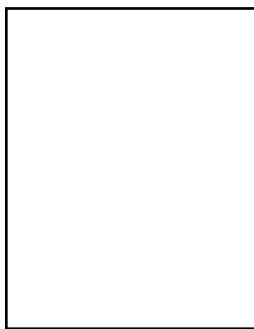


The Continuing Expansion of World Wireless Subscribers

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Herschel Shosteck received his doctoral degree in sociology and political science from the University of Wisconsin, Madison. His analyses and forecasts of the markets and economics of the cellular industry are reported by general and trade publications throughout the world.

Current world growth rates point to 400 million to 800 million cellular/wireless subscribers by year-end 2000. Three converging forces—political, economic, and technological—are driving continuing growth.

Throughout the mid-1980s, political forces constrained competitive telecom markets in many developing countries. As a consequence, the supply of services was limited. These constraints have since eroded, however, and telecommunications markets worldwide have increasingly opened.

Stimulated by dwindling political constraints, economies of developing nations are rapidly expanding. This is leading to increases in disposable income and, with that, the ability to buy telephone service.

Since 1985, the cost of fixed wireless service—telephony via radio—has declined from upward of \$5,000 per line to less than \$1,000. In areas lacking embedded copper infrastructure, wireless is now more cost effective than copper for fixed service. As such, wireless will become the primary means of providing fixed telephony in developing countries.

Political Forces

The loosening of political constraints on telecommunications has entailed three aspects: liberalization of equipment sales, privatization of state telecommunications monopolies, and deregulation of telecommunications services/introduction of service competition. A fourth aspect—recognition of telecommunications infrastructure as essential for rapid economic growth—is further stimulating the other three.

LIBERALIZATION OF EQUIPMENT SALES

National Postal, Telegraph, and Telephone (PTT) authorities have severed their exclusive supply relationships with favored manufacturers. Previously-closed equipment markets have opened. As an outcome, equipment prices have plummeted.

PRIVATIZATION OF STATE TELECOMMUNICATIONS MONOPOLIES

Privatization has compelled rational cost accounting and necessitated profitable operations. With rational accounting and profitability, PTTs have gained access to capital markets and, thereby, the resources to invest in new infrastructure. This is enabling them to provide more subscriber lines at lower costs.

DEREGULATION OF TELECOMMUNICATIONS SERVICES/INTRODUCTION OF SERVICE COMPETITION

PTTs are compelled to expand lines, shed inefficiencies, and reduce tariffs to remain competitive. Competition, and the PTT response, lead to rapid—and, in some cases, exponential—increases in the supply of telecom services at lower tariffs. These are stimulating extraordinary subscriber growth.

RECOGNITION OF TELECOMMUNICATIONS SERVICES AS ESSENTIAL FOR RAPID ECONOMIC GROWTH

Governments of developing nations are recognizing that telecommunications infrastructure is essential

to maximizing economic growth. This has stimulated liberalization, privatization, and deregulation/competition. The changes in Latin America and, more recently, China and India serve as examples.

Economic Forces

Economies of developing countries have been expanding for more than a decade. In 1994, the gross domestic products (GDPs) of 10 Asia-Pacific emerging nations grew by an average 7.3%. China, the most rapidly-growing Asian nation, expanded by 10.4%.¹ As impressive as it may be, growth in raw GDP masks the full potential of telecom subscriber gains.

Growth in telephone penetration will exceed growth in GDP due to “the income shift effect.” This effect recognizes that, as disposable income per capita/family passes certain thresholds, the number of persons/families who can afford consumer products and services—including basic telephony—increases more rapidly than the average income gains.

Within developing economies, relatively small—typically urban—segments of the population benefits disproportionately from economic expansion. If 10% to 30% of populations derive benefits from development, an average annual growth of 10% implies that the beneficiary groups are enjoying income growth of 33% to 100%. Such growth will quickly take these groups beyond the threshold of wanting to affording basic telephone service.

China serves as an illustration. In a population of 1.2 billion, 900 million live in the countryside, and 300 million live in cities. In 1992, the average income in cities was 2,000 yuan (\$365), while, in rural areas, it was 770 yuan (\$140). From 1989 through 1993, rural income increased by an average 1.8% per year. Concurrently, national GDP was expanding by an average 10% or more per year.²

This points to an extraordinary concentration of income among a newly-affluent urban class, enabling them to buy telecom equipment and services in unprecedented numbers. It explains why almost one million Chinese began subscriptions to cellular service during the first half of 1995, bringing total Chinese subscribers to 2.5 million on June 30, and a projected 3.5 million by the end of 1995.³

Income shift phenomena are occurring throughout Asia-Pacific and other developing economies.

Technological Forces

For demand to translate to subscribers, the supply of telecommunications facilities must expand with it. Five years ago, this could not have happened. The costs of placing copper wire—and the time required to do so—would have precluded serving “pent-up” demand.

However, as the ability to pay for telecom services is increasing, the costs of supplying it are decreasing. Depending on assumptions, the costs of wireline fixed service—copper or fiber—range from \$1,200 to \$2,000 per subscriber.

In contrast, the costs of wireless fixed service—basic telephone provided by radio rather than copper wire—are rapidly declining. In 1985-1986, these costs approximated \$3,500 to \$5,000 per line. By early 1994, they had fallen to \$1,000 per line.⁴ In early 1995, they fell to \$500 per line. At that time, Motorola announced:

...a \$100 million contract from Hungarian national operator Matav for the supply of a fixed wireless telephone system to serve 200,000 rural and urban subscribers across Hungary.⁵

This translates into a cost of \$500 per subscriber. With the cost of wireless fixed infrastructure falling to less than one-half of copper or fiber, wireless will become a major—and, arguably, the primary—technology for providing basic telephone service in developing countries.

It is because wireless will serve both mobile and fixed needs that 400 million to 800 million subscribers by year-end 2000 becomes plausible.

Forecasting Worldwide Cellular Subscribers Through 2000

Since 1991, worldwide cellular subscriber growth has accelerated. This has represented almost entirely mobile subscribers.

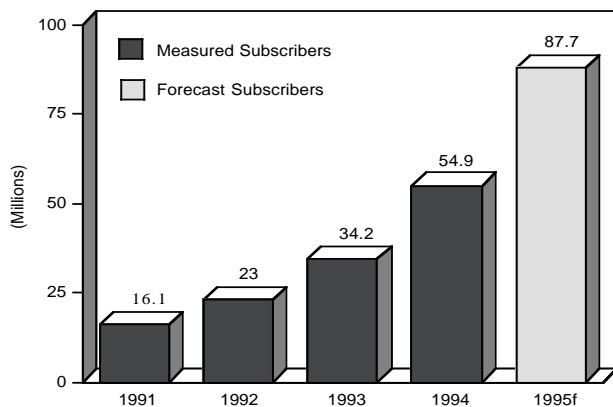
Figure 1 tracks and forecasts world subscriber growth from years-end 1991 through 1995.⁶ Subscribers increased more than threefold from 16.1 million at year-end 1991 to 54.9 million at year-end 1994. More important, the rate of growth increased.

- Between 1991 and 1992, world subscribers increased by 42.5%.
- From 1992 to 1993, they expanded by 48.8%.

- Between 1993 and 1994, it increased by 59.8%.

As fixed services become increasingly available, fixed subscribers in developing countries will maintain world growth rates at 40% per year or more through, at least, 2000.

Figure 1
Worldwide Cellular Subscriber Growth, 1991-1995



Source: Shosteck Associates, Ltd.

Table 1 compares cellular subscriber growth for the fully-developed countries (the United States, Canada, and Western Europe) to growth for the almost exclusively development economies of the rest of the world (RoW).⁷ Notwithstanding lower incomes, subscribers in the RoW have increased at a compounded annual growth (CAG) rate of 65%. Subscribers in the fully developed countries have increased at a CAG of 46%; the world increase has been 50%.

While incomes to purchase telephone service are increasing, wireless local loop technologies are reducing the costs of providing it. This assures that the extraordinary growth rates which have characterized the past years will continue through 2000.

Table 2 forecasts world cellular growth from 1995 through 2000. It assumes four rates of CAG: 35%, 40%, 45%, and 50%. Growth at these rates implies that world subscribers will range from 332 million to 625 million by year-end 2000. At 40% CAG, subscribers will reach 413 million; at 50% CAG—the average since 1991—subscribers will reach 625 million.

Motorola's Cellular Infrastructure Group foresees a similar market. Dr. Marty Singer, vice president and

director of business development and planning, anticipates that minutes of wireless use—mobile and fixed—will expand from 56 billion in 1993 to 2,000 billion in 2003.⁸ This expectation implies a CAG of 43%.

Mr. Michael Vadon, chairman of BRC Consultancy (London), posits that wireless subscribers could approach 800 million worldwide by year-end 2000. Mr. Vadon, formerly general manager of British Telecom's Mobile Phone Division, anticipates that, by year-end 1995, at least two wireless local loop (WLL) technologies, designed specifically for fixed applications, will come to market. They will be much simpler than mobile systems and therefore inherently lower in cost. They will use conventional fixed network switching and transmission technologies, thereby integrating easily into the fixed network.

Table 1
Worldwide Cellular Subscriber Growth, Mature and Developing Regions, 1991-1994

Year	U.S., Canada Western Europe	RoW
1991	12,995,000	3,111,000
1992	18,109,000	4,842,000
1993	26,173,000	7,977,000
1994	40,899,000	13,991,000

Source: Shosteck Associates, Ltd.

Table 2
Forecast Worldwide Cellular Subscriber Growth, 1995-2000

Year	Forecast Subscribers (Millions)			
	35% CAG	40% CAG	45% CAG	50% CAG
1995	74	77	80	82
1996	100	108	115	123
1997	135	151	167	185
1998	182	211	243	278
1999	246	296	352	417
2000	332	413	511	625

Note: Compounded annual growth of 50% is the current world rate.

Source: Shosteck Associates, Ltd.

At this point, the price advantage of wireless over copper will be so great that wireless for fixed service will gain full legitimacy and with that widespread adoption. Mr. Vadon foresees:

It will...take several reference systems...to overcome the reservations of...PTTs before they start to order WLL systems in quantity. Once this happens...growth in WLL sales will become truly exponential....

Mr. Vadon anticipates that large-scale orders for WLL systems will commence in 1997-1998. Presently, he foresees that deployment of WLL systems "will probably be limited by the manufacturing capacity available."⁹

The Strategic Implications for Sales and Profits

A continuing CAG of 40% or more through 2000 and possibly beyond poses major challenges to manufacturers, their suppliers, and network operators. All will face serious shortages of production capacity, components, and, especially, trained personnel. Those who act now to minimize such shortages will be at a major advantage to assure future sales and market share.

This will entail, at least, three steps:

- Building necessary production facilities.
- Developing strategic relationships with suppliers.
- Gaining access to qualified engineering personnel.

The most challenging of these steps will be gaining access to qualified engineering personnel.

The electrical engineering departments of North American universities offer a pool of skilled personnel which the industry can utilize to greater extent than at present. (We understand that this is also the case for universities in Europe, albeit to a lesser extent.)

We have discussed this with Professor Asrar U. Sheikh, who is in the Department of Systems and Computer Engineering at Carleton University in Ottawa, Ontario. The department has excellent relations with Bell Northern Research, the R&D arm of Northern Telecom. Prof. Sheikh observes that, notwithstanding the relationship that Carleton enjoys with BNR, both Carleton and BNR could benefit more.

He sees such benefits flowing from greater routinizing and formalizing current cooperation. He ob-

serves that sabbaticals, training, and R&D projects tend to be undertaken on an ad hoc basis. This requires a large administrative cost to initiate each project. It fails to utilize university staff effectively between projects.

Prof. Sheikh points out that the university would become exceptionally cost-effective in meeting industry needs through mechanisms which assured a continuous flow of short-term R&D and training contracts. He envisions such mechanisms taking the form of long-term fiduciary arrangements between manufacturers and carriers and the electrical engineering departments of qualified universities.¹⁰

Summary

Given continuous CAG of 40% to 50% or more over the next six years, the competitive danger—for manufacturers, component suppliers, and network operators—will center on insufficient investment in facilities and personnel. Companies which continuously invest will succeed. Those which hesitate will destine themselves to secondary status. nto

Author's Note—This analysis is drawn from the just released study, World Demand for Wireless Local Loop Systems: A Country-by-Country Forecast through Year 2000 (Wheaton, MD: Herschel Shosteck Associates, Ltd., 1995) (301-589-2259; fax: 301-588-3311).

¹ Derived by Herschel Shosteck Associates, Ltd., from "Economic Indicators," and "Emerging Market Indicators," *The Economist* (February 11, 1995):98, 100.

² "Revolt of the Peasants," *The Economist* (June 19, 1993):33-34.

³ "China: 1M Subscribers in Six Months," *Global Mobile* (July 27, 1995):1.

⁴ Hughes Network Systems, Inc., News Release, "Hughes Awarded Contract for Fixed Wireless Telephone System in Jakarta, Indonesia" (April 13, 1994).

⁵ "Motorola Wins \$100 Million Deal for Wireless Local Loop in Hungary," *Financial Times Mobile Communications* (June 15, 1995):9.

⁶ Data for the figure was also obtained from *European Mobile Communications*, *Financial Times Mobile Communications*, and *Global Mobile*.

⁷ Data for the table was also obtained from *European Mobile Communications*, *Financial Times Mobile Communications*, and *Global Mobile*.

⁸ Dr. Marty Singer, Cellular Infrastructure Group, Motorola, Inc., Presentation to Alex Brown & Sons (October 1994).

⁹ Mr. Michael Vadon, Herschel Shosteck Associates, Ltd./RTT Systems, Limited, "Strategic Cellular and Wireless Communications Seminars, (New Orleans, LA, January 30, 1995); Personal communication (February 26, 1995).

¹⁰ Prof. Asrar U. Sheikh, personal communication (March 9 and 13, 1995) (613-788-5723; fax: 613-788-5727).