

# Innovation and Patenting Activities at Universities in Taiwan

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**Abstract** — In this study, the author reviews patents granted to 174 Taiwanese universities during the period of 2004 to 2009 by taking bibliometrics approach to have a better understanding of innovation and patenting activities of Taiwanese universities. The results show that the university administrations take very proactive roles in patenting the research inventions or works that resulted by the universities funded researches after the passed the two Bayh-Dole like acts in Taiwan. 105 universities and colleges were granted patents during the reviewed period. The distribution of patents granted shows that general universities were granted mainly invention patents and universities of technology were more active in gaining utility model patents.

**Index Terms** — University Patenting, Patenting Activity, Patent Analysis.

## INTRODUCTION

The Bayh-Dole act of 1980 was seen as a vital initiative in United States technology policy and have been stated having major contribution to the rapid emergence of new high-technology firms and high rates of growth in the United States economy during the 1990s. Two Bayh-Dole like acts, Fundamental Science and Technology Act and Government Scientific and Technological Research and Development Results Ownership and Utilization Regulations passed in 1999 and 2000 in Taiwan, gave universities and non-profit institutions intellectual property control over their inventions and works that resulted from universities- and organizations-funded researches. These two acts encourage universities and non-profit institutions to pursue ownership of an invention in preference to the government. In this study, author reviews patents granted to 174 Taiwanese universities during the period of 2004 to 2009 by taking bibliometrics approach to have a better understanding of patenting activities of the universities.

Although there are studies indicated that the effects of Bayh-Dole on the content of research were modest (Meyer, 2003; Mowery et al., 2001; Mowery & Ziedonis, 2002), other studies did show that the Intellectual Property Regulations influenced by Bayh-Dole like acts did have major impact on university patenting (Baldini, Grimaldi & Sobrero, 2006; Lo, 2008). Taiwanese universities started to set up the intellectual property offices to be in charge of the patenting activities after passing the two Bayh-Dole like acts. The starting-up office shows that the universities tend to take more active role in pursuing ownership of inventions of their affiliates (Lo, 2008). In this study, the author tries to investigate the following questions,

- Are the universities and colleges in Taiwan active in the patenting activities?
  - Which universities and colleges are patenting active?
  - Are the universities of “Plan to Develop First-class Universities and Top-level Research Centers” also active in patenting?
  - What are the patenting strategies used in patenting
- Have Bayh-Dole like acts affected patenting activities of Taiwanese universities and colleges?
  - Have the numbers of patents granted to the universities and colleges increased after passing two Bayh-Dole like acts?
  - Have Bayh-Dole like acts continued affecting universities patenting activities?

## METHOD AND DATA

This study tries to reveal patenting activities of 174 Taiwanese universities by examining the Taiwan Intellectual Property Office (TIPO) patents granted to these 174 universities during the period of 2004 to 2009. The level of activeness in patenting of the studied universities is shown by the results of Patent Count. Two sets of TIPO patents related to the universities are included in this study. The patents in the first set are the patents granted to the universities as assignees. The university could be sole assignee or co-assignee with other individual or institute. The patents in the second set are the patent that original granted to other assignees but transferred to the universities after the patent issued during the period of 2004 to 2009. The data source used is Taiwan Patent Search provided by Intellectual Property Office,

Ministry of Economic Affairs of R.O.C.<sup>1</sup>. The distributions of productivities among different types of universities and various types of patents are further examined.

Taiwanese universities and colleges encompass 71 general universities, 92 universities of technology, and 11 military/police universities. Students of general universities, universities of technology and military/police universities are awarded a bachelor's degree upon completion of their undergraduate study; they will obtain a master's degree upon completion of their postgraduate study. However, the curriculum at most general universities focuses on academic studies and research, while universities of technology focus on practical and specific skills training, and military/police universities training commissioned officers. Bachelor's programs at all types of higher education institution require four years to complete; master's programs usually require two years; and a doctorate (PhD) needs at least three years. Figure 1 shows the current school system in Taiwan.

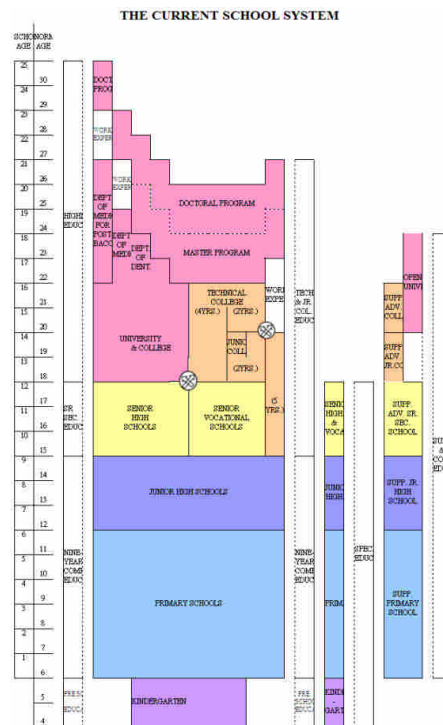


FIGURE 1  
EDUCATION SYSTEM IN TAIWAN<sup>2</sup>

The patent referred to the Patent Act of Republic of China is classified into three categories, Invention patents, Utility model patents, and Design patents. The term “invention” used in Patent Act is referred to any creation of technical concepts by utilizing the rules of nature; “utility model” is referred to any creation of technical concepts by utilizing the acts of nature, in respect of the form, construction or installation of an article; “design” is referred to any creation made in respect of the shape, pattern, color, or combination thereof of an article through eye appeal. The author uses the names of universities as search terms to retrieve patents for this study. To make sure the completeness of the data, authority records contain various forms of names are created for each school.

## RESULTS

The results of this study show that, (1) in the last 6 years, number of patents granted to Taiwanese universities and colleges continuously rose, (2) general universities and universities of technology have different patenting focus, military/policy universities have very limited number of patents granted, (3) 19 universities and colleges were granted more than 100 patents during the period of 2004 to 2009, (4) number of patents obtained via transferring of inventions and works that resulted from researches to the affiliated universities and colleges increased, (5) setting up intellectual property offices and internal policy to govern intellectual property right of the inventions and works that resulted from university-funded researches become common practice for universities and colleges, (6) Universities of “Plan to Develop First-class Universities and Top-level Research Centers” are active in patenting activities.

<sup>1</sup> <http://twpat.tipo.gov.tw/tipotwoc/tipotwekm>.

<sup>2</sup> <http://english.moe.gov.tw>

## (1) Number of Patents Granted to Taiwanese Universities and Colleges Continuously Rose

The results of patent count show that there are 5,979 TIPO patents granted to Taiwanese universities and colleges during the period of 2004 to 2009, 446, 774, 1,008, 950 and 1,220 patents granted annually, 996.5 patents in average. Except 5.67% decreased in 2007, numbers of patents granted continuously increased in 6-year period. Among the granted patents, 2,985 (49.92%) patents were invention patents, 2,881 (48.19%) were utility model patents and 113 ones (1.89%) were design patents. Comparing numbers of patents granted in each category annually, more invention patents were granted from 2004 to 2007 and the number of utility model patents exceeds the number of invention patents the first time in 2008, there were 438 invention patents and 758 utility model patents granted. Figure 2 shows numbers of patents granted from 2004 to 2009. Further looking into the possible cause and found that the examination of utility model patents was changed from substantive examination to formality examination. The change encourages some universities take more aggressive strategies in applying utility model patents, especially universities of technology, and the results show the influence.

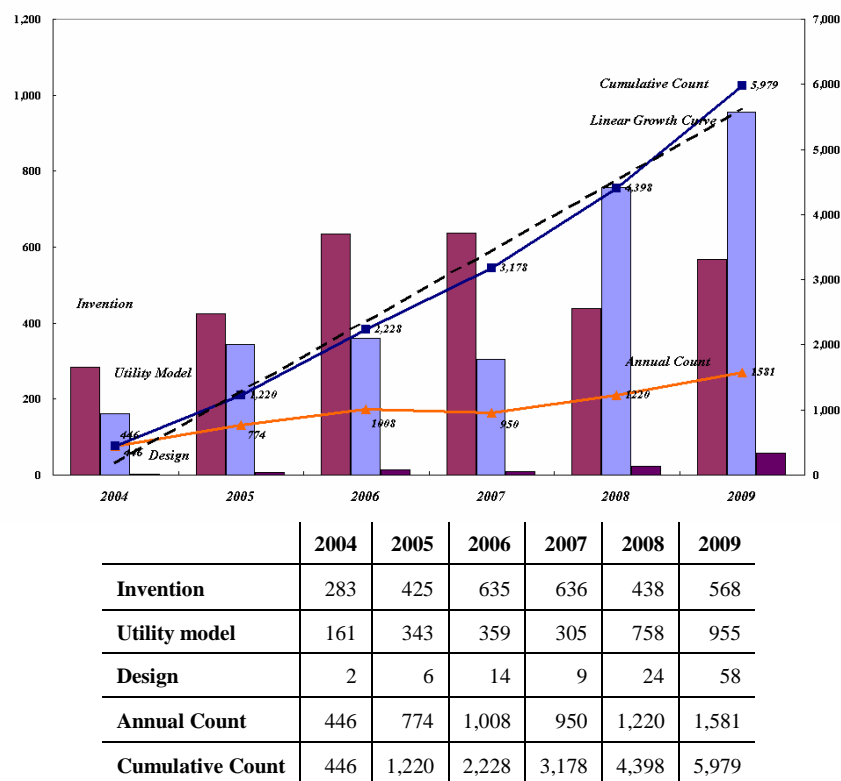


FIGURE 2  
PATENT COUNT AND GROWTH CURVE

## (2) General Universities and Universities of Technology Take Different Patenting Strategies

Military/Police universities were granted with very limited patents, 23 patents. Only general universities and universities of technology are included in this session. Comparing numbers of various types patents granted to general universities and universities of technology and it is found that patenting activities of general universities are mainly concentrating on applying invention patents, 87.67% (2,047) of the patents granted to general universities were invention patents. Universities of technology have different strategic plan in patenting. Taking the universities of technology as a whole to examine the distribution of patents granted, 71.86% (2,602) of patents granted were utility model patents and 25.43% (921) of granted patents were invention patents. Further checking the patent types by universities of technology, two groups of university of technology could be identified, invention oriented and utility model patent oriented. The first group, including National Formosa University, National Taiwan University of Science and Technology, National Taipei University of Technology, and National Kaohsiung University of Applied Sciences, were granted more invention patents. The percentages of invention patents are 94.15%, 58.33%, 52.68% and 57.14%. The other group of universities of technology is more utility model patent oriented. Among them, Yuan-pei University, Oriental Institute of Technology, Chia Nan University of Pharmacy and Science, Technology and Science Institute of Northern Taiwan, Far East University, and Kao Yuan University are the major universities. The ratios of utility model patents granted are 96.97%, 95.83%, 93.33%, 88.89%, 87.78 and 87.10%. Figure 3 shows the distribution of types of patents of general universities and universities of technology.

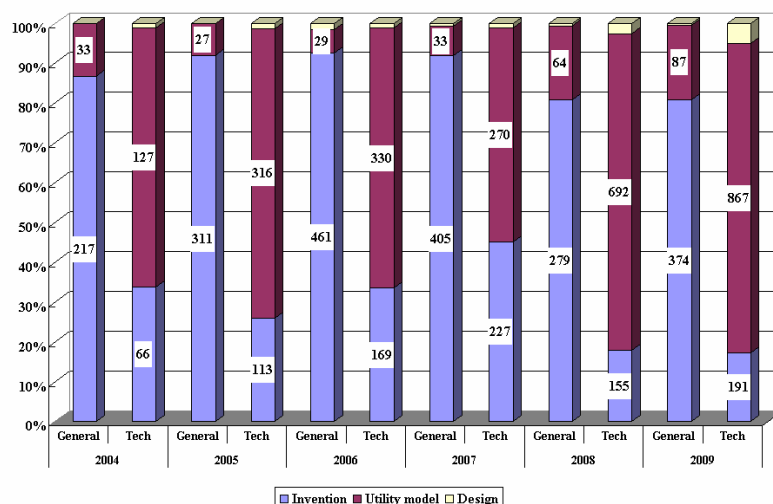


FIGURE 3  
DISTRIBUTION OF TYPES OF PATENTS - BY UNIVERSITY TYPES

### (3) Most Productive General Universities and Universities of Technology

#### a. Top 10 productive General Universities

National Cheng Kung University is the most productive general university out of 71 general universities, 314 patents were granted to National Cheng Kung University. Besides National Cheng Kung University, National Chiao Tung University, National Taiwan University, National Sun Yat-sen University and National Chung Hsing University are the most 5 productive general universities. Each of them was granted, 275, 240, 218 and 189 patents, mainly are invention patents. Among the productive general universities, Chung Yuan Christian University and Chang-Gung University take slightly different patenting strategies. Invention Patent is not the sole focus of Chung Yuan Christian University's patent strategies, 26.71% of the patents granted were utility model patents and Chung Yuan Christian University was also granted 12 design patents, the university was granted most number of design patents. Chang-Gung University was granted 92 patents and 11.96% of them were utility model patents. Table 1 shows the numbers of various types of patents granted to the most 10 productive general universities.

University	Invention		Utility Model		Design		Subtotal
	Patents	%	Patents	%	Patents	%	
Cheng Kung U.	283	90.13%	31	9.87%	0	0.00%	314
Chiao Tung U.	272	98.91%	3	1.09%	0	0.00%	275
Taiwan U.	221	92.08%	19	7.92%	0	0.00%	240
Sun Yat-sen U.	213	97.71%	5	2.29%	0	0.00%	218
Chung Hsing U.	183	96.83%	6	3.17%	0	0.00%	189
Tsing Hua U.	178	97.80%	4	2.20%	0	0.00%	182
Central U.	163	95.32%	8	4.68%	0	0.00%	171
Chung Yuan Christian U.	95	65.07%	39	26.71%	12	8.22%	146
Chang-Gung U.	81	88.04%	11	11.96%	0	0.00%	92
Feng Chia U.	75	96.15%	3	3.85%	0	0.00%	78
<b>Total</b>	<b>1,764</b>		<b>129</b>		<b>12</b>		<b>1,905</b>

TABLE 1  
TOP 10 PRODUCTIVE GENERAL UNIVERSITIES

#### b. Top 10 productive Universities of Technologies

Far East University is the most productive university, not only among universities of technology, but also among 174 universities and colleges. Far East University was granted 966 patents during the period of 2004 to 2009. The patents granted to Far East University were mainly utility model patents, 87.78% (848) out of 966. Next to Far East University is

Southern Taiwan University of Technology, which took similar patenting strategy, 70.80% (194) out of 274 patents granted were utility model patents. National Formosa University, listed on the 3rd, took very different patenting strategy, 94.15% (177) out of 188 patents granted were invention patents. National Taiwan University of Science and Technology, Chin-Yi University of Technology, are other productive universities of technology. Table 2 shows the numbers of three types of patents granted to the most 10 productive universities of technology. The two different patenting strategies taken by universities of technology are shown by the distribution of different types of patents of granted.

University	Invention		Utility Model		Design		Subtotal
	Patents	%	Patents	%	Patents	%	
Far East U.	117	12.11%	848	87.78%	1	0.10%	966
Southern Taiwan U. of Tech.	49	17.88%	194	70.80%	31	11.31%	274
Formosa U.	177	94.15%	11	5.85%	0	0.00%	188
Taiwan U. of Sci. & Tech.	84	58.33%	52	36.11%	8	5.56%	144
Chin-Yi U. of Tech.	32	22.70%	108	76.60%	1	0.71%	141
Hsiuping Inst. of Tech.	23	16.91%	106	77.94%	7	5.15%	136
Shu-Te University	12	8.96%	110	82.09%	12	8.96%	134
Nan Kai Inst. of Tech.	23	19.66%	93	79.49%	1	0.85%	117
Taipei U. of Tech.	59	52.68%	53	47.32%	0	0.00%	112
Tech. & Sci. Inst. of N. Taiwan	12	11.11%	96	88.89%	0	0.00%	108
<b>Total</b>	<b>588</b>		<b>1,671</b>		<b>61</b>		<b>2,320</b>

TABLE 2  
TOP 10 PRODUCTIVE UNIVERSITIES OF TECHNOLOGY

**(4) Re-assignment of inventions and works that resulted from researches to the affiliated universities and colleges is one of the strategies to obtain more patents**

Besides applying the patents as assignees, transferring assignment is also used as one of the patenting strategies to obtain more patents. There are 483 patents out of 5,979 patents (8.08%) granted to the universities and colleges were through assignment transferring. Reviewing the assignment documents, it is found that the patents were most re-assigned from the individuals or affiliations associate with universities and colleges within 3 years after the patents were granted.

**(5) University Intellectual Property Offices and Internal Governing Policy of Intellectual Property Right**

Further checking the organizations of the productive universities and colleges, it is found that those universities and colleges set up the offices to be in charge of patenting after passing two Bayh-Dole like acts. All the top 10 productive general universities have designated divisions or offices to take the full responsibility and sole in charge of patenting business. Most of the divisions are positioned under “Office of Research and Development” of universities and are often called “Technology Licensing Center” or “Division of Technology Transfer.” For universities of technology, most of the productive schools assign the works to “Division of Technology Cooperation”, “Innovation & Incubation Center” or “Section of Technical Services”, which are mostly positioned under Office of Research and Development to govern patenting activities. Those offices or sections are not solely designated to handle patenting. The only two exceptions are Far East University and Formosa University. The Center of Technology and Authorization of the Office of Industrial Academic & Cooperation of Far East University oversees all the patenting works of the affiliations and Technology Transfer Center of Research & Development Office of Nation Formosa University is the designated office in charge of the patenting works. Besides the designated offices, all the productive universities and colleges pass internal governing policy to encourage and regulate the patenting activities of affiliated individuals and institutes.

**(6) Universities of “Plan to Develop First-class Universities and Top-level Research Centers” are active in patenting activities**

Further examining the patenting activities was done for the 11 universities, Taiwan University, Cheng-kung University, Tsing-hua University, Chiao-tung University, Central University, Sun Yat-sen University, Yang-ming University, Chung-hsing University, Taiwan University of Science and Technology, Chang-gung University, and Cheng-chih University, which are chosen for “Plan to Develop First-class Universities and Top-level Research Centers.” “Plan to Develop First-class Universities and Top-level Research Centers” was launched in 2006 by Ministry of Education of

Taiwan to provide special funding to the chosen universities to support research and curriculum programs to develop first-class universities and top-level research centers. The results show that the universities chosen for this plan are highly patenting active, except Cheng-chih University and Yang-ming University due to the research focus. Cheng-chih University is known for the curriculum and research programs in social science and Yang-ming University is medical school. Both universities are not active in patenting activities. Other universities of “Plan to Develop First-class Universities and Top-level Research Centers” hold 1,589 patents, 26.58% of patents granted to Taiwanese Universities

## CONCLUSIONS

The universities started to take more aggressive strategies after two Bayh-Dole like acts passed in Taiwan and the influence of these two acts continues by the set-up of intellectual property offices in the universities and colleges, the passing of internal intellectual property policy and the increasing numbers of patents granted to the universities and colleges. In this study, the author tries to answers the following questions, “How active the universities and colleges are in the patenting activities?” and “Have Bayh-Dole like acts affected patenting activities of Taiwanese universities and colleges?” The results show that the number of universities and colleges with patenting activities continues to grow and the outcomes are also encouraging, the number of patents granted in 2009 increased 29.59% comparing to the number of patents granted in 2008. The universities of “Plan to Develop First-class Universities and Top-level Research Centers”, which was launched in 2006 and several universities of technology namely Far East University and National Formosa University, show the productive strength in patenting with very diverse focus. General universities that focus on academic studies and research target invention patents and universities of technology focus on practical and specific skills training mostly target utility model patents. The Patent Act of Republic of China and Bayh-Dole like acts continue influencing the patenting activities by authorizing the universities and colleges to gain more control of the inventions and works that resulted from universities- and colleges-funded researches, not only have the universities and colleges set-up designated department and drafting the internal policy to oversee the patenting activities, the focus of strategies is also shifted with the change of examination mechanism.

## REFERENCES

- Baldini, Nicola, Grimaldi, Rosa and Sobrero, Maurizio (2006). Institutional changes and the commercialization of academic knowledge: A study of Italian universities' patenting activities between 1965 and 2002. *Research Policy*, 35: 518-532.
- Lo, Szu-chia (2008). Analysis of University Patenting: 1995-2006. *University Library Quarterly*, 12(1): 62-71 ° (In Chinese)
- Meyer, Martin. (2003). Academic patents as an indicator of useful research? A new approach to measure academic inventiveness. *Research Evaluation*, 12(1): 17-27.
- Mowery, David C., et al. (2001). The growth of patenting and licensing by U.S. universities: an assessment of the effects of the Bayh–Dole act of 1980. *Research Policy*, 30: 99-119.
- Mowery, David C. and Ziedonis, Arvids A. (2002). Academic patent quality and quantity before and after the Bayh–Dole act in the United States. *Research Policy*, 31: 399-418.