

100 Years of Bicycle Mass Production: One Billion Bicycles

Alan A. Parker reviews a century of bicycle history and calls for an Asia-wide Bicycle Promotion Institute

The world's bicycle fleet increased to one billion during 1990, just one hundred years after the precursor of the modern mass-produced bicycle with its diamond frame and pneumatic tires was first made in England. 1890 and 1990 are both historic years to remember because they ushered in bicycle booms. The Anglo Saxon bicycle boom of the 1890s is about to repeat itself in Asia but on a much larger scale. If current trends continue the world bicycle fleet will increase to two billion well before 2025 when the world's population will be over 8 billion.

During the first bicycle boom, factories in the UK and the USA made their first one million bicycles in 1895. In 1995 the world's bicycle production capacity will reach 100 million bicycles a year and most bicycles will be made in developing economies. Graph 1 shows that since 1970 the greatest growth in the manufacture of bicycles has been in the developing world. Indeed, two thirds of the world's bicycles (800 million) are owned by people in eight developing countries.

The bicycle is arguably the greatest innovation in transport and its mass production has lifted many people out of poverty by enhancing their personal mobility and freight carrying capacity. According to the World Health Organization more

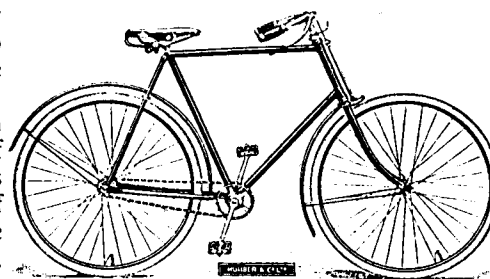
than 1.2 billion people still live in extreme poverty: the biggest single cause of death, disease, and suffering worldwide. Hopefully, cheap and reliable Asian bicycles made with modern machine tools, the principals of mass and flow production, and abundant cheap labor, will now reach the people who need them most.

This article argues that the western system of transport apartheid, of petrol power over pedal power has already been adopted in much of Asia with the result that cyclists are already be driven off the roads. There is now a need for the Asian bicycle industry to lobby Asian governments on behalf of bicycle users and establish an Asian equivalent of the Japanese Bicycle Promotion Institute.

THE PRECURSOR OF THE MODERN BICYCLE

It all began with the first industrial revolution and the need for a more efficient form of urban transport that did not rely upon the horse, which deposited between seven and 13 kilograms of manure a day and many liters of urine on city streets. In dry weather in large developed cities like London, New York, Paris, Melbourne and Sydney, pulverized horse dung blew everywhere. Horse manure attracted flies that multiplied profusely. The problem of sewage disposal had not been

solved, which resulted in regular outbreaks of typhoid until around the late 1890s. The growing use of bicycles reduced the numbers of horses ridden for personal use in



the cities and contributed towards a cleaner and healthier cities. Bicycles were of even more benefit in Melbourne with its appalling sewage problem (Priestley, 1984)

In 1890 two important innovations in mechanical engineering came together that made the bicycle lighter in weight, easier to use and by the mid 1890s, a lot easier to make in big batches. The first innovation in 1890 was the introduction of the Humber (diamond) pattern bicycle frame, which in time, became an industry wide standard, that made possible the standardization of tubes, cast lugs and bottom bracket castings, wheel sizes and also economized on amount of steel required. The Humber had properly raked front

forks with a steering head fitted with ball bearings, a sprung saddle and an adjustable seat post. The wheels were the same size and the chain drive to the rear wheel could be tensioned. (McGonagle, 1968)

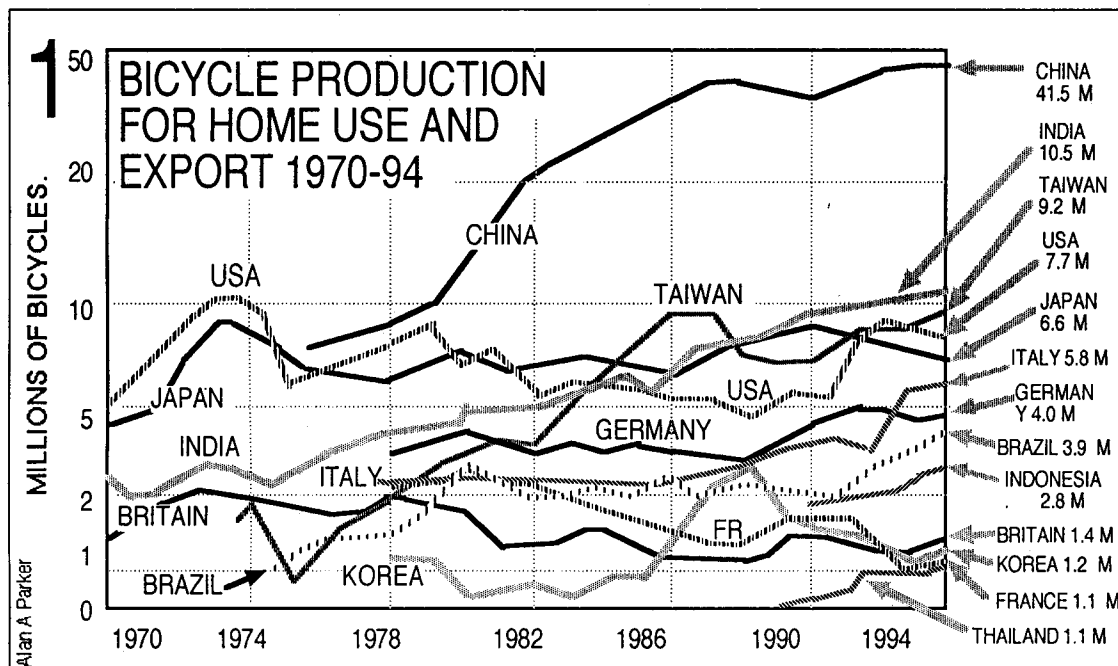
The second innovation in 1890 was the introduction of pneumatic tires on 1% of British bicycles sold that year. That great authority on bicycle design at the time Sharp (1986) had this say: "Whether judged by speed performances on the road or racing track, or from additional comfort

and ease of propulsion to the tourist, the greatest advance in cycle construction due to a single invention must be credited to Mr. James Dunlop, the inventor of the pneumatic tire."

In the early 1890s bicycle sales boomed and the bicycle industry sailed through the economic recession of 1893 on booming sales into the economic recovery of 1895. A mass market for bicycles existed for first time. The bicycle industry went into 1897 with a cushion of back orders from retailers who ordered three times as many bicycles as were actually sold. The market was saturated and a trade war ensued with the price of bicycles being halved and then halved again. the bicycle boom of the 1890s was over. Raleigh established in 1891 was one of the few bicycle companies to survive. Most interesting of all when we consider the roots of today's Asian bicycle boom is that the Japanese company Miyata was a gun manufacturer who made its first bicycles in 1881 and built the first 500 diamond frame bicycles with pneumatic tires in 1893.

BRITAIN EXPORTS BICYCLE FACTORIES

In 1950 bicycle manufacture was clearly concentrated in the developed countries. According to Carter (1962) in 1943 there were 66 million bicycles in the world of which 22 million were in the USA and UK, 39 million were in Germany, Italy, Holland, Belgium, Austria, Switzerland and Scandinavia



and the other five million were in Eastern Europe. His was an underestimate because Japan, also had a bicycle fleet of around ten million, so the world bicycle fleet was around 73 million in 1943.

There was a need for developing countries to make their own bicycles, but making sturdy and reliable bicycles is no simple matter at an early stage of industrial development. This is because it requires special skills in tool making, the design of press tools, jigs and fixtures and the provision of high quality raw materials. An independent bicycle parts industry is required for cold rolled steel strips, seam welded bicycle tubes, high carbon steel wire, plastic moldings, tires, enamels paints and precision components such as bearing and gearing systems are all required. Equally important is a measure of protection for indigenous industries because when this is done indigenous industries can survive the difficult early years.

The technology may be packaged in turnkey factories. Local industry can also acquire the technology they want through licensing agreements or can copy foreign products and do it the hard way. After World War 2 Japan was devastated and Britain was the major spreader of new bicycle technology in the 1950s and 1960s until Japan had rebuilt its cities and manufacturing capacity around 1970.

Britain contributed manufacturing know how and a quality product. Since 1918 bicycles and Sturmey Archer hub gears made by Raleigh have been exported to 140 countries and demonstrated to users that Raleigh was the Rolls Royce of the bicycle world. That is what the word Raleigh meant in

over 100 languages. In the 1950s and 1960s Raleigh established factories in Germany, Ireland, South Africa, India, Nigeria, and Malaysia and licensing agreements in Mozambique, Congo, Dahomey, Sri Lanka and Peru. Another British company Tube Investments was involved in bicycle manufacturing all over South America and indigenous bicycle industries are now thriving in Brazil, Argentina Colombia, Venezuela and Chile (Bowden 1975).

JAPAN: THE FIRST ASIAN NATION TO INDUSTRIALISE

Wars, imperial administrations, and international trade have spread technology around the world in the past. Japan was the first Asian nation to industrialize but it started later than in Europe after the US government sent seven warships to Japan and negotiated from a position of military strength a trade treaty in 1854. The voyage from Japan to the west coast of America took 30 days and through typhoon prone seas but the trade links grew. The Japanese were fascinated by products from foreign lands after 215 years of self imposed economic and political isolation.

Imported bicycles were popular in the 1860s and their were enough of them that by 1870 Osaka city introduced its first bicycle traffic law to protect pedestrians. Under the new political regime skilled gunsmiths who used to work for warring feudal lords found themselves unemployed and they turned to making bicycles.

Diamond frame bicycles with pneumatic tires had been made in 1893 and between 1896 and 1899 several manufacturers of bicycle parts appeared in the Osaka region.

These early bicycles were much too expensive for most young men who wanted to ride them, so bicycle rental shops sprang up all over Japan and gave the gunsmiths an additional market for their bicycles. The domestic market in 1900 was still dominated by imports (15,092) which was more than domestic production and that situation did not change until the start of World War I.

Modern bicycles were produced in quantity in 1931 and bicycle production reached 600,000 a year by 1934 and one million by 1939. During World War II production dropped to around 100,000 units a year but after the war bicycle production was built up to around one million per year between 1950 and 1956, then steadily increased until production peaked in 1973 at 9 million units as shown in figure 2.

Bicycle exports hit the one million mark in 1968 and steadily increased to 3 million bicycles in 1988 but in 1985 Japan's bicycle imports began to grow and by 1994 there were twice as many whole bicycles imported than exported and the trend will continue. Japanese domestic demand for bicycles is around 9 million per year and will probably stay at that level as the working week is reduced from six days to five days.

JAPAN LEADS THIRD WAVE

The influence of the old colonial powers in Asia has waned and over the last 25 years Asian industrial development has boomed. After 200 years of British, then American dominance Japan is now the regional catalyst at the center of the third great wave of industrial development. Japan was committed to a pragmatic program of nation building, protecting its industries until they were strong enough to win market share in other countries and is now a technology pioneer second to none. For example it was Japan who first perfected the seam welding of chrome-molybdenum alloy steel bicycle tubing that made lightweight bicycles possible at much lower prices.

In 1990 there were 55 companies making complete bicycles and 306 makers of bicycle parts collectively serving 35,000 retail sales outlets; mostly "mom and pop" stores. In 1993 the largest bicycle maker produced 1.3 million bicycles, and five other makers produced over 500,000 bikes a year. There are ten trade organizations supporting the bicycle industry and there is a trade organization supporting the 11 manufacturers with an annual output of 500,000 secure bicycle

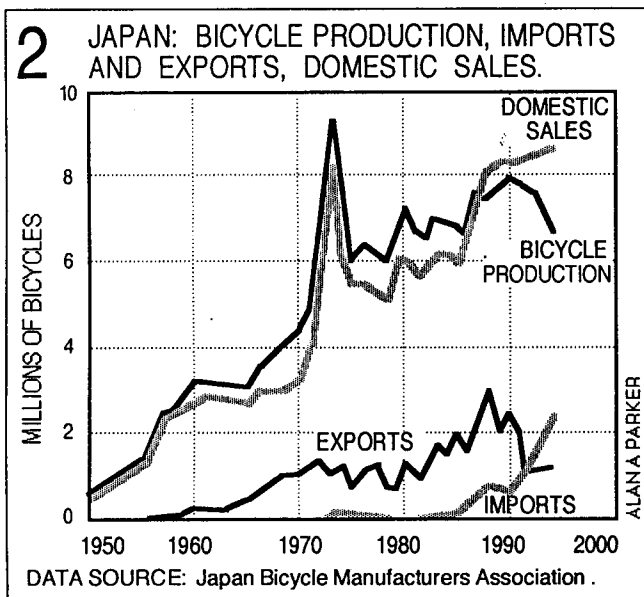
storage units of various kinds. In addition, the international Japanese trade organization JETRO, has offices around the world and provides bicycle trade information. The bicycle industry funds the Bicycle Promotion Institute which also acts as a lobby to government and conducts research of benefit to bicycle users.

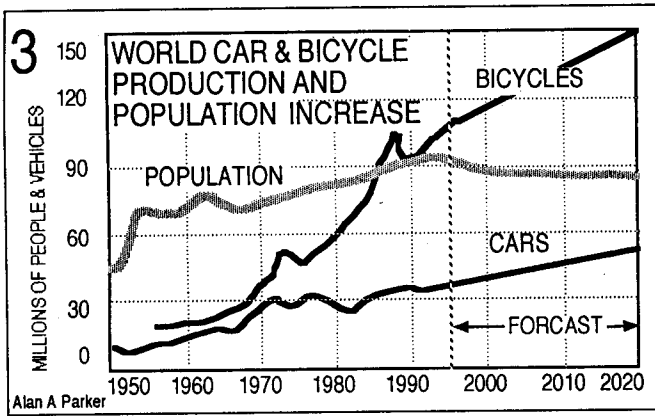
In the early postwar period Japan had the finest industrial intelligence apparatus in the world which would buy, borrow, beg or steal the best products and best ideas (like quality control) to do what had to be done in the national interest. Japan would also reject the worst ideas like "Taylorism". For the first time in 500 years of capitalism the dominant force was not European or Anglo Saxon, and the rising capitalist nations of Asia watched in admiration as Japan plundered the technical expertise of its former enemies. This demonstrated that in the post colonial age, nationalist industrial development policies are the vital driving force behind economic growth. At a macro level, mass producing bicycles is just a small part of Asian development but it is an integral part of the overall development process.

The Asian tigers quickly learnt the micro level tricks as well and by 1982 Cycle Press was bleating about Taiwan stealing Japanese bicycle designs and fiddling patents. The Taiwanese bicycle industry since then has built up a more cooperative relationship with Japan and developed a massive bicycle export industry (See figure 1) of over eight million bicycles a year, one million of which are sold in Japan. Taiwan's 1980s marketing materials look surprisingly similar to Japanese materials in the 1970s.

In the late 1980s Japan's industrial development policy changed, shifting labor, raw material and energy intensive industries offshore to the dynamic Asian economies and a network of Japanese or part Japanese companies making bicycles and bicycle parts is now spread all over Asia. Japan's bicycle industry is changing fast and they will be concentrating more and more on the production of high value added, quality precision bicycle parts and niche markets for high quality bicycles. The long term impact on Asian bicycle production will come from exporting the technology to make better bicycles, including power assisted bicycles with small electric motor drives or internal combustion engines.

WORLD BICYCLE AND CAR PRODUCTION 1950 TO 1995





Graph 3 shows the overall trends in making new cars, new bikes and new people since the 1950s. In 1950 around 15 million bicycles were manufactured. In 1995 the world bicycle industry in 65 countries will produce 100 million bicycles, mostly in developing economies; while the world's population grows by around 87 million. Current world demand for bicycles is growing fast because population growth has steadily increased in developing countries experiencing high levels of economic growth. The world's car fleet has grown from 50 million in 1950 to around 450 million in 1995 and the world's bicycle fleet has grown from around 66 million in 1950 to at least 1.1 billion in 1995 (graph 4). Meanwhile, population increased to around 3.1 billion people.

Graph 1 plots bicycle production data from 1970 to 1994 for the 14 countries that produced 87% of the world's bicycles in 1994. There are ten big industry groups making 40 million bicycles a year, which is more than the number of cars produced every year. The next eight biggest bicycle companies are producing between one and two million bicycles a year. The thousand or so other companies making bicycles, bicycle parts or assembling bicycles between them produce another 50 million bicycles each year.

The largest bicycle manufacturer is the Shanghai Phoenix Group which makes just over six million. The Derby (UK) group of companies is now making over five million bicycles a year. Another Chinese company, Shanghai Forever, makes just over four million bicycles per year and Hero Cycles of India makes nearly four million a year. The US groups Huffy Bicycle and Murray Ohio make 6.5 million bicycles between them. Such a volume of production allows not just mass production but in time fully automated production.

Industrial growth rates in China and much of Asia are comparable to the very high economic growth rates in the UK and USA during the latter part of the 19th Century. In all these developing countries bicycles are not toys or recreational vehicles but are used for all manner of transport trips and carrying goods. The tricycle substitutes for the use of taxis, light vans and lorries for moving all kinds of goods and people.

BICYCLE PRODUCTION IN CHINA AND INDIA

China has the largest bicycle fleet (450 million) and that is increasing at the rate of 36 million bicycles a year as it modernizes the economy and moves towards a stable human population of 1.6 billion in the year 2030. The large bicycle fleet will

reduce the output of greenhouse gases, air pollution and petroleum imports. Ten companies can each produce over 1 million bicycles a year and three companies can produce more than 3 million bicycles a year. The domestic bicycle market will grow to a 100 million bicycles a year if provisions for safe cycling are made in the growing cities.

China is now producing more and higher quality bicycles because of Japanese and Taiwanese involvement. The China Bicycle Association has 380 bicycle and bicycle part manufacturers in its membership and assists members with statistics, information and establishing quality standards. The industry is becoming far more sophisticated with exports up from 3.7 million in 1990 to 10.5 million in 1994. Japan and Taiwan have set up manufacturing facilities and joint ventures to build bicycles to satisfy International Standards Organization (ISO) quality standards.

After independence India produced 1.4 million bicycles in 1962 in 18 factories with several hundred small producers and makers of bicycle parts. The traditional Indian bicycle was built to last, and the average

bicycle lasted around 15 years of heavy use. A low cost design innovation was tubular inserts brazed inside the bicycle tubes at the lugs reinforcing the tube and creating the equivalent of a double butted tube. In 1994 India produced 10.5 million bicycles mostly from a modern bicycle industry of 8 manufacturers and 80 makers of bicycle parts. However, there are still several thousand very small scale assemblers of bicycles and makers of parts. Repairing old bicycles involves many thousands of people in repair shops.

Prior to 1988 India had the most protected economy in the democratic world but now the door is wide open for foreign investment and technology. In 1988 India exported few bicycles but exports grew to 2.4 million in 1994. Bicycle production lines have been modernized and the quality and design of exported bicycles has greatly improved and mostly conform to ISO specifications.

FUTURE WORLD DEMAND FOR BICYCLES

In the 15 nations of the European Union the most recent population surveys show that there is almost zero population growth with an average population increase of only 0.1%. By the year 2025 the population of the European Union would be around 372 million and reducing.

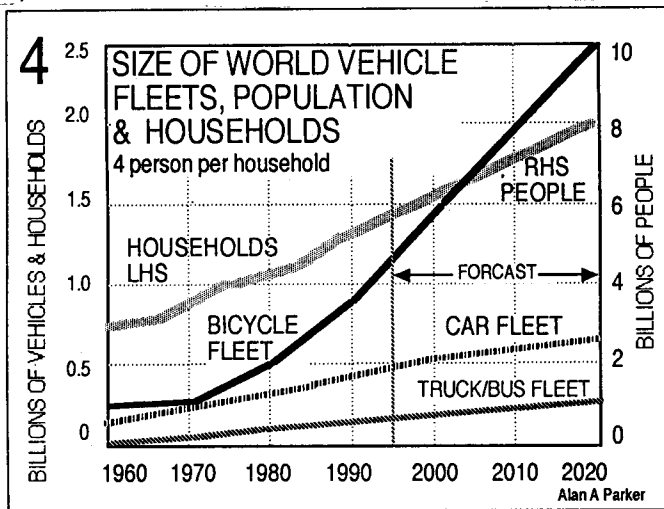
There are 400 million bicycles in today's developed countries and this figure will increase by perhaps another 100 million mainly in north America but not much more. The world's population will increase to 8.2 billion by the year 2025. There will be 2.6 billion more people, mostly in developing countries where most of the future demand for bicycles will be concentrated. Graph 4 shows this writer's projections for the increase in vehicle populations and the UN population projections.

Another reason why the future of the bicycle industry is almost guaranteed is that the non renewable resources of the world may only stretch as far as providing access to a bicycle and a basic form of public transport for most people on spaceship earth. The high levels of multiple car ownership that exist in the developed world are totally unsustainable and cannot happen in most developing countries except for elite minorities who have a real need or are so rich they can afford them.

There is much uncertainty about future resource scarcities which are beyond the scope of this paper. However, planning for the sensible and safe use of bicycles is obviously a good risk management strategy for both conserving resources and ensuring a measure of social equity for future generations.

By the year 2025 there will be massive population growth in Asia: 305 million more Chinese, 455 million more Indians and 79 million more Indonesians. In Africa, where the population growth rate was four times higher in 1995 than in Asia, there will be 800 million more people, and in Latin America 60 million more people. As bicycles last only one fifth of an average lifetime of 65 years (1995) in Asia, the existing production of bicycles is not keeping up with the demand generated by the sheer numbers of people born 15 to 20 years ago who are now adults. That will only happen after many years of zero population growth beyond the year 2030 when bicycle production reaches around 300 million units a year

In the developing world per capita bicycle ownership is not the best way to measure the benefits of producing billions more mass produced bicycles. This is because most bicycles are household vehicles used by more than one family member. If we assume four people per family household to the year 2020 we can conclude that household bicycle ownership is increasing, and that bicycles are getting to more people.



Graph 4 shows that in 1994, the world car fleet is around 450 million, the bicycle fleet is 1.1 billion and the number of households is 1.4 billion. It is clear that the car fleet is not increasing as fast as the increase in the number of households, let alone the total population. The positive trend is that bicycle ownership is increasing faster than the annual increase in the number of households.

FUTURE CONSTRAINTS TO BICYCLE USE

In some developing countries today the bicycle plays an important part in reducing oil imports, transport infrastructure costs and in reducing household transport costs. In a few countries the use of bicycles is planned for but in most of them they are discriminated against by a bureaucratic elite that uses cars and gives priority to cars in urban planning. Transport planning in India, Thailand, Indonesia, and Malaysia is dominated by petrol heads addicted to an alien car culture. As the growth in the number of cars accelerates, bicyclists have been literally run off the roads in Bangkok and in most large Indian and Taiwanese cities. Even in Vietnam, local officials are infatuated with car culture and it is doubtful if cyclists will be able to ride bicycles safely in a few years. Witness the banning of rickshaws in Jakarta and the attempts to ban rickshaws in so many other cities in Asia.

In developing countries the reliance on bicycles and birth control is just as important as the planned transition to a mixed economy in which market forces are allowed much greater freedom of action. For example China is not a rich country but it has experimented with some novel transport planning ideas in large cities that use bicycles and buses in an integrated system. Even in China the bicycle fatality rate may rise rapidly due to an infatuation with car culture in certain regions and there is no long term national bicycle policy.

Car dominated transport systems are definitely not sustainable now and to blindly hope that some solar powered car made with minimum resources will be soon available is gambling with the welfare of the human race. The fact is that half the cars produced this year throughout the world will still be in use in ten years time. It seems rather obvious

that a world car fleet using today's technology of above one billion would be an environmental disaster.



Yamaha's PAS has a DC motor and rechargeable battery integrated with the frame

Even with the technology of 2010 the sustainable limit may be two billion cars. If that is so, in a world of 8.2 billion people, the future transport role of the bicycle is far more important than that of the car.

THE NEED FOR AN INTERNATIONAL BICYCLE MOVEMENT

There is a need for a strong international bicycle organization to promote the development of bicycle-safe and bicycle-friendly transport systems throughout the world, so that cyclists are not driven off the roads as they have been in so many developed countries. The Asian bicycle industry is now rich enough to act as a lobby for the cycling working class and farmers of Asia and hopefully in time the Asian middle class. The only motor vehicle that has a guaranteed future is an electric power assisted bicycle or rickshaw that plugs into batteries fed by solar electric roof tiles that should be standard fittings on every house in the year 2050. Yamaha and Sanyo are already making these products.

A bicycle lobby is needed in all Asian countries to act with at least the vigor of the Japanese Bicycle Promotion Institute. However, it should be possible to do much better than that. The Asian bicycle industry needs to set up an Asian Bicycle Promotion Institute as a

lobby to government and become a regional center of excellence for bicycle planning expertise. In the long term there is a potential trillion dollar bicycle market out there that needs to be secured and a billion dollars spent in the next thirty years on realizing that potential and protecting cyclists would only be the equivalent of what car makers have done for their customers.

The bicycle should rank as one of humanities greatest inventions and the technology for energy efficient powered assisted bicycles will also stand the test of time. This is why governments in all countries should provide bicycle facilities and plan cities in such a way as to give non-motorized transport and new, more energy efficient forms of transport greater priority.

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Alan A. Parker has been a bicycle planning advocate for 20 years, lobbying to make Melbourne and other Australian cities bicycle friendly. Author of the book "Safe Cycling: a Defensive Strategy Plan for Melbourne" in 1976, he has also written for "Australian Cyclist" and "Freewheeling". A founder member and former vice president of the Bicycle Federation of Australia, he has been Vice President of the Town and Country Planning Association (TCPA) since 1988.