



Using the Patent Analysis to Examine the Future Development Trend of the Life Cycle of Taiwan's Fitness Equipment and Bicycle Industries

Ming-Han Chiang,¹ Li-Wei Liu,^{2*} Cheng-Yu Tsai,³ Yi-Liang Yeh⁴

¹ Dean of Student Affairs in National Tainan Junior College of Nursiny of West Central Dist, Tainan City 70043, Taiwan R.O.C

² Associate Prof. of Department of Leisure Services Management in Chaoyang University of Technology, 168, Jifeng E. Rd., Wufeng District, Taichung, 41349 Taiwan, R.O.C.

³ Associate Prof. of Department of Sports, Health and Leisure in Aletheia University, Madou Dist., Tainan City 72147, Taiwa R.O.C.

⁴ Master's Degree of Department of Leisure Services Management in Chaoyang University of Technology, 168, Jifeng E. Rd., Wufeng District, Taichung, 41349 Taiwan, R.O.C

ABSTRACT

Objective – This study aims to analyse the current situation of Taiwan's fitness equipment and bicycle industries, to compare their future development. As a result of globalization and the trend of the knowledge economy, patent information can be used to predict the trend of these industries.

Methodology/Technique – This study uses M-Trends as a research tool. The scope of the study is the number of patents issued between 1996 and 2015.

Findings – The research results show that the technology lifecycle of the fitness equipment and bicycle industries are both mature.

Novelty – This study analyzes the life cycle of Taiwan's fitness equipment and bicycle industries through EXCEL, to build a patent figure, and compare the technology life cycle to show Taiwan's fitness equipment and bicycle industries in the technology lifecycle phase.

Type of Paper: Empirical.

Keywords: Patents; M-Trends; Fitness Equipment Industry; Bicycle Industry; Taiwan.

JEL Classification: L62, Z23.

1. Introduction

1.1 Research Background and Motivation

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* Corresponding author:

E-mail: llouis@cyut.edu.tw

Affiliation: Chaoyang University of Technology Department of Leisure Services Management

Global economic growth and the use of patent knowledge and intellectual property rights play a key role in this research. Patents can promote innovation and economic growth, and prevent the violation of other patents. Patents can also help enterprises grow, enhance corporate value, whether for large enterprises or small businesses, and can enable businesses or investors to effectively grasp key technology trends. The development of the sports industry, for example, is an important industry for a country's competitiveness and on the global scale. At present, manufacturing products is Taiwan's primary sports-related industry. The US sports-related industries are worth approximately 4,984 billion US dollars per year, and accounts for around 2.6% of the total Gross Domestic Product (GDP). The related output value is \$ 3.75 billion (Shao-Tung Cheng, 2016), which shows the importance of the sports industry around the world.

Taiwan relies on a complete, low-cost and high-quality supply system. US fitness equipment manufacturers use Original Equipment Manufacturing (OEM) to commission a large number of orders by the Taiwanese manufacturing companies. In a competitive environment, Taiwan's fitness equipment manufacturers need to develop the correct business strategies that will enable them to succeed in their chosen enterprises in a highly competitive market. Therefore, the use of patent analysis of the number of pieces to explore Taiwan's fitness equipment industry is another motivation for this study.

In addition to the study of the fitness equipment industry, this study also examines Taiwan's bicycle industry. As a result of greater awareness of environmental protection, global warming and international oil prices, bicycle riding has become a popular leisure sport. However, international competition in this industry has, in recent years, faced several challenges such as globalization and the economic integration of regional trade agreements and trade organizations. As a result of this, as well as tariff barriers between countries and relocation of manufacturing profit margins, Taiwan's bicycle industry struggles to remain in the global market. Therefore, the use of patent number analysis to examine Taiwan's bicycle industry is a further motivation of this study.

The third part of the study focuses on the development of Taiwan's fitness equipment manufacturing industry and bicycle industry to provide future investment in the sports industry, or entrepreneurs in this area.

This study uses M-Trends patent search and analysis, management platforms, and patent number analysis methods to analyze the data of patents issued between 1996 and 2015. The study aims to promote future investment in the sporting industry, or to encourage entrepreneurs in this area.

1.2. Research Purposes

1. To determine the number of patents to understand the status of the fitness equipment industry.
2. To know the status of the bicycle industry according to the number of patents.
3. To compare the fitness equipment and bicycle industries.

2. Literature Review

Kala (2009), states that the "cycle industry seeks to upgrade technology". Kala has also stated that the cycle industry has claimed it is capable of surpassing China in bicycle production, if provided with the latest infrastructure and technology capabilities.

M-Trends Patent Search and Analysis Management Desk use patent searches to access the world's leading official databases, and establish the WEPBAT global patent database to support multi-national searches, to download patents. In the management trend analysis, a graphical chart is used to assist enterprises to obtain patent information, in order to gain an understanding of market trends. This graph is mainly divided into the number of patents, the state of the analysis, the company's that do not analyze, (master) inventor analysis,

(main) review committee analysis, (main) IPC analysis and the main UPC analysis (Shao Sung Lo, 2010). The method used in this study is the number of patents analysis.

The number of patent analysis is used to analyze the trend of technology development by determining the status of the technological lifecycle, in order to predict the future of technology progression. This involves the following information: the inventor, the number of patents over a period of time, cited analysis within the project, the number of analyses conducted, and citation data analysis.

The purpose of the technology life cycle diagram is to understand the process of change in technology. This can be used by enterprises to establish a patent portfolio and to further innovate their patent commercial business model.

Table 1. Patent Technology Lifecycles

Stage	Appellation	Explanation
Phase 1	Budding period	Manufacturers will be willing to invest low. The number of patent applications and the number of patents are small.
Phase 2	Growth period	Industrial technology breakthrough manufacturers for the market value of a cognitive and competing into development. The number of patent applications and the number of patent rights rose sharply.
Phase 3	Mature period	Manufacturers to invest in R & D resources no longer expand. Only a few continue to develop this type of technology.
Phase 4.5	Recession	Industrial technology research and development bottlenecks difficult to break or the industry is too mature.

Source: Huang (2009).

3. Methodology

3.1 Analysis Methods and Retrieval Conditions

The study aims to examine the fitness equipment and bicycle industries through a M-Trends patent search and analysis management platform. Information on patent trends can be used by enterprises to make decisions regarding their business development. Quantitative analysis is used to quantitatively study the general results of the specific research object. In the quantitative study, the information is expressed by a number. In the scientific research, the quantitative analysis method can provide a greater understanding of the object of further refinement. However, a more scientific understanding will enable enterprises to grasp the nature of the relationship between the variables, and to predict the trend of patents in certain industries.

This study uses the keywords “fitness”, “sports equipment” into the M-Trends patent search and analysis management platform. Following this, the keyword “bike” was used and “electric bicycle” was removed. In order to improve the efficiency of the analysis, this study excludes any patents issued prior to 1996, in light of the 20 year lifecycle of a patent. Therefore, the examination period is from 1 January 1996 to 31 December 2015. The total number of patents found for the invention was 9,734, while the total number of biopsy invention patents was 11,805. This information as then put through the EXCEL software for the number of patent analysis. The detailed search conditions used are shown in Table 2 and Table 3.

Table 2. Fitness Equipment Search Conditions

Retrieve condition setting table	
Retrieve the database	M-Trends patent search and analysis system

Retrieval date	Announcement date from January 1, 1996 to December 31, 2015 only
Keywords (Unlimited)	Fitness and sports equipment
Search grammar	(TAC: (fitness) OR TACD (sports equipment)) AND PD: [1996-01-01 TO 2015-12-31] AND ADPT = (invention model design)
Final number of patents invention	9,734 invention patents

Table 3. Bicycle Search Conditions

Retrieve condition setting table	
Retrieve the database	M-Trends patent search and analysis system
Retrieval date	Announcement date from January 1, 1996 to December 31, 2015
Keywords (Unlimited)	Bicycle AND NOT electric bike
Search grammar	(TTL: (bike) AND NOT TTL: (electric bike)) AND PD: [1995-01-01 TO 2015-12-31] AND ADPT = (invention model design)
Final number of patents invention	11,805 invention patents

Source: This study.

4. Research Results and Analysis

4.1 Analysis of Number of Patents for Fitness Equipment

According to the analysis, the number of patents issues between 1996-2015 for inventions in the fitness equipment industry in Taiwan was less than 300 before 1997. This number gradually increased from 2003 and rose to more than 600. In 2006, this number plummeted below average, and then rose again in 2007. Overall, the number of patents are above average, and in 2005, the numbers reached its peak at 733.

Table 4. Fitness Equipment: The Number of Patents

Number of patents over the years										
Years	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Number of patents	265	432	357	369	388	378	363	489	489	629
Years	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Number of patents	429	448	528	553	588	502	564	612	618	733

Source: This study.

4.2 Fitness Equipment Life Cycle Analysis

According to the analysis of the number of patents in issued between 1996 and 2015, the number of patents and the number of patent rights increased year by year. The results for Taiwan's fitness equipment industry patents show that the current industry is in the third stage: technical maturity.

Table 5. Fitness Equipment Technology Life Cycle

Technology Lifecycle Analysis - Patentee										
Years	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Number of	265	432	357	369	388	378	363	489	489	629

patents										
Patent full	196	247	232	236	258	278	252	308	317	405
Years	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Number of										
patents	429	448	528	553	588	502	564	612	618	733
Patent full	281	284	371	387	429	360	409	437	422	465

Source: This study.

4.3 Analysis of Number of Patents for Bicycles

According to the analysis of the number of patents in Taiwan from 1996 to 2005, it can be seen that the number of patents for bicycle inventions in Taiwan was lower than the average of 590 before 2005 and rise to 618 in 2005. The growth rate was 5%. In 2006 fell to 521 and then began to rise year by year. In 2011 fell to 723, and then rebounded to 922 in 2013. In 2014 is slight decline, 2015 reached the highest point of 1011.

Over the years the number of patent ups and downs, the overall number of bike patent number is to continue to rise. And in 2008, the number of patents are higher than the average. As shown in Table 6.

Table 6. Bicycles: Number of Patents

Number of patents over the years										
Years	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Number of										
patents	313	310	260	279	459	465	354	456	499	618
Years	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Number of										
patents	521	584	604	879	901	723	765	922	882	1011

Source: This study.

4.4 Bike Lifecycle Analysis

The analysis of the patented lifecycle diagram shown in Table 7 demonstrates that the number of patent rights has not increased significantly and the number of patents has increased greatly. In terms of the status quo of patents in the Taiwan bicycle industry, the results show that Taiwan 's bicycle industry is also in the third stage: the mature period.

Table 7. Bicycle Technology Lifecycle

Technology Lifecycle Analysis - Patentee										
Years	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Number of										
patents	313	310	260	279	459	465	354	456	499	618
Patent full	190	192	181	173	277	273	205	222	223	256
Years	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Number of										
patents	521	584	604	879	901	723	765	922	882	1011
Patent full	233	261	304	509	552	470	446	514	454	490

Source: This study.

4.5 Industry Analysis

This study uses 5 year cycles and compares the number of patents issued in the fitness equipment and bicycle industries in Taiwan. Table 8 shows that the number of fitness equipment and bicycle patents in Taiwan are almost the same. Further, the number of fitness equipment patents has increased slowly year by year, reaching its highest point of 733 in July, while the number of bicycle industry patents has increased more rapidly. The number of patents of this industry reached 1011 in 2015. In the analysis process, the number of fitness equipment patents (A) and the number of bicycle industry patents (A) are divided by the number of patents (B) to obtain the average number of units (A/B). Figure 4.3.1 shows the number of fitness equipment units maintained at 1.5 per year. The number of bicycle units reached its highest peak in 2005 at 2.4 per year, and fell to 1.54 per year in 2011. However, in the past 5 years, this number has risen again to 2.1 per year. The average number of fitness equipment patents is 1.49 per year, while the average for the bicycle industry is 1.85 per year.

Table 8. Number of Patents in the Fitness Equipment and Bicycle Industry

Years	1996		2001		2006		2011		2015	
Industry	Fitness	Bicycle	Fitness	Bicycle	Fitness	Bicycle	Fitness	Bicycle	Fitness	Bicycle
Number of patents (A)	295	313	378	465	429	521	502	723	733	1011
years	1996		2001		2006		2011		2015	
Industry	Fitness	Bicycle	Fitness	Bicycle	Fitness	Bicycle	Fitness	Bicycle	Fitness	Bicycle
Number of Patents (B)	196	190	278	273	281	233	360	470	465	490
Number of units (A / B)	1.35	1.65	1.36	1.70	1.53	2.24	1.4	1.54	1.58	2.1

Source: This study.

5. Conclusion

This research uses a patent analysis point of view to examine the fitness equipment and bicycle industries in Taiwan, to establish the status of patent layout and technology trends. This study hopes to provide information on domestic industries related to technology research and development, which may assist with the decision making process of businesses in these areas. This is achieved by observing the development trends of these industries in Taiwan through the patent management chart, including the number of patents issued and the patentee technical lifecycle. The results show that the number of patents being issued in these two industries between 1996 and 2015 has fluctuated over time, however, it is clear that the overall number of patents continues to rise. Further, according to the data, both industries are now in the mature stage of the patent lifecycle. This study uses M-Trends patent searches and analysis management platforms. The results also show that the average number of patents issued is higher in the bicycle industry than the fitness equipment industry.

This study recommends that the fitness equipment industry should improve its OEM production yield, stabilize its orders and seek to attract new customers. The study also reveals that the current fitness industry in Taiwan remains biased towards Original Equipment Manufacturing (OEM) and Original Design Manufacturing (ODM). To bring their brands into the existing market, the bicycle industry should undertake continuous research and development of new technologies, to maintain its market competitiveness and to consolidate their existing brands.

References

- Pavitt, K. (1988). Uses and abuses of patent statistics. In *Handbook of quantitative studies of science and technology* (pp. 509-536).
- Huang, Y. Y. (2009). Potential Benefit of Patent Search in the Research Development Projects —Using Sun Shading

- Device as an Example (Master's Thesis, National Taiwan University of Science and Technology, Taiwan Taipei).
- James, M. L., and Hsun, C. C. (2010). Using Patent Analysis to Explore the Development of Radio Frequency Identification. *Journal of Science and Technology Management*, 15(1), 24-48.
- M-Trends Patent Search and Analysis System (2016). <http://www.ltc.tw/Pages/products-mt.html>.
- Tung, S. C., and Yuan, S. F., and Jin, H. L., and Yuan, P. L., and Shu, C. Y., and Ju, C. L. (2017). *Introduction of Sport Management*. Sample City: Hwa Tai Publishing.
- Sung, S. L. (2010). Technical Analysis of Food and Beverage Industry. *Journal of China University of Science and Technology*, (42), 315-331.
- Juan, C. L. (2011). *The Analysis and Development of Bicycle Industries Taiwan*. (Master's thesis, Feng Chia University, Taiwan Taichung).
- Kumar, R. (2016). Role of Engineering Export Promotion Council in Promotion of Export of Bicycles and Their Spare Parts-An Empirical Study of Bicycle Exporters in Ludhiana. *Journal of Commerce and Management Thought*, 7(1), 91.