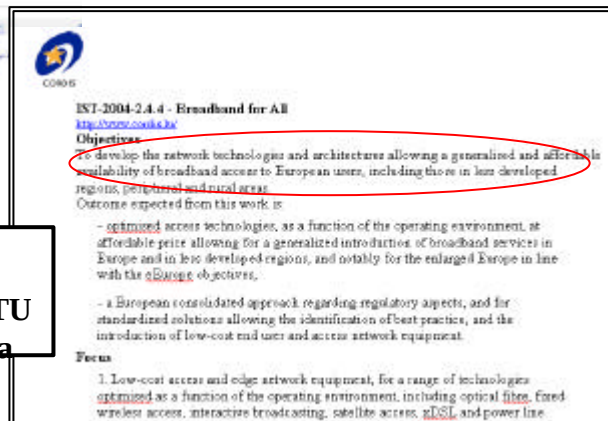
ITU WTID 2002

NOTE: Not available in the latest WTI database

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## Application of WT/ICT Indicators - EU Projects as CORDIS



Possible  
application of ITU  
Indicators data

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## Rural network evolution in developing countries/regions :

### SUMMARY

#### Applied WT/ICT indicators:

- Main telephone lines in largest city
- Population - Urban population (%), Population of largest city
- % digital main lines
- Teledensity statistics for largest cities

To be maintained also in the future and to add indicators for different services used in rural areas as key factor for their network development

## Different new services possible with the NGN

### Today Services :

#### Traditional

- Voice
- Data

#### Broadband

##### Business customers

- High speed Internet access
- LAN-to-LAN connectivity
- VPN
- E - commerce

##### Residential customers

- High speed Internet access
- On-line gaming

### Future Services :

- **Triple play** – offering voice, data, video using the same platform

*Introduction of a variety of new services and applications will be possible because of the open interfaces that are typical for NGN*

## IT density as bases for new services requiring PC/Internet access

Density statistics for Information technology :

|                        | Internet hosts per<br>10 000 inhabitants | Internet users per<br>10 000 inhabitants | PCs per 100<br>inhabitants |
|------------------------|------------------------------------------|------------------------------------------|----------------------------|
| Low Income             | 0,98                                     | 62,21                                    | 0,59                       |
| Lower Middle<br>Income | 4,32                                     | 264,94                                   | 2,45                       |
| Upper Middle<br>Income | 78,69                                    | 992,66                                   | 8,24                       |
| High Income            | 1 484,20                                 | 3 992,87                                 | 37,31                      |
| Africa                 | 3,38                                     | 84,89                                    | 1,06                       |
| Americas               | 1 332,97                                 | 2 164,28                                 | 26,57                      |
| Asia                   | 28,73                                    | 433,97                                   | 2,18                       |
| Europe                 | 191,47                                   | 1 804,54                                 | 17,94                      |
| Oceania                | 885,26                                   | 2 771,59                                 | 39,91                      |
| WORLD                  | 232,66                                   | 820,81                                   | 7,74                       |

Ratio Low Income/High Income : 1 : 64   1 : 15   1 : 63   1 : 15

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## Application for evaluation of different new services possible with the NGN

### SUMMARY

Available WT/ICT indicators, which could be used :

- DSL Internet subscribers
- % of homes with a Personal Computer
- % of homes with Internet
- Internet users per 100 inhabitants
- Internet users (estimated)
- Personal computers
- Cable modem Internet subscribers

Indicating availability of resources (PC, Internet)  
necessary for the new services and penetration of  
some broadband access technologies (DSL)

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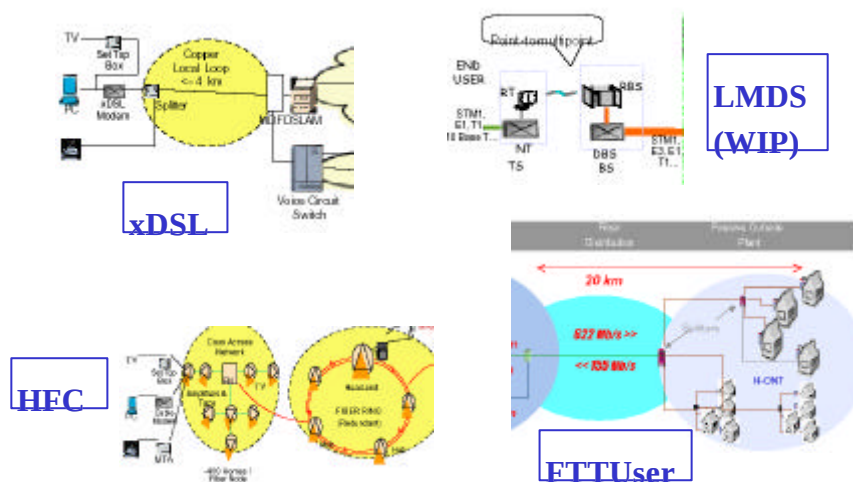
## Application for evaluation of different new services possible with the NGN

Other WT/ICT indicators, which could be needed :

To present all different broadband access technologies :

- HFC Internet (broadband access) subscribers
- Wireless Internet (broadband access) subscribers
- FTTH subscribers
- other broadband access technologies subscribers

## Technological alternatives for NGN Access



## **Application for evaluation of different new services possible with the NGN**

**Other WT/ICT indicators, which could be needed :**

**To present penetration of different services, e.g. :**

- **Voice subscribers/users ( % voice subscribers/users )**
- **High speed Internet users**
- **Video users**
- **On-line gaming users**
- **SMS/MMS users**

## **Application for evaluation of different new services possible with the NGN**

**Other WT/ICT indicators, which could be needed :**

**To present traffic volume of each service, e.g.:**

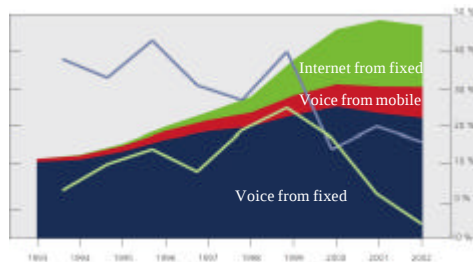
- **Voice traffic per user/subscriber fixed network**
- **Voice traffic per user/subscriber mobile network**
- **Internet traffic per user**
- **Video traffic per user**
- **On-line gaming traffic per user**
- **SMS/MMS traffic per user**

## Traffic per user for fixed line telephony and mobile telephony

Case of Norway:

|                                  | Trafikk fordelt på trafikkretninger<br>Traffic split on traffic directions |                    |        | Gjennomsnittlig varighet per samtale<br>Average duration per call |                    |       |
|----------------------------------|----------------------------------------------------------------------------|--------------------|--------|-------------------------------------------------------------------|--------------------|-------|
|                                  | Privat<br>Residential                                                      | Besøkt<br>Business | Total  | Privat<br>Residential                                             | Besøkt<br>Business | Total |
| Ordinære numre Ordinary numbers  | 45,5 %                                                                     | 61,2%              | 100,0% | 5,8                                                               | 7,5                | 4,6   |
| Abonnementlinje Access telephone | 2,5 %                                                                      | 11,0%              | 8,3%   | 2,4                                                               | 2,8                | 2,2   |
| Utlendte International           | 1,9 %                                                                      | 1,1%               | 2,3%   | 7,9                                                               | 1,8                | 5,3   |
| Besøkt nummer Business services  | 20,7 %                                                                     | 19,9%              | 27,3%  | 13,2                                                              | 7,3                | 11,2  |
| Andre numre Other numbers        | 14,8 %                                                                     | 4,8%               | 11,6%  | 5,2                                                               | 1,3                | 2,9   |
| Total                            | 100,0%                                                                     | 100,0%             | 100,0% | 7,0                                                               | 9,2                | 5,4   |

*Traffic minutes for fixed line telephony*



|                   | Trafikk fordelt på trafikkretninger<br>Traffic split on traffic directions |        | Gjennomsnittlig varighet per samtale<br>Average duration per call |      |
|-------------------|----------------------------------------------------------------------------|--------|-------------------------------------------------------------------|------|
|                   | 2001                                                                       | 2002   | 2001                                                              | 2002 |
| for fixed network | 95,5%                                                                      | 92,9%  | 1,17                                                              | 1,38 |
| for fixed network | 37,7%                                                                      | 34,1%  | 2,38                                                              | 2,17 |
| total             | 3,3%                                                                       | 4,2%   | 2,97                                                              | 3,13 |
| total             | 1,9%                                                                       | 1,4%   | 1,42                                                              | 1,38 |
| total             | 1,9%                                                                       | 1,5%   | 1,85                                                              | 1,78 |
| total             | 100,0%                                                                     | 100,0% | 1,53                                                              | 1,62 |

*Traffic minutes for mobile telephones*

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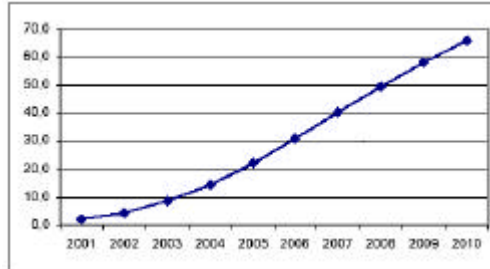
## Application for evaluation of different new services possible with the NGN

- It is understandable that collection of precise statistics per service will be quite difficult task, as far as big variety of the NGN services is expected, but such information will be very useful and ITU is in the unique position to be able to demand it.
- Another area, where ITU could try to assist his developing countries members is the *forecasting* of the telecom indicators.

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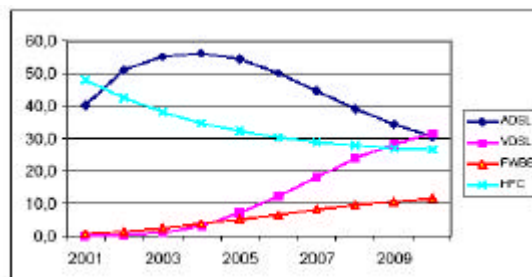
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## Broadband penetration and market share



*Broadband penetration forecasts for the residential market of West European countries*

*Market share evolution of ADSL, VDSL, FWBB (Fixed wireless broadband) and HFC/cable modem*



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## Company Forecast of Telecom Indicators - Example

|                                                           | 2000  | 2001  | 2002  | 2003  | 2004  | 2005  |
|-----------------------------------------------------------|-------|-------|-------|-------|-------|-------|
| No of Main Telephone Lines in Service (x)                 | 2,002 | 2,022 | 2,550 | 2,960 | 3,360 | 3,660 |
| No of Main Telephone Lines/100 Inhabitants                | 30.3  | 31.1  | 37.8  | 46.4  | 50.9  | 55.2  |
| No of Cellular Mobile Phone Subscribers (x)               | 619   | 1,560 | 2,546 | 3,500 | 3,400 | 3,750 |
| No of Mobile Phone Subscribers/100 Inhabitants            | 7.8   | 19.7  | 32.7  | 39.8  | 45.2  | 49.6  |
| No of Mobile Phone Subscribers/100 Fixed Line Subscribers | 21.4  | 63.0  | 86.3  | 103.0 | 116.4 | 126.5 |
| No of Internet Users (x)                                  | 400   | 605   | 670   | 850   | 1,246 | 1,220 |
| No of Internet Users/100 Inhabitants                      | 5.3   | 7.6   | 8.6   | 11.5  | 15.7  | 16.1  |
| No of Broadband Internet Subscribers (x)                  | 0     | 0     | 5     | 50    | 50    | 200   |
| No of Broadband Internet Subscribers/100 Inhabitants      | 0.0   | 0.0   | 0.0   | 0.3   | 0.7   | 2.6   |
| No of PCs (x)                                             | 361   | 430   | 470   | 540   | 590   | 620   |
| No of PCs/100 Inhabitants                                 | 4.5   | 5.3   | 6.0   | 7.0   | 7.7   | 8.3   |
| No of Pay TV Subscribers (x)                              | 0     | 0     | 1     | 23    | 110   | 306   |
| No of Pay TV Subscribers/100 Inhabitants                  | 0.0   | 0.0   | 0.0   | 0.3   | 1.3   | 4.0   |
| ICT market (US\$bn)                                       | 400   | 530   | 605   | 643   | 710   | 860   |
| ICT market/GDP (%)                                        | 4.0   | 3.9   | 4.0   | 4.1   | 4.3   | 5.0   |
| Exports of telecom equipment (US\$bn)                     | 3.1   | 3.3   | 2.9   | 3.4   | 4.2   | 4.3   |
| Imports of telecom equipment (US\$bn)                     | 35.7  | 33.0  | 29.5  | 32.0  | 36.0  | 36.5  |

**Possible ITU activity for developing countries**

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## **Analysis based on the World Telecommunication Indicators Database presented in ITU Network Planning Seminars/Workshops**

- *ITU Regional Seminar for the EUR and CIS Region on Network Planning Strategy for Evolving Network Architectures, Warsaw, October, 2003*
- *Colloque Sur La Nouvelle Génération de Réseaux (NGN), Tunisie Télécom en Collaboration avec l'UIT, Tunis, October, 2003*
- *ITU/BDT Arab Regional Workshop on "Wireless Network Evolution", Muscat, May, 2004*
- *ITU/ITC Regional Seminar on Network Evolution to Next Generation Networks and Fixed Mobile Convergence for CEE, CIS and Baltic States, Moscow, April, 2004*
- *Workshop on NGN Economics, ITU Centre of Excellence for Europe, Warsaw, October, 2004*

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Geneva, 10-11 February 2005 - 29

## **Application of ITU WT/ICT Indicators – different areas**

- *ITU-D Regional Seminars & Workshops*
- *ITU Center of Excellence Seminars & Workshops*
- *Presentations for telecom companies*
- *Lectures for university/college students on "Telecommunications Networks" and "Network Planning"*
- *Exercises/Demos for university/college students*

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Geneva, 10-11 February 2005 - 30