This book deals with the second revolution in automobile manufacturing and its implications for manufacturing generally. Just as Henry Ford and General Motors’ Alfred Sloan pioneered mass production, the Japanese in the 1950s and 1960s developed and perfected what Womack, Jones and Roos call lean production. It is called lean production because it requires less of everything as compared with mass production:

...half the human effort in the factory, half the manufacturing space, half the investment in tools, half the engineering hours to develop a new product in half the time. Also, it requires keeping far less than half of the inventory on site, results in many fewer defects, and produces a greater and ever growing variety of products. [p.13]

While the fundamental ideas of lean production are said to be the source of Japan’s enormous success in the auto industry, they are shown not to depend upon Japanese cultural traits but, in fact, are universal and hence, can be applied anywhere in the world in a great variety of industries. The Machine That Changed the World draws on 116 monographs prepared by the International Motor Vehicle Program at the Massachusetts Institute of Technology. (A list of titles is given in the book’s Appendix B.) The research was conducted over five years and cost five million dollars. Funding was provided by thirty-six organizations consisting of auto assemblers, component suppliers and governments. The result is probably the most comprehensive study ever taken of any industry and represents an enormous contribution to our understanding of manufacturing industry and the automotive industry in particular. Already the study has served as one of the eight industry analyses on which the MIT Commission on Industrial Productivity based its widely cited recommendations for productivity growth [Dertouzos, Lester and Solow 1989].

The book is divided into three parts: the origins of lean production, the elements of lean production and diffusing lean production. In chapter two of part I, a brief look at the craft origins of the automotive industry at the end of the nineteenth century is given followed by an account of the transition to the mature mass production system which began in the 1920s. The strengths and weaknesses of mass production are enumerated in order to provide a comparison with lean production.

Chapter three traces the genesis of lean production in the 1950s as developed by Eiji Toyoda and Taiichi Ohno at the Toyota Motor Company in what was first known as the Toyota Production System and later spread to...
other Japanese automakers. The system did not arise out of a grand design, but rather as a response to the difficulties Toyota found itself in the 1950s, especially the lack of capital and the small market which left it unable to copy the American mass production system. By devising lean production, Toyota combined "the advantages of craft and mass production, while avoiding the high cost of the former and the rigidity of the latter" [p.13].

The authors provide an excellent analysis of the key features of lean production such as: teams of multiskilled workers in the factory and in the development of new models; responsibility accorded to workers in avoiding and detecting defects; small-lot continuous flow production; just-in-time production and delivery with very low inventory levels; the use of highly flexible, increasingly automated machinery; the never ending quest for incremental improvement ("kaizen"); and the nature of the relationship between the assemblers and their component suppliers.

In part II, the chapters proceed through each of the steps of lean production: the factory as represented by the final assembly plant, product development and engineering, the components supply chain, the method of selling cars and trucks and finally, managing the global lean production enterprise. The authors are expert at dissecting the system and at the same time indicating how each part is integral to the whole.

Chapter four, on running the final assembly plant, initially provides a detailed contrast between a typical mass production plant in North America and a Toyota lean production plant. It is followed by an analysis of a survey of more than ninety assembly plants in seventeen countries with respect to productivity and quality by region and country of ownership. Among the conclusions are that: first, there is a considerable range of productivity performance and quality levels in Japan; all the Japanese firms are not equally lean; second, the Japanese have been able substantially to replicate their production system in Japanese-owned plants in North America; third, the best United States-owned plants in North America are now approaching the levels of the average Japanese plant in terms of productivity and quality. Ford is singled out as the North American producer most advanced in its adoption of lean production. It is now nearly as lean in its North American assembly operations as the average Japanese transplant in North America. Ford’s success suggests that lean production can be implemented fully by Western companies and that lean is no longer synonymous with Japanese.

In chapter five, on designing the car, the authors show how lean producers are able to manufacture autos with shorter development time and less effort compared to mass producers. This allows them to offer a wider variety of products and replace them more frequently. The secret is in strong leadership of a tightly knit team that practices simultaneous, rather than sequential, development and makes optimal use of the assemblers' resources and brings early into the process the key suppliers which are an integral part of the product development teams. These suppliers deal directly with the vehicle producers