Chapter XIII
Spatiality and Political Economy of the Global Fiber Optics Industry

Barney Warf
University of Kansas, USA

ABSTRACT

Fiber optics forms the pivotal telecommunications technology of the contemporary global economy, offering greater speed and security than other modes. This chapter reviews the historical development of this communications technique. It then views its rapid growth within the context of contemporary globalization. Fiber's role in contemporary urban restructuring is noted. The chapter then turns to the spatial distribution of the world's fiber lines, noting major transatlantic and transpacific markets and newer systems. The enormous construction boom of the 1990s and early 2000s, however, led to severe overcapacity, with significant economic fallout.

INTRODUCTION

The core of the global telecommunications infrastructure is an extensive and seamlessly integrated network of fiber optics lines. Indeed, far more than any other technology, such as copper cables, microwaves, or satellites, fiber optics supply the vast bulk of data, voice, and video transmission services around the world. Because of their capacity to deliver high volumes of information rapidly and securely (e.g., via broadband), fiber optics cables form the backbone of the Internet as well as private corporate lines, and are widely used in the electronic media for commercial and residential purposes (e.g., cable television). The technology is thus central to understanding contemporary economic, political and cultural transformations.

The objective of this chapter is to offer a reasonably comprehensive overview of fiber optics as a technology, an industry, and a force within the contemporary global economy. It begins with a brief history of how this phenomenon came to be, including the long history of scientific innovation behind it. Second, it situates and contextualizes fiber optics within the contemporary information-intensive global economy. Unfortunately, this issue has often been approached in apolitical and technocratic terms that ignore the social origins and consequences of the industry. Third, it turns briefly to the urban dimensions of this technology, the ways in which it is implicit in folding and refolding the spatiality of urban accessibility. Fourth, it maps out the global geography of fiber optics, focusing on the two major markets across the Atlantic and Pacific Oceans. Fifth, it explores three consequences of the fiber boom of the 1990s, including a wave of corporate failures, the emergence of dark fiber, and the challenge to the satellite industry.

A BRIEF HISTORICAL OVERVIEW OF FIBER OPTICS

Fiber optics are long, thin, flexible, highly transparent rods of quartz glass (or less commonly, plastic) about the thickness of a human hair that can transmit light signals through a process of internal reflection, which retains light in the core and transforms the cable into a waveguide (Agrawal 2002; Freeman 2002; Crisp and Elliot 2005). They can transmit voice, video, or data traffic at the speed of light (299,792 km/sec.); because light oscillates much more rapidly than other wavelengths (200 trillion times per second in fiber cables v. two billion per second in a cellular phone), such lines can carry much more information than other types of telecommunications. Modern fiber cables contain up to 1,000 fibers each and are ideal for high-capacity, point-to-point transmissions. Moreover, fiber cables do not corrode or conduct electricity, which renders them immune to electromagnetic disturbances such as thunderstorms.

Their development reflects a long history of experimentation and technological change. The origins of fiber optics go back to Jean-Daniel Colladon at the University of Geneva, who demonstrated light guiding in 1841. Subsequent experiments in 1870 by British physicist John Tyndall, who used moving water through curved rods to conduct light, showed that optical signals could be bent and that light therefore did not need always to travel in a straight line. In 1880, William Wheeling patented the method of "piping light" through mirrored pipes. Alexander Graham Bell's "photophone" in the 1880s transmitted voice signals on a beam of light; the concurrent introduction of Thomas Edison's light bulb enhanced the popularity of technologies of light. In the 1920s, Scottish television inventor John Baird and Clarence Hansell in the U.S. patented the idea of using transparent rods to transmit images (Hecht 1999). In the 1950s, experiments by Brian O'Brien at the American Optical Company and Narinder Kapany (who coined the term "fiber optics") at the Imperial College of Science and Technology in London developed a fiberscope, or forerunner to contemporary fiber optics, a technology that led to laparoscopic surgery. The introduction of a dense coat, or cladding, around the glass core, by Lawrence Curtiss of the University of Michigan, prevented the loss of light and led to near-perfect internal reflection within the core of the cable. In the 1960s, the use of laser diodes in helium-neon gas perfected this technique at Bell Labs in New Jersey. In 1956 British physicist Charles Kao showed that light attenuation was caused by impurities in the glass and suggested optimal maximum levels of glass purity for long distance transmission. Ten years later, Robert Maurer, Donald Keck and Peter Schultz of the Corning Glass Works (later Corning, Inc., now the largest provider of fiber cable in the world) developed rods of pure fused silica that greatly reduced light attenuation to the levels that Kao specified. In 1960, Theodore Maiman of the Hughes Research