

Chapter 5

EXPANDING TERRITORIES: Transport Systems Past and Future

Nebojsa Nakicenovic

International Institute for Applied Systems Analysis, Austria

5.1 INTRODUCTION

Transport and communication systems are the elements which integrate human activities in space and time. They record our past and will be the important determinants of our future. As a rule, those forms of infrastructure which are used for the movement of people, goods and information diffuse slowly and span many decades from their first introduction to obsolescence. Some of them are almost immortal, even though they often provide different services from those originally intended. Obsolete canals were reused to build railways a century ago in England. Ancient Roman roads have often been buried beneath modern highways. Old harbours are being converted into modern commercial and residential areas.

In this sense, many forms of infrastructure often serve as "rights-of-way", as actual transport systems replace each other in the eternal quest to increase the quality of service, reliability and speed, and to make the movement of people, information and tangible goods more efficient and convenient. While old forms of infrastructure are frequently recycled, new systems which provide even greater possibilities are also introduced so that diversification and productivity usually increase in time. Thus, complexity increases, resulting in numerous interlaced and overlapping niches occupied by competing modes of passenger travel, information channels and transport modes for goods and services.

The history and vintage structure of these systems will, to a large extent, determine and constrain the potential for introducing new systems. The development of new systems is, at the same time, a long-term process. The regularities in this evolutionary process that are reflected in the dynamics of change provide insights into possible future developments.

5.2 TRANSPORT INFRASTRUCTURES

One clear trend emerges from historical analysis: transport systems have become increasingly fast and more productive (when measured in terms of ton-kilometers and passenger-kilometers). The first major improvement occurred with the age of canals. They represented a fundamental construction effort toward reducing natural barriers in order to connect coastal and inland waterways into one integrated transport infrastructure. At the same time, canals were a powerful motor for the industrial age. Waterways allowed for new flows of goods, unprecedented exchanges between regions, specialization of labor, and access to more distant energy and raw material resources.

The modern age of canals started about two centuries ago and lasted almost one hundred years. By the 20th century most national canal systems were in place and many links had already been decommissioned. Eventually they yielded to the vicious competition of railroads.

The first railways were constructed in the 1830s and were able to extend the range, speed and productivity of canals. More important, perhaps, was the capability to overcome even more imposing natural barriers. Bridges and tunnels were built for canals, but railways were capable of following traffic and freight demand more directly. Wherever demand existed it was almost always possible to build a railway line. In time, North America and Europe were overlayed with elaborate networks of railway systems. Together with railways a new era of coal, steam, steel and telegraph began. The great railways era lasted until the 1920s.

Around the turn of the century the automobile was born. It became the symbol of modern industrial development along with oil, petrochemicals, electricity, the telephone and (Fordist) manufacturing. Paved roads reduced the time-space dimensions of modern societies. Speed and performance increased once again. This flexible and individual mode of transport became affordable for a wider social strata, and it was not until the last two or three decades that the disadvantages of the automobile have become socially transparent. This illustrates the extent to which the automobile age is perceived as one of the preconditions for modern industrial development. So much so that the car became almost a synonym for individual freedom and mobility.

Figure 5.1 illustrates the development of the four major transport systems in the USA, represented by the growth in length of the respective infrastructures: canals, railways, surfaced roads and airways. The length of all four has increased by more than four orders of magnitude during the last two centuries. Each successive mode of transport expanded into an infrastructure which was ten times larger than the previous one. The first canals were built in the 1780's, reaching a total length of 4,000 miles by the 1870's before saturation and decline; thus the expansion of canals lasted about 90 years. The first railroads were built in the 1830s and