



The Evolution of the Bicycle¹

People began exploring the idea of the bicycle in the middle of the nineteenth century and a huge variety of types emerged between 1860 and 1890. Various attempts were made to establish a dominant design, but it was not until near the turn of the century that the experiments with wheels, gears, seats, etc. converged to the now familiar 'diamond frame'. This still forms the basis of most cycle design.

Manufacturers introduced all sorts of incremental improvements including new materials (e.g. alloy steels for the frame), new components (e.g. gears), accessories (e.g. lights), etc. By 1930 there were bicycles to suit different market segments, ranging from dependable working cycles with three-speed gears, lever-operated brakes, through to high-performance racing and sports bikes made of lightweight materials and incorporating advanced gear and braking technology. This phase was very much about market segmentation – innovating to suit the needs of different user groups.

The post-war period in Europe led to an expansion in the demand for cycles as a cheap mode of transport and this put emphasis on production to low cost and high quality. For a long period innovation focused on process improvement to achieve these goals and the product and market remained stable – essentially characteristic of the mature phase in the product/technology life cycle.

This did not mean that more radical concepts were not being explored, simply that they were not adopted widely. Innovation was still taking place in specialist niches, for example, in racing bike technology where new materials played a role. But it was not until the 1960s when Alex Moulton introduced his small wheel collapsible bike that mainstream product innovation took place. His original design was for a bicycle which could be folded up and carried on the train for commuters to use between the office and the station; other variants included a small shopping bike.

Such models were not huge commercial successes but they demonstrated the potential of the design in terms of efficiency and reliability – traditionally smaller wheels posed problems with transmission and with shock absorption. The market where it really had an impact was in 'fun bikes' for children; in particular manufacturers borrowed from the idea of motorcycle crosscountry rallying to create the BMX – bicycle motor cross – market. This opened up a new business and tapped into the increasingly affluent markets of the 1970s.

Considerable product innovation followed this development, especially around accessories, new lightweight materials, and cycle clothing (helmets, etc.). The leisure cycle industry expanded further as the BMX kids grew up and began demanding adult versions which could travel offroad; this led to the development of the mountain bike and to a resurgence of interest in cycling as a leisure activity rather than as a mode of transport.

For manufacturers this came at a good time since the rise of car ownership had impacted heavily on traditional markets. It opened up a phase of product differentiation – broadly into leisure and transport cycling but within these categories into multiple variants. (We should not underestimate the process innovation challenges posed by trying to do this. For example, the National Bicycle Company of Japan now offer 18 basic models, a choice of 19 colours and 6 different calligraphies – giving a staggering potential choice of 11, 231, 862 variants!)

¹ This case is based on work by the Open University/UMIST Design and Innovation Group.



Innovation continues – for example, there is considerable interest in recumbent bicycles where the rider lies down on a low-level cycle, which is more efficient in terms of energy transmission and aerodynamics; the resulting design is capable of speeds in excess of 40km/hour. Motorizing cycles with various kinds of electric devices has been tried, notably with the ill-fated Sinclair C5; although unsuccessful the concept of electric motor assistance to pedal power has led to the relatively successful Zeke device. But the pattern appears to have stabilized again into a transitional/mature phase with emphasis on product differentiation of an incremental nature in specialized market niches, and in process innovation towards cost reduction.

Given the 150-year history of the bicycle, with its patterns of radical change followed by convergence and consolidation, it would be foolish to suggest that today's product represents the end of the road for innovation in this sector.