Benchmarking Telecommunications in Developing Countries:

A Poland Case Study

Stanley L. Kroder, Ph.D. & Gary F. Wilkinson, Ph.D.

Since the early 1990s, the economies of Central and Eastern Europe (CEE) have been dramatically transformed. Changes in the telecommunications industry have been a reflection of the overall economic and social transformation of the region. This article uses the techniques of benchmarking and diffusion analysis to describe the changes within the telecom industry in this region to draw conclusions about telecommunications policy. *Benchmarking* is often used to examine an organization's characteristics (usually a company) by assessing its position relative to a carefully chosen comparison set. This paper uses that paradigm to assess a developing country's telecommunications system. Poland is the focus of discussion in this article; however, the techniques used to analyze Poland's telecommunications development are applicable to any country.

Many countries are rapidly modernizing telecommunications as part of an overall effort to provide the products and services to aid its domestic businesses in competing more effectively in the global market. Nations require a well-developed telecommunications system in order to grow domestically and attract and retain multinational organizations. By benchmarking telecommunications, we compare the focal country's telecommunications infrastructure to that of other countries and draw conclusions concerning the effectiveness of its telecommunications policies. We have used a basic diffusion model to also draw policy implications concerning the pace of telecommunications infrastructure development.

Poland was chosen as the focus for this study since it's one of the most important and largest developing countries in Central and Eastern Europe. Its economy is robust by CEE standards and is being transformed from one that was centrally planned to one that is market-oriented. Poland's telecommunications sector languished for years under Soviet domination. The pent-up demand for services is reflected by the rapid growth that has occurred in that country since 1989, when Soviet domination ended. Benchmarking statistics are presented to show how Poland, as well as most of its CEE neighbors, dramatically changed telecommunications infrastructure development since the socialist period.

We also compare Poland's level of telecom development with European Union (EU) countries and draw additional policy lessons from that. While telecom in the EU countries is clearly well ahead of that in Poland, there are two reasons for this comparison:

(1) Poland plans to enter the North Atlantic Treaty Organization (NATO) and the European Union (EU). Its major trading partner is Germany, the largest member

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of the EU. Thus, industries within Poland may face higher costs and less efficient production due to inferior telecommunications services, compared with the EU countries with which it will trade.

(2) We believe that the pattern of telecom development in the EU countries is a leading indicator of the situation in Poland. If this is true, Poland will take a very long time to come close to matching the telecom development in the West, unless policy changes are made which encourage rapid wireless and broadband infrastructure development. Our recommendation is that greater liberalization in Poland is necessary to further accelerate the pace of telecom growth to close the gap with EU countries.

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Benchmarking

Many studies of an organization's effectiveness concentrate on internal factors. In the case of telecom, these may include government policy, regulatory climate, extent of privatization and competition, pricing policies, business climate, and availability of foreign exchange. By contrast, benchmarking concentrates on external comparisons. These measurable factors will be at a country level and include, for example, teledensity (main telephone lines per 100 in the population), productivity, GDP, and population.

In this article, we use the benchmarking paradigm to compare one country's telecommunications sector to those of other countries in the comparison set. During most of the period under review, there was only one telecom company in the countries we studied, the state owned-and-operated monopoly. Recently, some of these countries have privatized telecom and/or opened the door to competition. Even where there are two or more telecom companies, the information source we used aggregated data at the country level. Conclusions derived from this analysis will apply only to the country as a whole. In this way, we are able to observe how the target of the study measures up to relevant groups. Readers may gain a new perspective based on this quantitative assessment.

Benchmarking has limits. The comparisons are based on broadly aggregated indices. However, there may be significant organizational or environmental differences that are hidden by the level of this analysis. For example, currency fluctuations are not uniform across countries. The reader must be mindful of this situation when drawing conclusions from the data and analysis presented herein.

Selection of Poland as Focal Country

Poland is the largest country in Central and Eastern Europe aside from the Ukraine, a former Soviet State.

- Its economy is changing from command to market driven.
- Its telecom sector was under-developed during the 45 years of Soviet dominance.[1,2]
- Its compound annual growth rate in teledensity was 12.3% between 1991 and 1995.

Only Hungary, with a rate of 14.1%, was greater. The popular media considers Hungary, the Czech Republic, and Poland as the most "Western" among the CEE countries. These three are the only CEE countries under consideration for entry into NATO. We selected Poland out of this group since it has nearly four times the population of either of the other two, and its telecom infrastructure is less well developed (e.g., 1995 teledensity: Poland = 15 versus Hungary = 19 and Czech Republic = 24).

Poland is planning the first phase of privatization of its state-owned telephone operator (TPSA) in 1998. With the largest population and a less well-developed telephone system, Poland offers investors and strategic partners the greatest opportunity in terms of unrealized market potential. The benchmarking done in this article may be useful to those who are interested in Polish telecom including regulators, operators, and manufacturers, as well as academ-

ics. Furthermore, this technique can be used for any country; Poland is simply an interesting case study.

We believe this study is unique in that it uses longer time series than those in other papers reviewed in our literature search. This permits analysis of trends rather than using a snap shot approach of only one or several recent years of data.[3] We have constructed three groups each of EU and CEE countries. Poland is compared to a total of six relevant groups of countries over at least 10 years in order to determine its standing in both east and west.

Selection of Comparison Countries

We formed two independent comparison groups—the 14 other CEE countries[4,5] and, separately, the 15 EU countries and ranked them according to 1995 teledensities. Then, the top, middle, and lower thirds according to teledensity were grouped and averages of those were used to compare with Polish telecommunications. The following table shows the ranking and the countries in each of the three categories. Poland is included in the CEE list to illustrate its position in the low segment. For all benchmarking purposes, however, Poland is excluded from the set of "low" CEE countries. Polish telecommunications indicators are shown separately as the focal point of the study.

In the subsequent sections, we present various benchmarking comparisons. In all cases, we show two sets for each parameter: Poland versus EU countries and Poland versus CEE countries. On each chart, Poland is compared to three sets of data representing the average of the countries in the high, medium, and low set. Each section will contain interpretation of the data in support of the quantitative measures that are shown graphically.

Teledensity

We begin our analysis with the growth in teledensity of wireline phones. Wireless has been excluded for two reasons:

Table 1
EU & CEE Country Comparison Groups

	European Union		*Central & Eastern Europe*	
	Country	**1995 Teledensity**	**Country**	**1995 Teledensity**
High	Sweden	68	Slovenia	31
	Denmark	61	Bulgaria	31
	Luxembourg	56	Latvia	28
	France	56	Estonia	28
	Finland	55	Croatia	27
Mid	Netherlands	53	Lithuania	25
	UK	50	Czech Republic	24
	Greece	49	Slovak Republic	21
	Germany	49	Yugoslavia	19
	Austria	47	Hungary	19
Low	Belgium	46	Belarus	19
	Italy	43	Ukraine	16
	Spain	39	Poland	15
	Ireland	37	Moldova	13
	Portugal	36	Romania	13

Source: ITU World Telecom Indicators, 1996

We formed two independent comparison groups—the 14 other CEE countries and, separately, the 15 EU countries and ranked them according to 1995 teledensities.

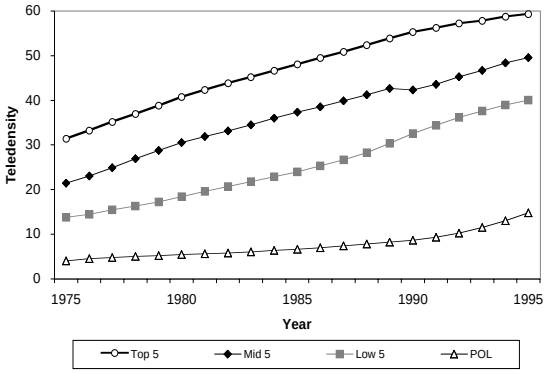
(1) The data sets we use cover the period of 1975 to 1995. Wireless became important in Poland only in the last few years of this period.
(2) By 1995, wireless in Poland was growing rapidly; yet, it was small by comparison to wireline. That year, Poland had nearly six million main telephone lines compared with 75,000 cellular phone subscribers. By December 1997, that number had increased more than ten fold to 875,000.

In the authors' opinion, wireless will soon need to be included in teledensity studies as it becomes an equal partner with wireline service. That was not the case during the period of comparison.

The next two graphics illustrate teledensity for the EU and CEE countries and Poland. In Figure 1, the teledensity of Poland lags behind EU countries, which is not surprising since telecommunications was not a priority in Poland under the Communists. At the start of the time series, the Low 5 EU group was approximately where Poland was 20 years later (teledensity of 15). From 1975 until 1990, teledensity in western countries was increasing at a steady pace, while that of Poland was nearly flat. A dramatic change started in 1990, the first full year after the collapse of the Soviet bloc. The radical nature of this shift is more obvious in subsequent graphs where the teledensity range is smaller. Yet, in 1995, Poland's teledensity was still far behind that of the EU countries (15 versus 60). Later, we examine the rate of change in teledensity. By so doing, we will be able to identify the distinct phases of growth that have been experienced by the EU countries and draw additional comparisons to Poland.

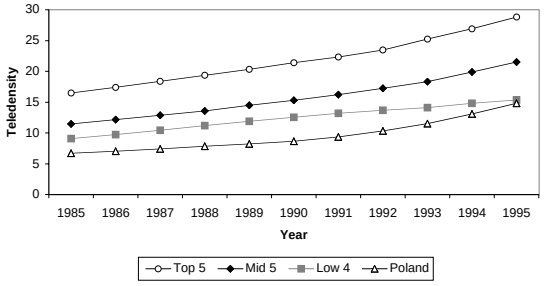
Next, we compare Poland's teledensity to that of the CEE countries (Figure 2). Poland was below the teledensity for the CEE countries until the last year in the series, 1995, when it reached the average of the "low" group. In 1985, the teledensity in Poland was approximately 7, less than half the average for the top group of CEE countries. From 1991 forward, Poland accelerated its telecom development and began to close the gap with the low group.

Figure 1
EU Teledensity



Source: ITU World Telecom Indicators, 1996

Figure 2
CEE Teledensity



Source: ITU World Telecom Indicators, 1996

Diffusion

By inspecting teledensity over a relatively long time horizon, we observe the classic product diffusion model at work.[6] *Diffusion* is characterized in three distinct phases. First, there is a slow initial deployment as the costs are relatively high and market demand must be established. Second, there is a period of more rapid adoption as demand increases and prices drop. Third is when the rate slows as the product and market matures. In general, the diffusion curve is "S" shaped.

This can be seen in Figure 1 for the Top 5 countries where the curve is turning down

toward the end of the period, indicating a maturing market. This slowdown can result from a substitution effect which, in the case of telecom, may be caused by the introduction and rapid acceptance of wireless in the most developed nations. Poland, by contrast, experienced a very long first phase due to the security policy of the Communist regime. During the 1990s, it is entering the second phase with strong, pent-up demand and a government that is dramatically increasing its investment in telecom. Due to the late start, the diffusion process in Poland may be more rapid than for its counterparts in the West. The substitution effect of wireless can be expected to cause the wireline diffusion process to enter the third phase at a lower level of teledensity than in the EU countries.

Rate of Change of Teledensity

Analyzing the rate of change of teledensity with respect to time is also very instructive. First, this investigation exposes the extent to which a country is committed to growth in the telecommunications sector. For example, the change in Poland's approach toward telecom can be observed by the rate of change in teledensity that began in 1990 (see Figure 3). That year, the annual change in teledensity was 0.4. Five years later, in 1995, it had quadrupled to 1.8.

Second, by using this technique, we can show the diffusion process in action. Notice the shape of the curves for the EU countries. Each one has a distinct maximum representing the point on the teledensity curve where the rate of change goes from acceleration to deceleration or the *point of inflection*. This is further evidence of a diffusion process. The Top 5 reached a maximum in 1977 and the Mid 5 in 1978. The Low 5 did not peak until 1990. In contrast, Poland has a long flat curve followed by a very steep ramp-up as it moves from the first to second phase of diffusion.

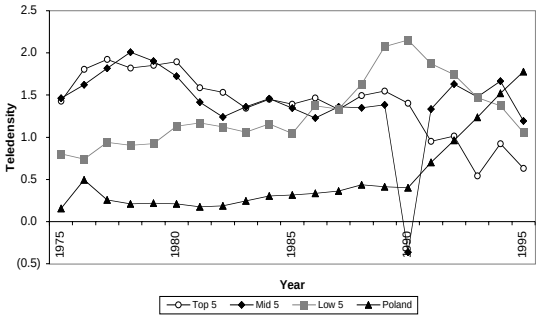
Using diffusion theory, we expect that the rate of change for Poland will slow down and eventually reach a maximum. From empirical observation, we note that, in 1995, Poland's rate of change in teledensity was 1.8. In the 20-year history of the EU countries shown in this study, the maximum rate was in the range of 2.0. Poland should have reached that range in 1996. If history can be trusted, we would expect to see Poland's rate of change level off at about 2.0 and drop slightly in the next few years to a pace of 1.2 to 1.5 per year.

Figure 3 shows the diffusion process that has taken place in the development of the telecom infrastructure over time. The first phase is characterized by a flat rate of change for the teledensity followed by a rapid increase during the second phase. When the peak is reached, we expect the rate to become more moderate.

There is a striking anomaly in this data set in 1990 for the Mid 5 EU countries. That was the year German reunification was reflected in the ITU data. The ITU merged the data on teledensity from West and East Germany into a single entity, which produced the effect of lowering German teledensity from 46.5 in 1989 to 40.2 in 1990. Although not reported separately by the ITU, East Germany must have had a teledensity of 18.1 before reunification, placing it in the Low 5 of the CEE countries. This is the only case where the rate of change of teledensity is negative.

Figure 4 shows the same analysis for the CEE countries. During the years of Soviet dominance in CEE, the change in teledensity is almost flat for all four plots. Clearly, Poland is substantially below the lowest

Figure 3
EU—Rate of Change of Teledensity



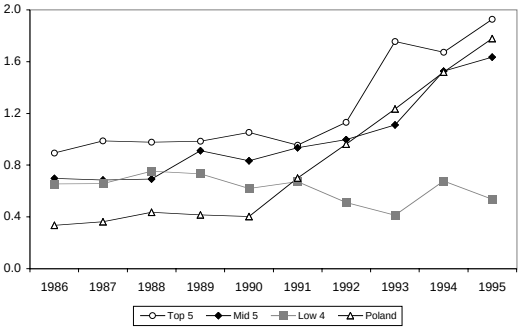
Source: ITU World Telecom Indicators, 1996

An Important Finding

The rate of change of teledensity can be used as a barometer for detecting shifts in telecom public policy. A surge in this measure indicates that the nation is changing its policy by reacting to a strong demand for increased telecommunications services. A peak followed by a slight decline suggests that the market is maturing, reflected by the slowing of the rate of change. Using the diffusion construct, the downturn of the rate of change of teledensity is a signal that telecom expansion is slowing.

group, indicating the total lack of interest in telecommunications development prior to the end of Soviet dominance. Note that Poland passed the lowest group in 1991 and has a slope approximately that of the top two groups.

Figure 4
CEE—Rate of Change of Teledensity



Source: ITU World Telecom Indicators, 1996

Productivity indicators are important in measuring where a telephone operator is with respect to others in the industry and for normalizing results between countries. Indeed, in the United States, the stock market analysts watch these indicators when assessing U.S. telecommunications service providers.

Measures of Productivity

In this section, we explore two productivity indicators that are common to this industry—main lines per employee and revenue per employee. These indicators are important in measuring where a telephone operator is with respect to others in the industry and for normalizing results between countries. Indeed, in the United States, the stock market analysts watch these indicators when assessing U.S. telecommunications service providers.

Historically, the industry has been very labor intensive. Productivity gains are made by increased use of technology and by changing management's focus on productivity. The latter factor may be addressed by one or more of these approaches:

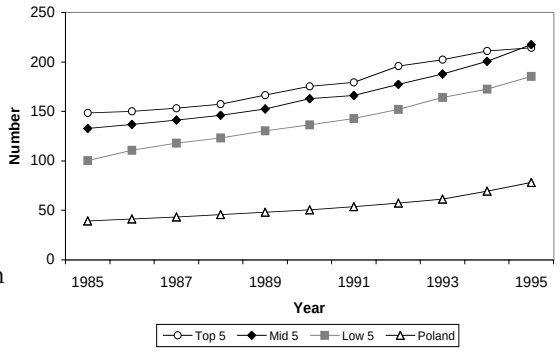
- Re-engineering.
- Renegotiating labor contracts.
- Introducing competition.
- Privatizing telecom with incentives on productivity.

A benchmarking study provides a developing country's telecom policy makers with a basis for setting productivity goals. Undoubtedly, many developing countries have done that in preparation for obtaining financing, planning for privatization, and developing strategies for strategic alliances.

Main Lines per Telecommunications Employee

Poland's lack of telecom development during the period of Soviet dominance is apparent in Figure 5. In 1985, the gap between the EU Low 5 and Poland was 55 lines per employee. By 1990, the gap had widened to 90. Even with the rapid build-up since then, the gap increased to 105 by 1995.

Figure 5
Telephone Lines per Telecom Employee



Source: ITU World Telecom Indicators, 1996

The good news is that Poland is increasing worker productivity in an absolute sense as summarized in Table 2. The work force is not growing as rapidly as is the number of access lines, that is, the number of main lines increased by a much greater extent than did the work force.

Worker productivity is moving in the right direction, but it has a long way to go to compare with that of any EU country. The following example puts Poland's dilemma in perspective.

Table 2
Worker Productivity in Poland

	1990	1995	% Change
Number of Workers	65,000	73,267	13%
Number of Main Lines	3.293 million	5.728 million	74%
Main Lines per Employee	50.7	78.2	54%

Source: ITU World Telecom Indicators, 1996

Example: For Poland to catch up

For Poland to match the average of the EU Low 5 worker productivity as of 1995, Poland must keep headcount flat and increase the teledensity from 15 (which it was in 1995) to 33. If Poland can increase teledensity at the rate of two lines per year (in 1995, the rate of increase was 1.8 per year), then, in 2004, Poland will be where the EU Low 5 average was 10 years earlier.

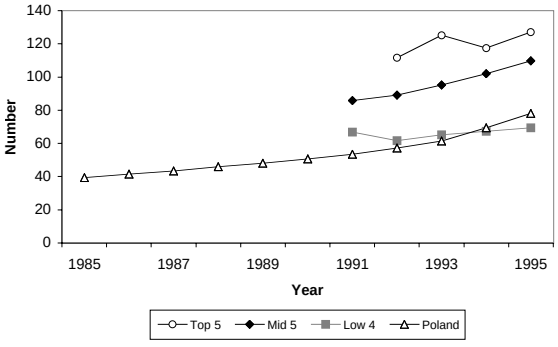
This analysis dramatizes the position in which Poland finds itself. The strides that Poland has made since 1990 must be sustained over an extended period of time to close the gap with EU countries. This is a daunting task. An alternative approach for Poland and other developing countries is to shift to wireless, which is less labor and capital intensive and faster to deploy.

Next, we compare telecom worker productivity in Poland to its neighbors in the CEE. Poland surpassed the average of the Low 4 CEE countries in 1994 and, by 1995, was slightly ahead of this group. The comparison with the other two CEE groups, however, is not as favorable. As seen in Figure 6, the slope for Poland is about equal to that of the Top 5 and Mid 5 CEE countries. This means that the gap remains constant. In a recent article, David Rocks[7] stated that Poland's neighbors—Hungary and the Czech Republic—are significantly ahead of Poland according to this measure.

Telecommunications Revenue per Main Line

We start this section with two caveats. First is currency. The ITU database expresses financial indicators in local currency and in U.S. dollars. In this report, we will use U.S. dollars to normalize between countries. The ITU translates the local currency to U.S. dollars by taking the average exchange rate (local currency units per U.S. dollar) for a year and dividing it into the financial measurement expressed in local currency. We have not attempted to remove currency fluctuations and inflation that may differ from country to country.

Figure 6
CEE—Telephone Lines per Telecom Employee



Source: ITU World Telecom Indicators, 1996

An alternative approach for Poland and other developing countries is to shift to wireless, which is less labor and capital intensive and faster to deploy.

Second is measuring telecom revenue. The telecom sector is notorious for using subsidies to implement public policy. In most countries, the price of local service is held at or below cost while long distance, both domestic and international, is priced well in excess of costs. In developing countries, low interest loans and grants from international agencies and other shifts in a country's public funding for telecom may distort the revenue picture for intercountry benchmarking. Yet, we use the data for country to country comparisons. Both factors represent limits in our ability to benchmark these dimensions effectively. While more sophisiticated modeling could be done, we believe that an adequate benchmarking analysis can be accomplished with the ITU data in spite of these limitations.

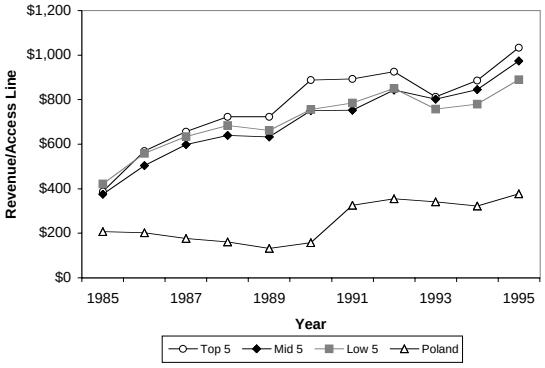
In Figure 7, we show revenue per access line. On the surface, Poland appears much lower than the EU countries. However, when we consider the differences between GDP per person, the relationship changes. For example, in 1995, the average GDP per person for the Top 5 EU countries was $25,016, while it averaged $2,415 for Poland, a ratio of approximately 10:1. On the other hand, revenue per access line for the Top 5 EU countries was $1,033, and Poland's was $377 or 2.7:1. If we adjust the numbers based on the difference in GDP per person, Poland's revenue per access line is considerably more than that of the EU countries.

Poland's telecom revenues in comparison to its CEE peers is very favorable. Since GDP per person displays a greater similarity among the CEE countries than between Poland and the EU countries, this may be a more useful comparison than with the EU countries. Poland's position on this measure is outstanding; however, potential shortcomings remain as mentioned earlier.

Telecommunications Revenue as a Percent of GDP

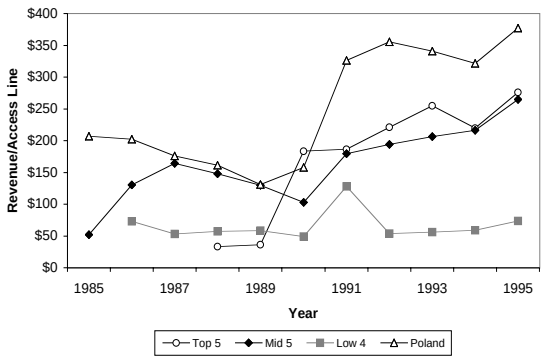
Another common measure used to compare telecom policy between countries is telecommunications revenue as a percent of GDP. In countries that lag in the development of telecom, we would expect to see a low ratio. As seen in Figure 9, Poland has a dramatically lower ratio when compared to the EU countries during the time of the Soviet domination. After the Communists ceded power, however, Poland's change in telecom policy increased rapidly from approximately 0.5% to 1.7%. This is a very positive sign considering that the EU countries hovered between 1.7% and 2.1% from 1985 to 1994. If Poland's GDP grows, we expect to see similar gains in telecom revenue. The ratio does have some room for growth though, if it is to track EU experience.

Figure 7
EU—Telecom Revenue/Access Line



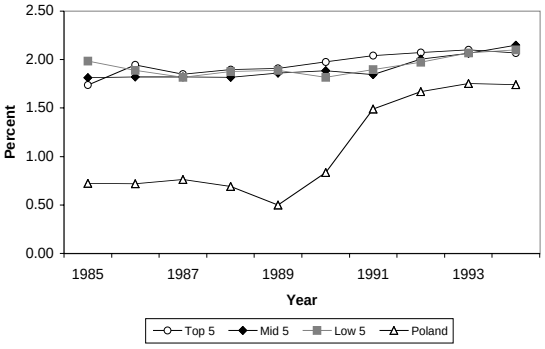
Source: ITU World Telecom Indicators, 1996

Figure 8
CEE—Telecom Revenue/Access Line



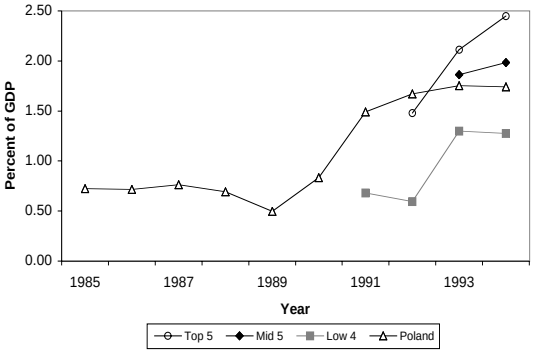
Source: ITU World Telecom Indicators, 1996

Figure 9
EU—Telecom Revenue as Percentage of GDP



Source: ITU World Telecom Indicators, 1996

Figure 10
CEE—Telecom Revenue as Percentage of GDP



Source: ITU World Telecom Indicators, 1996

GDP per person is important to consider when benchmarking various telecom indices between East and West.

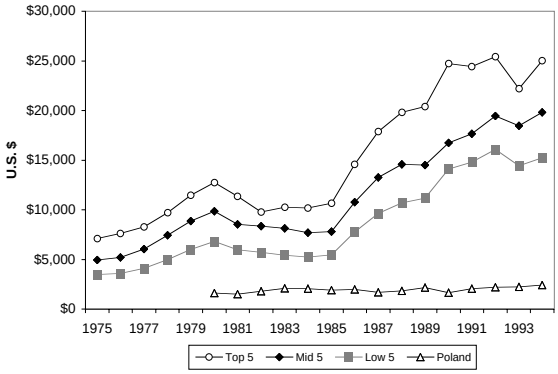
The data is more sparce for the CEE countries, as seen in Figure 10. There are only two years (1993-1994) for which we have data for all four sets in this benchmarking group. Poland is below both the Top 5 and Mid 5 comparison groups, which is consistent with its place in most other measures. We should note that the Top 5 CEE countries exceed the Top 5 EU countries on this measure, which means that Poland does not have to feel constrained to the 2% maximum that is derived from the EU analysis.

GDP per Person

This measure compares one country's economy to others. Poland was far behind the EU countries before 1985, and the gap has increased significantly since that time. The GDP of three EU groups rose dramatically from 1985-1995, while Poland's GDP per person remained flat. In 1995, Poland's GDP per person was one-tenth that of the Top 5 in EU countries. This disparity in the broadest measure of economic vitality is important to consider when benchmarking various telecom indices between East and West.

When we compare the GDP per person for the CEE countries and Poland, we find a much narrower range in that variable. Figure 12 shows that Poland and the top two comparison groups of CEE countries are comparable, which indicates Poland is not disadvantaged. This measure is subject to the vagaries of general economic fluctuation that takes place between countries with different currencies and ever-changing exchange rates.

Figure 11
EU—GDP per Person

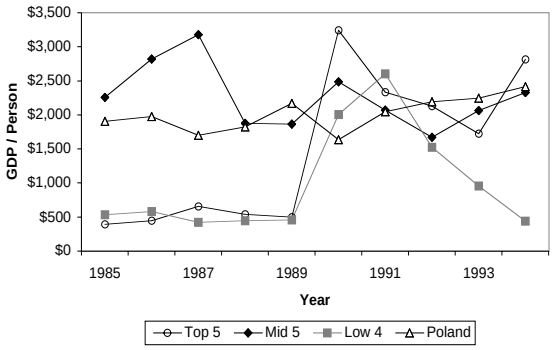


Source: ITU World Telecom Indicators, 1996

Telecommunications Investment per Access Line

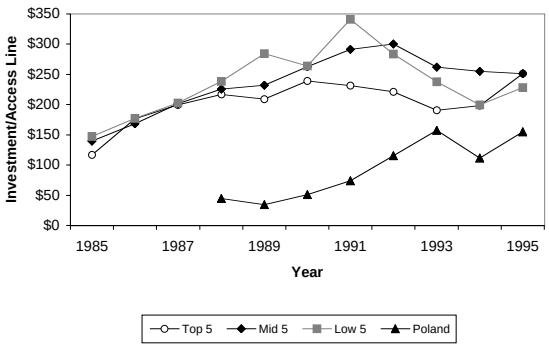
Investment in telecommunications is another important factor to include in this benchmarking analysis. As we have done previously, the country data is normalized

Figure 12
CEE—GDP per Person



Source: ITU World Telecom Indicators, 1996

Figure 13
EU—Telecom Investment per Access Line



Source: ITU World Telecom Indicators, 1996

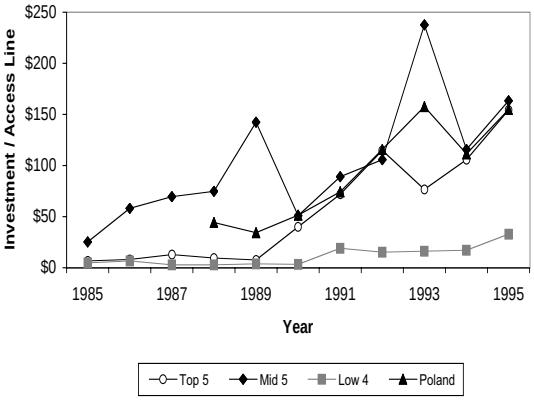
Considering the difference in GDP per person, Poland, with a telecom investment per access lines of $150, compares favorably to the EU on this measure, which represents a clear shift in policy.

by dividing the telecom investment in U.S. dollars by the number of access lines. This comparison, as shown in Figure 13, illustrates the growth of the EU countries from approximately $150 in 1985 to $250 in 1995. The data for Poland begins in 1988 when its investment per access line was $50. By 1995, that figure tripled. Considering the difference in GDP per person, Poland, with a telecom investment per access lines of $150, compares favorably to the EU on this measure, which represents a clear shift in policy.

You will note an interesting characteristic in this data. During the period of 1988-1990, the Low 5 EU countries were making a heavier investment per access line than the Top 5. This inversion suggests that the Low 5 were attempting to catch up with their peer group.

In Figure 14, we see that Poland is making an investment per access line that is very close to the average of the Top 5 and Mid 5 CEE countries, and nearly four times that of the Low 4. Based on this analysis, Poland seems to be positioned well on this dimension.

Figure 14
CEE—Telecom Investment per Access Line



Source: ITU World Telecom Indicators, 1996

Policy Implications

A major policy issue facing all developing countries is what type of market structure will provide the greatest incentive for development of the telecommunications infrastructure. The example we have presented with benchmarking the telecom development in Poland clearly demonstrates that the command economy under socialism was far inferior to the current market-oriented economy. Western economists have almost unanimously held the belief that socialism was inferior to capitalism in promoting general economic development. However, growth in some sectors of socialist economies rivaled similar sectors in Western economies. Our information shows that the telecommunications sector lagged far behind its Western counterparts.

The change from a system of government controls and management of the telecommunications system to one with profit incentives resulted in a radical change in the teledensity growth. In Poland, this change was not caused by the introduction of significant levels of competition. The market structure has remained almost a total monopoly.[8] The change has been largely due to the change in incentives for the management of the telephone system.

Beyond the clear policy direction favoring free market incentives, market structure recommendations are less definitive. We have shown evidence that the slower pace for introducing competition into the Polish market very likely resulted in slower teledensity growth than would have been the case if more aggressive policies promoting competition had been implemented. Both Hungary and the Czech Republic instituted policies that encouraged greater competition compared with Poland, and teledensity growth was higher. Other economic and demographic factors may have also contributed to teledensity differences between these countries such as differences in income levels, level of foreign investment in the telecom sector, and general economic conditions.

Finally, the benchmarking and diffusion analysis comparing telecom development in Poland with the EU countries shows that Poland should not simply adopt policies which place the country on a similar path as the EU. Our recommendation is that policies within Poland must accelerate telecom development in order to close the gap with the EU countries. Technology may provide the means for this accelerated development through wireless and fiber optic deployment, but policies must encourage greater competition and foreign investment. Present policies, which are bringing about gradual change and the prospects for a continued monopoly market structure, do not appear to provide sufficient economic incentives for Poland to close the gap in telecom development with the EU. ntq

Authors' Note: The methods used in this study provide a framework for comparing any developing country to its relevant peer group. However, using countrywide data certainly can mask important developments. In spite of this, we believe that, by using time series and country averages to smooth the data, the relative positions can be judged equitably. We hope that other researchers might extend this analysis to other countries and dimensions in order to verify the value of this approach.

Editor's Note: The text of this article has been abridged for the printed version of *NTQ*. To get the full text of this article, go to NTOnline at www.tfi.com/clientsvcs/ntonline.

[1] Paul J. J. Welfens, "Telecommunications and Transition in Central and Eastern Europe," *Telecommunications Policy*, Vol. 19, No. 7 (1995):561-577.
[2] Johannes M. Bauer and Joseph D. Straubhaar, "Telecommunications in Central and Eastern Europe," in C. Steinfield, J. M. Bauer, and L. Caby, Eds., *Telecommunications in Transition* (Thousand Oaks, CA: Sage, 1994), pp. 255-271.
[3] Robin Brown, "Eastern European Market Opportunities," *New Telecom Quarterly*, Vol. 1, No. 4 (November 1993):3-6.
[4] Gyula Sallai, Ivan Schmideg, and George Lajtha, "Telecommunications in Central and Eastern Europe," *Telecommunications Policy*, Vol. 21, No. 5 (1996):325-340.
[5] Albania is a CEE country, but its telecom infrastructure is so weak by comparison that we have eliminiated it. Albania's teledensity in 1991 was 1.25 and in 1995, it was 1.15. Therefore, it has been omitted since its telecommunications sector is so vastly different from the other CEE countries.
[6] Jaishankar Ganesh, V. Kumar, and Velavan Subramaniam, "Learning Effect in Multinational Diffusion of Consumer Durables: An Exploratory Investigation," *Journal of the Academy of Marketing Science*, Vol. 25, No. 3 (1997):214-228.
[7] David Rocks, "Going to Market," *tele.com*, Vol. 3, No. 8 (1998):85-90.
[8] An interesting insight was provided by Dr. Henryk Lasota, Professor of Telecommunications, Polytechnic University in Gdansk, Poland who noted that there is considerable competition in the telecom equipment and labor sectors even though the TPSA still holds a monopoly for services.

Present policies, which are bringing about gradual change and the prospects for a continued monopoly market structure, do not appear to provide sufficient economic incentives for Poland to close the gap in telecom development with the EU.