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**World Telecommunication/ICT Indicators Meeting**  
**Geneva, Switzerland, 15 – 17 January 2003**

## **Application of ICT Indicators in Network Planning**

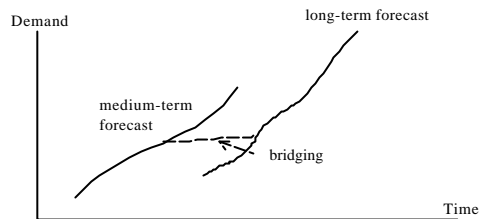
**Ignat Stanev**  
**International Teletraffic  
Congress – ITC**

### **Application of the world telecommunication/ ICT indicators in Network Planning**

- **to evaluate subscribers potential**
- **to evaluate the impact of Cellular mobile development**
- **to evaluate rural network development**

## Application to evaluate subscribers potential :

### Long term network planning (Target network)

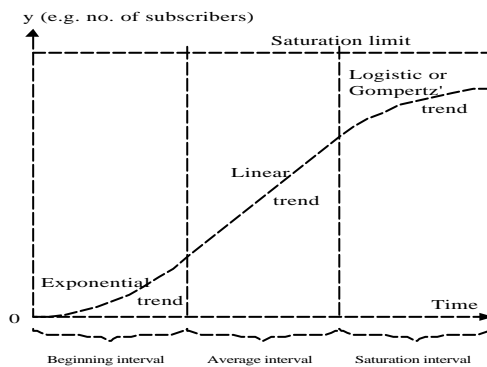


### Medium term network planning

### Short term network planning

## Application to evaluate subscribers potential :

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



Forecasting is done usually for urban sub areas, populated places, sites, etc.

**Problem:** how to define a saturation limit

## Application to evaluate subscribers potential :

| Network growth<br>(compound annual growth<br>rate in %) | New telephone lines<br>added 2000-2001 | New mobile subscribers<br>added 2000-2001 |
|---|--|---|
| Low Income  | 8,3                                    | 72,4                                      |
| Lower Middle Income                                     | 17,2                                   | 70,5                                      |
| Upper Middle Income                                     | 7,4                                    | 27,8                                      |
| High Income   | 0,3                                    | 14,8                                      |
| Africa  | 7,6                                    | 51,0                                      |
| Americas  | 2,1                                    | 21,2                                      |
| Asia  | 12,4                                   | 38,4                                      |
| Europe  | 2,4                                    | 20,0                                      |
| Oceania   | 0,2                                    | 26,7                                      |
| WORLD   | 6,0                                    | 26,7                                      |

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## Application to evaluate subscribers potential :

highly developed countries:

| Country                     | Population<br>(in<br>thousands) | Teledensity<br>[%] | Average<br>house-<br>hold size | Teledensity<br>per house-<br>hold [%] | Residential<br>lines<br>[%] |
|-----------------------------|---------------------------------|--------------------|--------------------------------|---------------------------------------|-----------------------------|
| Australia                   | 19,157                          | 52,46              | 2,64                           | 101,2                                 | 73,0                        |
| Canada                      | 30,750                          | 67,65              | 2,65                           | 98,2                                  | 63,4                        |
| France                      | 58,892                          | 57,93              | 2,46                           | 94,0                                  | 74,0                        |
| Germany                     | 82,260                          | 61,05              | 2,16                           | 95,5                                  | 77,0                        |
| Italy                       | 57,298                          | 47,39              | 2,71                           | 96,9                                  | 67,1                        |
| Japan                       | 126,919                         | 58,58              | 2,70                           | 116,8                                 | 73,9                        |
| New Zealand                 | 3,831                           | 49,99              | 2,91                           | 103,0                                 | 70,8                        |
| Republic of<br>Korea        | 47,300                          | 46,37              | 3,04                           | 105,5                                 | 74,6                        |
| Spain                       | 46,600                          | 42,12              | 3,25                           | 100,8                                 | 74,5                        |
| Sweden                      | 8,881                           | 68,20              | 2,22                           | 98,7                                  | 65,3                        |
| Switzerland                 | 7,204                           | 72,67              | 2,02                           | 99,6                                  | 68,0                        |
| United<br>Kingdom           | 59,766                          | 58,86              | 2,38                           | 93,0                                  | 70,1                        |
| United States<br>of America | 275,130                         | 69,97              | 2,58                           | 94,1                                  | 65,8                        |

- *teledensity per house-hold 100%*
- *ratio residential to business 3 to 1*

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## Application to evaluate subscribers potential :

### HIGHLY DEVELOPED COUNTRIES:

- ❖ Average household size in the highly developed countries  
- from **2,0** to **3,2**
- ❖ Ratio residential to business subscribers  
- about **3** to **1**
- ❖ Teledensity per house-hold in the highly developed countries  
- around **100%**

**Example:**

|  |          |
|--|----------|
| <b>Germany</b> : 50,7 Million (61,6%)        | - 61,05% |
| <b>Switzerland</b> : 4,76 Million (66%)      | - 72,67% |
| <b>United States</b> : 141,6 Million (51,5%) | - 69,97% |

## Application to evaluate subscribers potential :

### different countries in the world :

| Country      | Population (in thousands) | Teledensity [%] | Average household size | Teledensity per household [%] |
|--------------|---------------------------|-----------------|------------------------|-------------------------------|
| Argentina    | 37,032                    | 21,32           | 3,71                   | 68,7                          |
| Brazil       | 170,115                   | 18,18           | 3,78                   | 41,6                          |
| Bulgaria     | 8,225                     | 35,04           | 2,83                   | 84,6                          |
| China        | 1,295,330                 | 11,18           | 3,72                   | 33,9                          |
| India        | 1,012,396                 | 3,20            | 5,44                   | -                             |
| Indonesia    | 212,029                   | 3,14            | 4,34                   | 11,3                          |
| Iran         | 63,661                    | 14,90           | 4,59                   | 56,1                          |
| Kenya        | 30,669                    | 1,05            | 3,22                   | 1,4                           |
| Mexico       | 98,881                    | 12,47           | 4,60                   | 42,0                          |
| Morocco      | 28,351                    | 5,03            | 5,43                   | 21,0                          |
| Pakistan     | 141,256                   | 2,16            | 6,02                   | 9,8                           |
| Peru         | 25,662                    | 6,69            | 4,63                   | 25,0                          |
| Philippines  | 76,499                    | 4,00            | 5,01                   | 14,0                          |
| Russia       | 146,934                   | 21,83           | 2,83                   | 48,7                          |
| South Africa | 43,686                    | 11,36           | 4,39                   | 27,9                          |
| Sudan        | 31,095                    | 1,24            | 6,07                   | 5,7                           |
| Thailand     | 60,607                    | 9,23            | 3,87                   | 24,2                          |
| Turkey       | 65,700                    | 28,0            | 4,56                   | 97,0                          |
| Uganda       | 22,210                    | 0,28            | 4,85                   | 0,5                           |

#### Brazil:

54,8 Million (34 %)

#### China:

447 Million (35 %)

#### Russia:

64 Million (43 %)

#### South Africa :

12,4 Million (29 %)

## Application to evaluate subscribers potential :

Average household size for the selected countries –  
from 2,8 to 6,0

Example of calculated subscriber potential for  
some countries, based on the above estimation :

- Brazil: 54,8 Million (34 %) potential teledensity
- China: 447 Million (35 %) potential teledensity
- Russia: 64 Million (43 %) potential teledensity
- South Africa : 12,4 Million (29 %) potential teledensity

## Application to evaluate subscribers potential :

some LDCs :

| Country                  | Number of subscribers | Teledensity [%] | Average household size | Teledensity per household [%] |
|--------------------------|-----------------------|-----------------|------------------------|-------------------------------|
| Angola                   | 96,350                | 0,78            | 5,1                    | -                             |
| Eritrea                  | 27,375 *              | 0,68            | 5,0                    | 1,8                           |
| Ethiopia                 | 194,494               | 0,30            | 4,2                    | 0,7                           |
| Guinea                   | 44,046                | 0,55            | 4,2                    | 0,6                           |
| Lesotho                  | 23,144 *              | 1,00            | 5,2                    | 2,0                           |
| Malawi                   | 41,362 *              | 0,37            | 7,9                    | 1,2                           |
| Myanmar                  | 229,320               | 0,48            | 5,0                    | -                             |
| Tanzania                 | 150,141               | 0,45            | 5,5                    | 1,0                           |
| Solomon Islands          | 7,860                 | 1,95            | 7,1                    | 2,0                           |
| * only fixed subscribers |                       |                 |                        |                               |

Angola:  
3,45 Million (26 %)

Myanmar:  
13,1 Million (27 %)

Tanzania:  
8,2 Million (23 %)

## **Application to evaluate subscribers potential :**

### **CONCLUSION**

**Demand/service forecasting with trend methods could use the proposed evaluation of the subscribers potential to calculate saturation limits**

**Subscribers potential is in the developing and the least developed countries, as far as the highly developed countries are already close to saturation**

## **Application to evaluate the impact of Cellular mobile development :**

**The impact of the Cellular mobile development on the teledensity of the PSTN is based on the statistics for:**

- ❖ **average PSTN teledensity**
- ❖ **percentage of residential lines**
- ❖ **Cellular mobile Teledensity**

**The compound annual network growth of the telephone lines and the mobile subscribers could also serve as indicator**

## Application to evaluate the impact of Cellular mobile development :

highly developed countries - data from 1997 :

| Country           | Population | PSTN Teledensity | Residential lines | Cellular mobile Teledensity |
|-------------------|------------|------------------|-------------------|-----------------------------|
| Australia         | 18,532     | 50,45            | 72,0              | 24,71                       |
| Canada            | 30,287     | 60,95            | 67,4              | 14,23                       |
| France            | 58,607     | 57,5             | 74,0              | 9,99                        |
| Germany           | 82,207     | 54,98            | 75,8              | 10,09                       |
| Italy             | 57,520     | 44,68            | 76,5              | 20,46                       |
| Japan             | 126,166    | 47,86            | 70,0              | 30,33                       |
| New Zealand       | 3,789      | 48,57            | 77,0              | 14,94                       |
| Republic of Korea | 46,000     | 44,4             | 78,3              | 14,96                       |
| Spain             | 39,323     | 40,32            | 74,9              | 11,03                       |
| Sweden            | 8,848      | 67,93            | 75,6              | 35,82                       |
| Switzerland       | 7,094      | 66,09            | 74,3              | 14,72                       |
| United Kingdom    | 59,028     | 54,0             | 73,4              | 14,98                       |
| USA               | 274,028    | 64,37            | 66,5              | 20,65                       |

data from 2000 :

| Country           | Population | PSTN Teledensity | Residential lines | Cellular mobile Teledensity |
|-------------------|------------|------------------|-------------------|-----------------------------|
| Australia         | 19,157     | 52,46            | 73,0              | 44,69                       |
| Canada            | 30,750     | 67,65            | 63,4              | 28,46                       |
| France            | 58,892     | 57,93            | 74,0              | 49,33                       |
| Germany           | 82,260     | 61,05            | 77,0              | 58,60                       |
| Italy             | 57,298     | 47,39            | 67,1              | 73,73                       |
| Japan             | 126,919    | 58,58            | 73,9              | 52,62                       |
| New Zealand       | 3,831      | 49,99            | 70,8              | 56,33                       |
| Republic of Korea | 47,300     | 46,37            | 74,6              | 26,82                       |
| Spain             | 40,600     | 42,12            | 74,5              | 60,93                       |
| Sweden            | 8,881      | 68,20            | 65,3              | 71,72                       |
| Switzerland       | 7,204      | 72,67            | 68,0              | 64,39                       |
| United Kingdom    | 59,766     | 58,86            | 70,1              | 72,70                       |
| USA               | 275,130    | 69,97            | 65,8              | 39,79                       |

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## Application to evaluate the impact of Cellular mobile development :

Impact of Cellular mobile on residential teledensity:

Case of Italy:

Year 1997: average PSTN teledensity **44,68 %**, residential lines **76,5 %**  
cellular mobile teledensity **20,46 %**

Year 2000: average PSTN teledensity **47,39 %**, residential lines **67,1 %**  
cellular mobile teledensity **73,73 %**

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## Application to evaluate the impact of Cellular mobile development :

| Network growth (compound annual growth rate in %) | New telephone lines added 2000-2001 | New mobile subscribers added 2000-2001 |
|---|-------------------------------------|--|
| Low Income  | 8,3                                 | 72,4                                   |
| Lower Middle Income                               | 17,2                                | 70,5                                   |
| Upper Middle Income                               | 7,4                                 | 27,8                                   |
| High Income                                       | 0,3                                 | 14,8                                   |
| Africa  | 7,6                                 | 51,0                                   |
| Americas  | 2,1                                 | 21,2                                   |
| Asia  | 12,4                                | 38,4                                   |
| Europe  | 2,4                                 | 20,0                                   |
| Oceania   | 0,2                                 | 26,7                                   |
| WORLD   | 6,0                                 | 26,7                                   |

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## Application to evaluate the impact of Cellular mobile development :

### CONCLUSION

**Influence of Cellular mobile penetration consists of decreasing of residential lines – even with increasing of average PSTN teledensity**

**Even the highly developed countries experience considerable growth of the mobile subscribers (14,8%), especially in comparison to the growth of the telephone lines (0,3%)**

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## Application to evaluate rural network development :

- ❖ Rural network development has to be evaluated in connection with the evolution of the PSTN telecom network towards the next generation network (NGN)
- ❖ Teledensity statistics for Largest cities
- ❖ Telecom indicators for Central, East European and CIS countries including % digital
- ❖ Density statistics for Information technology

## Application to evaluate rural network development :

**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                    |

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## Application to evaluate rural network development :

**Telecom indicators for Central and East European and CIS countries :**

| Country         | Population<br>Total<br>(M) | GDP<br>Per capita<br>(US\$) | PSTN                      |                 |                |                 | Residen-<br>tial(%) | Internet<br>Users for<br>100000 | PCs<br>For 100<br>inhabitants |
|-----------------|----------------------------|-----------------------------|---------------------------|-----------------|----------------|-----------------|---------------------|---------------------------------|-------------------------------|
|                 |                            |                             | Main lines<br>(thousands) | Density<br>2001 | Digital<br>(%) | Density<br>2001 |                     |                                 |                               |
| Armenia         | 3.79                       | 544                         | 579.3                     | 13.97           | 20.9           |                 | 142.05              | 0.79                            |                               |
| Azerbaijan      | 7.78                       | 490                         | 865.5                     | 11.13           | 30.4           |                 | 32.13               | ...                             |                               |
| Moldova         | 4.39                       | 294                         | 676.1                     | 15.40           | 34.0           |                 | 136.67              | 1.59                            |                               |
| Tajikistan      | 6.13                       | 178                         | 773.0                     | 3.63            | 7.4            |                 | 5.77                |                                 |                               |
| Ukraine         | 50.30                      | 608                         | 10.669.6                  | 21.21           | 7.9*           |                 | 119.29              | 1.83                            |                               |
| Uzbekistan      | 25.76                      | 676                         | 1.663.0                   | 6.58            | 33.8           |                 | 59.39               |                                 |                               |
| Albania         | 3.97                       | 940                         | 197.5                     | 4.97            | 78.9           |                 | 25.19               | 0.76                            |                               |
| White Russia    | 10.25                      | 814                         | 2.857.9                   | 27.88           | 35.8           |                 | 411.87              | ...                             |                               |
| Bosnia          | 4.07                       | 1.178                       | 450.1                     | 11.07           | 41.6           |                 | 110.65              | ...                             |                               |
| Bulgaria        | 8.11                       | 1.473                       | 2.913.9                   | 35.94           | 12.0           |                 | 746.27              | 4.43                            |                               |
| Kazakhstan      | 16.09                      | 973                         | 1.834.7                   | 11.31           | 29.3           |                 | 61.64               |                                 |                               |
| Latvia          | 2.35                       | 2.930                       | 724.8                     | 30.83           | 52.2           |                 | 723.10              | 15.31                           |                               |
| Lithuania       | 3.68                       | 3.042                       | 1.151.7                   | 31.29           | 46.5           |                 | 679.16              | 7.06                            |                               |
| Rumania         | 22.39                      | 1.636                       | 4.094.0                   | 18.28           | 54.8           |                 | 446.63              | 3.57                            |                               |
| Russia          | 146.76                     | 1.709                       | 35.700.0                  | 24.33           | 27.1           |                 | 293.00              | 4.97                            |                               |
| Macedonia       | 2.04                       | 1.705                       | 538.5                     | 26.35           | 71.7           |                 | 342.47              |                                 |                               |
| Turkmenistan    | 4.84                       | 582                         | 387.6                     | 8.02            | 20.4           |                 | 16.55               | ...                             |                               |
| Yugoslavia      | 10.68                      | 1.067                       | 2.443.9                   | 22.88           | 53.0           |                 | 561.80              | 2.34                            |                               |
| Croatia         | 4.66                       | 4.253                       | 1.700.0                   | 36.52           | 76.0           |                 | 558.91              | 8.59                            |                               |
| Czech           | 10.77                      | 4.931                       | 3.846.0                   | 37.43           | 85.7           |                 | 1.367.66            | 12.14                           |                               |
| Estonia         | 1.43                       | 3.455                       | 503.6                     | 35.21           | 71.2           |                 | 3.004.59            | 17.48                           |                               |
| Hungary         | 9.97                       | 4.561                       | 3.730.0                   | 37.40           | 85.8           |                 | 1.484.01            | 10.03                           |                               |
| Poland          | 38.63                      | 4.078                       | 11.400.0                  | 29.51           | 77.6           |                 | 983.72              | 8.54                            |                               |
| Slovak Republic | 5.40                       | 3.540                       | 1.556.3                   | 28.80           | 70.0           |                 | 1.203.26            | 14.81                           |                               |

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## Application to evaluate rural network development :

- ❖ **Low and Middle Income countries -  
big gap between large cities and rural areas**

**Low Income: 9,3 % versus 2,1 %  
Middle Income: 24,8% versus 7,3 %**

- ❖ **Central and East European and CIS countries –  
still plenty of analogue equipment mostly in  
rural areas**

**From only 7 % to 85 % digital**

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## Application to evaluate rural network development :

### Density statistics for Information technology :

|                     | Internet hosts per 10000 inhabitants | Internet users per 10000 inhabitants | PCs per 100 inhabitants |
|---------------------|--------------------------------------|--------------------------------------|-------------------------|
| Low Income          | 0,98                                 | 62,21                                | 0,59                    |
| Lower Middle Income | 4,32                                 | 264,94                               | 2,45                    |
| Upper Middle 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                    |

## Application to evaluate rural network development :

### CONCLUSION

**It is easily seen that there is a big gap between the highly developed countries and the rest of the world**

**What could not be seen from the statistics is the expected very uneven distribution of the information technology between large cities and rural areas**

**In any case conclusion could be that the evolution towards the next generation network in the rural areas have to be considered very carefully**

## **Application of ICT Indicators in Network Planning :**

### **CONCLUSION**

**World Telecommunication/ICT Indicators are  
very useful for network planning purposes**

**To evaluate subscribers potential, the impact  
of Cellular mobile and rural network  
development are some of the possible  
applications**