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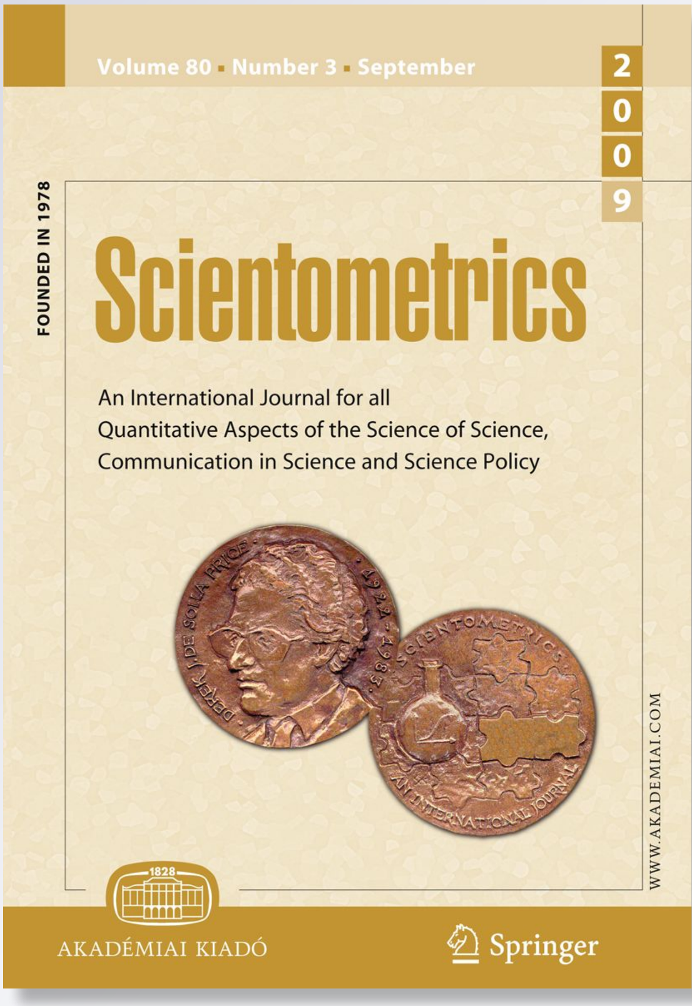

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Abstract With the growth of competition between nations in our knowledge-based world economy, excellence programs are becoming a national agenda item in developing as well as developed Asian countries. The main purpose of this paper is to compare the goals, funding policies and selection criteria of excellence programs in China, Japan, Korea and Taiwan and to analyze the academic achievement of their top ranked universities in three areas: research output, internationalization, and excellence, by using data from the Shanghai Jiao Tong, QS, and HEEACT rankings. The effectiveness of Taiwan's "Development Plan for World Class Universities and Research Centers of Excellence" was assessed as a case study in the paper via a survey targeting on 138 top administrators from 11 Taiwan's universities and 30 reviewers. The study found that more funding nations had, the more outputs and outcomes they would gain, for example China. The Taiwan case demonstrates that world-class universities and research centers are needed in Asian nations despite the concerns for inequality which they raise.

Keywords World class university · Global ranking · Excellence initiative

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Introduction

Over the past decade, the term "world class" has been used widely to describe how a university develops its capacity to compete in the global higher education marketplace. However, no one knows exactly what a World Class University looks like. In 2005, "the Center for World-Class Universities" (CWCU) founded by Shanghai Jiao Tong University boldly defined the term by saying that a growing acceptance from inside and outside of academia that cutting-edge technologies and innovations originate from and require exceptional centers of research and learning has precipitated the worldwide phenomenon known as the "world-class university" (WUC-3 official website 2009; Hou et al. 2011). In other words, this means that "its quality must surpass the expectation of their various stakeholders" (De Maret 2007, p. 33). Feng (2007) stated that there were two generic features for a world class university: presidential leadership, and producing graduates with global citizenship. Altbach (2007) described "world class universities" in a more specific way, indicating that the key elements that a world class university should consist of include excellence in research, top professors, academic freedom, governance, adequate facilities, funding, and so on. In order to make its features more explicit, the former Tertiary Education Coordinator at the World Bank, Jamil Salmi (2009) defined a world class university with three major indispensable elements, which include a high concentration of excellent faculty and brilliant students; abundant resources to offer a rich learning environment and conduct advanced research; and favorable governance features that encourage strategic vision, innovation and flexibility, and enable institutions to make decisions and manage resources without being encumbered by bureaucracy.

With the growth of competition between nations, the creation of world class Universities is becoming a national agenda item in developing as well as developed countries. Germany's excellence initiative and the UK's research assessment exercise (now the research excellence framework) are among the earliest initiatives adopted to consolidate national economic and academic development. In Europe, France, Spain, Denmark and Russia have followed by implementing similar funding policies. Consequently, "policy-makers in many countries have prioritized building research universities that would help their countries obtain a superior position in the global competition", which came to influence the countries in the Asia Pacific region (Shin 2009, p. 669). Marginson (2010) has indicated that accelerated public investment in research and "world-class universities" has forged a unique culture, which he terms the "Confucian Model," in this region.

Several Asian nations have chosen to invest in research universities and centers to lift their volume of research output in order to move up the global rankings quickly (Shin 2009; Marginson 2010; Neubauer 2010; Hou et.al 2011; Altbach 2011). Several excellence programs have been created in Asia. In 1998 China approved a special funding program to build research universities as part of its ''985 project''. The South Korean government supported the 1999 Brain Korea 21 (BK 21) program; and in 2002, the Japanese government established a plan to foster around 30 universities to become 'world class' institutions (Oba 2008; Shin 2009; Yonezawa 2010). Similarly, the Taiwan government launched the "Development Plan for World Class Universities and Research Centers of Excellence" to build at least one university as one of the world's top 100 in 5 years and at least fifteen key departments or cross-campus research centers as the top in Asia in 10 years (Hou 2011a).

Malaysia embarked on the "Accelerated Program for Excellence" (APEX) in 2008, when it was hoped that "this kind of fast-track transformation will push the other universities to adopt a similar stance to achieving world-class status" (AKPET 2011). The

APEX chose nine selected institutions in terms of their outstanding leadership, faculties, student body, and infrastructure (AKPET 2011; Mukherjee and Wong 2011). Singapore developed "Research Centres of Excellence"(RCEs) in 2007 and "the Competitive Research Programme Funding Scheme"(CRP) in 2009 to build up research capacity and capability in Singaporean higher education, as well as creating world-class research centres (NRF 2011; Mukherjee and Wong 2011). In 2010, the Australian Research Council conducted the first full "Excellence in Research for Australia" (ERA) evaluation across all eight discipline clusters and the second round will start in 2012. Indian and Vietnamese governments have also announced national plans aiming at building fourteen and four "world class universities" respectively in the future (Altbach 2010; University World News 2009).

Generally speaking, Asian excellence programs are clearly aimed at building at least one world class university within a period of time through the policy of funding concentration, which significantly enhances a university's volume of research papers, international collaborations and exchanges. Conversely, the effectiveness of this approach and its impact on Asian higher education have becoming a challenging issue inside individual countries, because it raises issues such as overemphasizing meritocratic culture and disseminating research output internationally (Shin 2009).

The main purpose of the paper is to compare the goals, funding policies and selection criteria of the excellence programs in China, Japan, Korea and Taiwan and to analyze their academic achievement of the top ranked universities in three areas: research output, internationalization, and excellence, by using data from the Shanghai Jiao Tong, QS, and HEEACT rankings. The effectiveness of Taiwan's "Development Plan for World Class Universities and Research Centers of Excellence" will be assessed as a case study at the end of the paper.

Development of excellence programs in the Asia pacific region

Excellence programs in China, Japan, South Korea, and Taiwan

From the early 1950s onwards, most research funding in the US and the UK has gone into a small number of elite universities. These countries both have a larger number of world class universities than Asian nations. Learning from the Western experience, China, Taiwan, Japan and South Korea started in the 1990s to develop so-called "Excellence" programs, which involve allocating resources to a small number of universities to enhance their research power and their attractiveness to top students on the world stage. Examples mentioned above include the Chinese 985 initiative, BK21 in Korea, Taiwan's "Development Plan for World Class Universities and Research Centers of Excellence" and the COE/Global 30 scheme in Japan. The four excellence programs in China, South Korea, Japan and Taiwan are described below (Table 1).

Chinese 985 initiative

Prompted by a concern for higher education quality and competitiveness, the Chinese government launched two major initiatives named Project 211 in 1995 and 985 in 1998. While 100 universities were selected to receive special funding to improve their overall performance in Project 21, Project 985 mainly aimed to develop 10 Chinese universities to top global ranking positions in the 21st century. As Chinese President Jiang's said in a

Table 1 Comparison of excellence programs among China, South Korea, Japan and Taiwan

	China 985	Korean brain 21	Japanese COE and global 30	Taiwan 5 year 50 billion
Starting year	Phase one: 1998–2003	Phase one: 1999–2005	COE: 2002–2007	Phase one: 5-year 50 Billion Program: 2006–2010
	Phase two: 2004–2007	Phase two: 2006–2012 (7 years)	Global 30 : 2008–	Phase two (moving into top universities program): 2011–2015
Goal and mission	Developing 10 Chinese universities to global rankings	Cultivating global leaders	Recruiting 300,000 international students	Developing at least one university as one of the world's top 100 universities in 5 years and 10 fields or research centers as "world class"
Focus	Research/ international reputation	PhD programs/ future leaders	Internationalization/ economic growth	Research/international reputation
Number of recipients	39–49 universities	67 universities	19–30 universities	11–12 universities
Total funding	US $ 5 billion	US $ 3.5 billion	US $ 2.5 billion	US $ 1.67 billion

Source: by author

public statement at the 100th anniversary of Peking University, China needs to develop some world class universities to implement modernization in Chinese society (Halachmi and Ngok 2009; Wang 2010). In 1998 the first nine recipients officially recognized by the Ministry of Education formed a "Chinese Ivy league" to achieve the 985 global target. This program was subsequently expanded, and in all, 39 universities were selected. However, the program has not admitted other universities since 2007.

The second phase of the program from 2004 to 2007 focused more on quality improvement in scientific research output. Wang stated that the 985 Project and university ranking system "have made a significant impact on the quality of China's rapidly proliferating institutions of higher education" (Wang 2010).

BK21 in South Korea

To respond to concern over the low quality of Korean higher education, the MOE launched the Brain Korea 21 program (BK21) in 1999. BK 21 aimed at producing "next generation leaders with creativity" by providing fellowship funding to graduate students, postdoctoral researchers and contracted professors at an institutional level (Korea Research Foundation 2010). In the first phase from 1999 to 2005, the Korean MOE awarded US $ 1.4 billion to 67 universities with PhD programs. 87.1 % of the funding was granted for science and engineering studies. In the second phase starting from 2006, the program will award US $ 2.1 billion on the basis of departmental-level excellence and university-industry links (RAND 2010).

COE and global 30 in Japan

Japan's "21st Century Center of Excellence" is an excellence initiative by the Japanese Ministry of Education, Culture, Sports, Science and Technology (MEXT) to raise standards of research in Japanese universities by rewarding innovation and excellence with large grants (MEXT 2002). After hot debate domestically, in 2002, MEXT selected research units as Centers of Excellence instead of institutions. (The scheme changed its name to "Global Centers of Excellence" in 2006) (Yonezawa 2010).

In 2008, MEXT launched the other project, named "Global 30," and stressed "the importance of securing a leading position for Japanese higher education in Asia through promoting internationalization of higher education and maintaining Japan's share in the international student market" (Yonezawa 2010, p. 3). MEXT set the aim of recruiting 300,000 international students to study in Japan by 2020. In the 2009 first round selection, the government only selected 13 universities, based on the setting of specific institutional goals and their accomplishment by a predetermined date (Yonezawa 2010). Each university was granted US $22–44 million.

"Development plan for world class universities and research centers of excellence" in Taiwan

In response to the quest for a world-class university, the Taiwan government launched the "Development Plan for World Class Universities and Research Centers of Excellence" in 2006. The program aims to develop at least one university as one of the world's top 100 universities in 5 years and at least fifteen key departments or cross-campus research centers as the top in Asia in 10 years (Hou 2011a; Hou et al. 2011). From 2006 to 2010, 11 universities were selected and funded by the Excellence program. The second phase from 2011 to 2015 changes the program's name to "Moving into Top Universities Program". It sets five specific goals, including internationalizing top universities and expending students' global perspectives, promoting universities' research and innovation quality, building international capacity of faculty and students, strengthening collaboration between universities and industry, and enhancing graduates' competence in response to social and market demands (Department of Higher Education 2011).

The four nations hope that the funding concentration policy will have the same result for them as it has for the US and the UK. In fact, there has been continuous debate over the effect of these policies and on the performance of the recipients of this concentrated funding within each nation. So, Yale University President Richard C. Levin observed the "excellence" trend among Asian nations and came up with two main reasons for it. First, all Asian nations understand the importance of university-based scientific research in driving economic growth. Second, they expect to "educate graduates for careers in science, industry, government, and civil society who have the intellectual breadth and critical-thinking skills to solve problems, to innovate, and to lead" (Levin 2010).

Academic performance of Asian institutions in global rankings in terms of relation between input and output indicators

Global rankings exist because of the new forces of marketization and competition, and the emergence of a range of systems for ranking universities has crystallized awareness of "world class universities" (Salmi 2009). The first such system, developed in 2003, the Shanghai Jiao Tong Academic Ranking of World Universities, is intended to measure the peak of academic performance as defined by measures such as the Nobel Prize. The second, the QS World University Ranking, uses a range of measures including opinion surveys, number of international students and faculty and attempts to measure internationalization (Hou et al. 2011). The global ranking entitled "Performance Ranking of Scientific Papers for World Universities" by the Higher Education Evaluation and

Accreditation Council of Taiwan (HEEACT), calculated on the basis of the quantity and quality of papers on SCI and SSCI journals, has been published annually from 2007 (Hou 2011b; Hou et al. 2011). Other ranking systems such as "Webometrics Ranking of World Universities", the "New Global University Ranking", The "SCImago Rankings", and Times Higher Education's "World University Rankings" also draw international attention.

Each ranking has its own features and characteristics due to its different objectives and organizational nature. According to Hou et al. (2011), the QS ranking focuses the international reputational dimension by evaluating an institution mainly on academic peer review measures. The ARWU ranking, while using quantitative indicators such as numbers of Nobel Prize winners and highly cited researchers, tends to favor universities with extraordinary research output and award-winning faculty. Similarly, the HEEACT ranking employs objective bibliometric indicators that evaluate both the quantity and quality of a university's scientific papers, and incorporates the assessment of long-term and short-term achievements in its composite measures. It focuses on the research outputs of an institution more than other rankings do.

Despite major differences in the methodologies, there is a level of agreement on which universities are regarded "the best" (Usher and Savino 2007). In 2010,142 universities are in both ARWU's and QS's top 200, albeit often in very different positions. Ten universities are in ARWU, HEEACT and QS top 20, and 16 of them are on both ARWU and HEEACT. This suggests that there is a genuine world body of top universities which any ranking methodology within reason is likely to find.

The experience of publishing the world university rankings shows that Asia was the main area of the world in which they found acceptance and became important. The reason seems to be that rankings are a simple way for universities to see their own progress at a time when Asia is growing in importance and needs a stronger university system to support its ambitions. Examining an average number of top 500 Universities in Asia by three rankings from 2004 to 2010, it can be found that Japan, China, Korea and Taiwan, which all had Excellence Programs, indeed had a better performance than other Asian nations. Table 2 shows that Japan has the highest number of top 500 universities, with an average number of 31.3, comparing to 12.3 institutions in China, 9.7 in South Korea, and 6.5 in Taiwan. We see to our surprise that the total number of top 500 universities in Japan declined in all three rankings from 2004 to 2010. By contrast, China has been growing dramatically in the ARWU ranking. South Korea and Taiwan are both growing steadily in the three rankings.

Assessment of academic output among the institutions in four nations

When it comes to the number of the paper published on SCI and SSCI journals, China increased doubled over the past 5 years with an increase rate of 97 %. Comparing Korea and Taiwan that grew steadily with 58 %, Japan declined slightly on the contrary (Fig. 1).

Table 2 Average number of top 500 universities of Japan, China, South Korea and Taiwan by three rankings

Country	ARWU (2004–2010)	HEEACT (2007–2010)	QS (2007–2010)	Average no.
Japan	33.3	31	29.5	31.3
China	12	13.3	11.5	12.3
South Korea	8.5	9	11.5	9.7
Taiwan	5.6	5.3	8.5	6.5

Source: authors

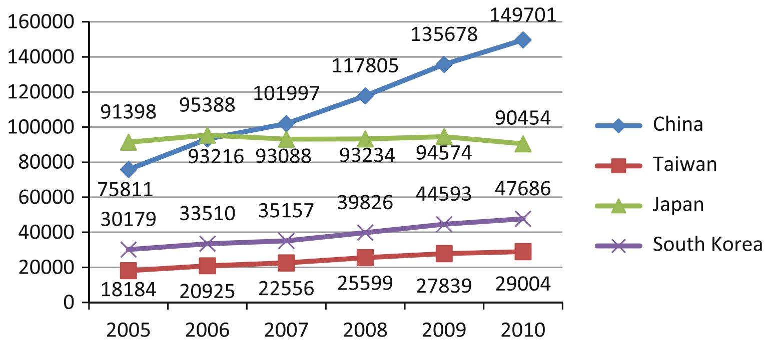

Fig. 1 The number of the paper published on SCI and SSCI journals in China, Taiwan Japan, South Korea

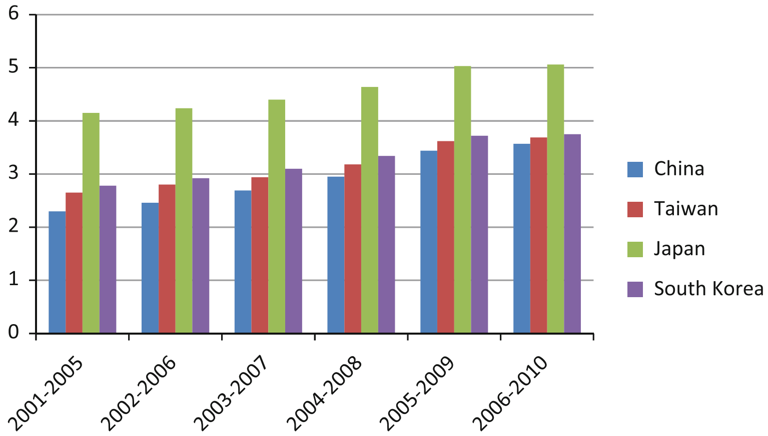

Fig. 2 Average citations of SCI and SSCI journals in 5 years in China, Taiwan Japan, South Korea

As to average citations, China increased by 55 % over these 5 years, compared to Taiwan with 39 %, South Korea with 34.8 %, and Japan with the lowest rate of 21 % (Fig. 2).

China and South Korea had an significant increase in the number of papers in Nature and Science (Fig. 3). Regarding average citations, South Korea increased by 40 %, with lower increases for Japan and Taiwan (Fig. 4).

Considering the indicator of their number of incoming international students, South Korea has increased by 150 %, compared to Taiwan with 43 % and China with 36 %. On a relative basis, Japan didn't perform as well as these other three (Fig. 5).

Examining correlations between input and output indicators

To discover whether the excellence programs of the four nations are worth investing in and are achieving their goals, the relations between the funding invested through excellence initiatives and other output indicators were examined by the use of scatter digrams. Generally speaking, the more the nations put into these efforts, the more outputs and outcomes they will gain. With more than US$ 5 billion of funding, China has indeed had more output in papers, internationalization and excellence, followed by South Korea (Table 1).

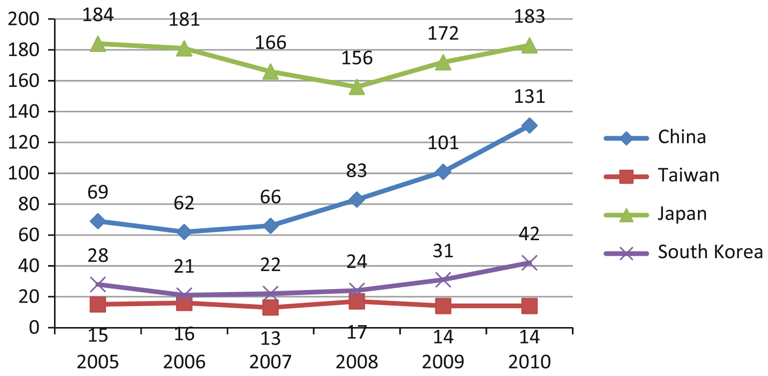

Fig. 3 Number of papers in nature and science in 5 years in China, Taiwan Japan, South Korea

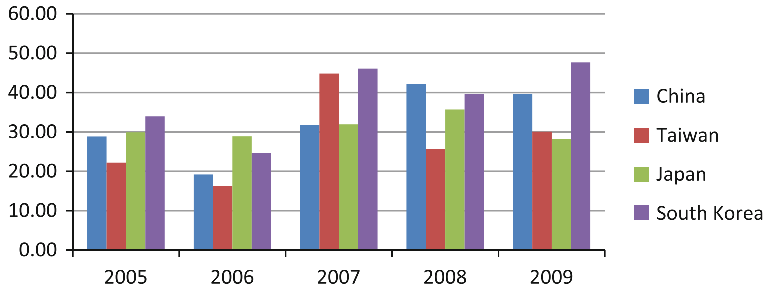

Fig. 4 Average citations in nature and science in 5 years in China, Taiwan Japan, South Korea

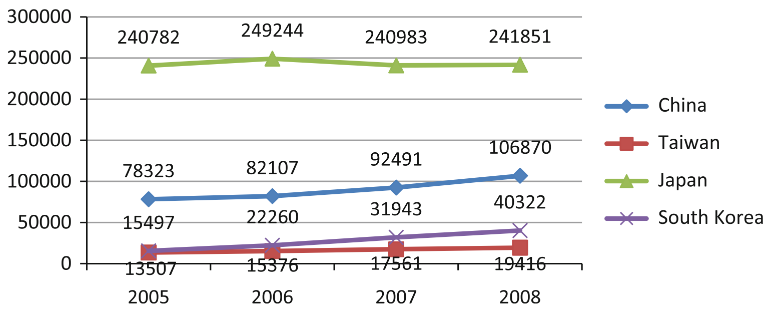

Fig. 5 Number of international students in China, Taiwan Japan, South Korea

Figure 6 shows that China invested most, and at the same time, produced most growth in its total number of SCI and SSCI papers. On the contrary, Japan has a lower rate of increase in spending than Taiwan, with least funding producing more papers. With regard to the relation between funding and the number of Nature and Science papers, China still produced the most SCI and SSCI papers of the four. Though Taiwan has a lowest increase rate in N&S papers, it had better performance than the other three nations when it comes to citations (Fig. 6).

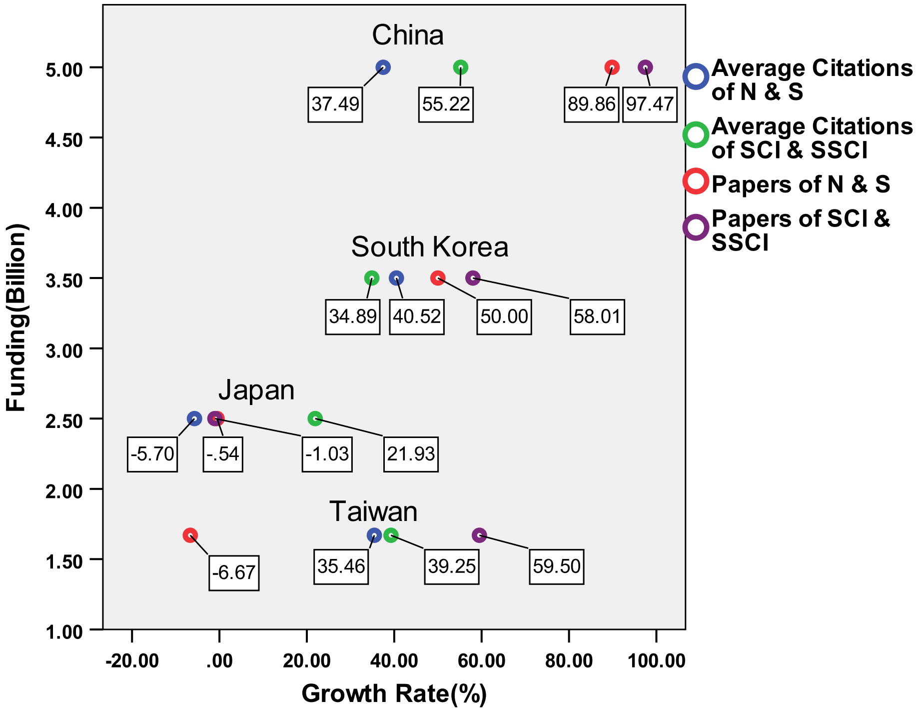

Fig. 6 The relationship between funding and research output in China, Taiwan Japan, South Korea

As to the indicator of the number of international students, South Korea had better outcomes than other three and China has a lower rate of increase (Fig. 7).

Checking the correlation coefficients between funding and other indicators in the four nations, it can be found that the scores of SCI&SSCI papers, SCI&SSCI average citation, N&S papers, Award on Staff winning Nobel Prizes and Fields Medals are higher than of N&S average citation, international students and Alumni winning Nobel Prizes and Fields Medals. So, it seems that massive funding could contribute to the number of publications in a short period of time. When it comes to internationalization and Alumni of winning Nobel Prizes and Fields Medals, it may be difficult for these four nations to make significant progress (Table 3).

Generally speaking, the four nations have significant increases in their number of SCI and SSCI papers. However, there is still a slight difference between them. China has the best performance in paper publications; Taiwan is better on paper citations; South Korea has better performance on internationalization; and Japan is relatively better at winning Nobel Prizes than the other three nations. In other words, China and Taiwan have achieved the goals which the excellence programs set. In contrast, Korea successfully attracts international students to study in Korea by comparison with Japan.

Reassessment of an excellence program: the Taiwan experience

In response to the quest for an excellent university and as one of "Ten New Major National Projects", the Taiwan government launched the Development Plan for World Class

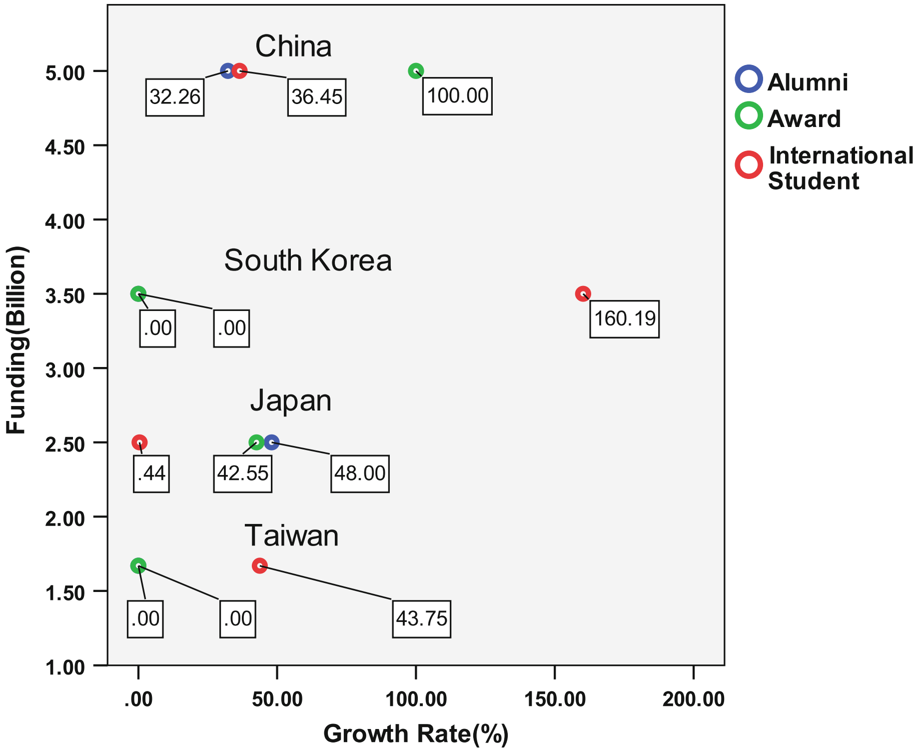

Fig. 7 The relationship between funding and internationalization and excellence in China, Taiwan Japan, South Korea

Universities and Research Centers of Excellence in 2006 and the second round started in 2011. The selected universities were given flexible governance over the use of the grants by block-funding policy (Department of Higher Education 2011).

From 2006 to 2010, National Taiwan University received $500 million, up to 30 % of the total funds available, compared to National Cheng Kung University with 17 %, National Tsing Hue University with 11.2 % and National Chiao Tung University with 8.6 %. There are five recipients funded with less than 5 % of the total. Two private universities were funded initially, but one was not funded after 2008 (Table 4).

According to the ARWU, QS and HEEACT global rankings, there are around seven to eight Taiwan institutions on the top 500, including National Taiwan University, National Cheng Kung University, National Tsing Hua University, National Chiao Tung University, Chang Gung University, National Central University and National Yang Ming University, and National Sun Yat Sen University. Only Chang Gung University is a private institution.

It can be found that the institutions in the top 500 of these rankings are all recipients of money from the excellence program from the MOE (Table 5). Institutions in the QS top 500 shared 90 % of the total fund, with corresponding figures of 88.2 % in the ARWU ranking, and 83.9 % in the HEEACT ranking. The top three recipients on the top 500 in the three rankings are all national universities. To the public's surprise, Chang Gung University, with lesser total funding of US $40 million, performed better than the other recipients did. Generally speaking, there is a high level of correlation between the three global ranking outcomes and MOE funding. The more funding the institution gains, the higher it ranks.

Table 3 Correlation coefficients among indicators in China, Taiwan Japan, South Korea

	SCI&SSCI paper	SCI&SSCI average citation	N&S paper	N&S average citation	International student	Alumni (alumni of an institution winning nobel prizes and fields medals)	Award (staff of an institution winning nobel prizes and fields medals)
Funding	0.6263	0.6671	0.9790*	0.3499	0.1822	0.2620	0.7607
SCI&SSCI paper	–	0.9710*	0.7501	0.8833	0.3036	−0.4083	0.3596
SCI&SSCI average citation	–	–	0.7546	0.7490	0.0770	−0.2035	0.5450
N&S paper	–	–	–	0.5316	0.3176	0.0643	0.6546
N&S average citation	–	–	–	–	0.6421	−0.7779	−0.1076
International student	–	–	–	–	–	−0.7273	−0.4996
Alumni	–	–	–	–	–	–	0.7049

* *p* value <0.05 means level of significance is obviously correlated

Table 4 MOE grants Taiwan's universities received from 2006 to 2011 (USD in million)

Institutions	2006	2007	2008	2009	2010	Total 5-year funding		2011
National Taiwan University	100.0	100.0	100.0	100.0	100.0	500	30 %	103.3
National Cheng Kung University	56.7	56.7	56.7	56.7	56.7	283.5	17 %	53.3
National Tsing Hua University	33.3	33.3	40.0	40.0	40.0	186.6	11.2 %	40.0
National Chiao Tung University	26.7	26.7	30.0	30.0	30.0	143.4	8.6 %	33.3
National Central University	20.0	20.0	23.3	23.3	23.3	109.9	6.6 %	23.3
National Sun Yat-sen University	20.0	20.0	20.0	20.0	20.0	100	6 %	13.3
National Yang Ming University	16.7	16.7	16.7	16.7	16.7	83.5	5 %	16.7
National Chung Hsing University	13.3	13.3	15.0	15.0	15.0	71.6	4.3 %	10.0
National Taiwan University of Technology and Science	10.0	10.0	6.7	6.7	7.3	40.7	2.4 %	6.7
National Cheng Chi University	6.8	10.0	6.7	6.7	6.7	36.9	2.2 %	6.7
Chang Gung University	10.0	10.0	6.7	6.7	6.7	40.1	2.4 %	6.7
Yuan Ze University	7.7	10.0	–	–	–	17.7	1.1 %	–
National Taiwan Normal University	–	–	–	–	–	0		6.7

Source: Department of Higher Education (2011)

Academic assessment

To show their actual performance, Taiwanese institutions will be reviewed first on three key indicators, including research, internationalization, and university and industry collaboration.

Table 5 Ranks of Taiwan's universities in ARWU, QS and HEEACT global rankings (2006–2010)

Global rankings	Institutions	2006	2007	2008	2009	2010	% of Total fund
QS	National Taiwan University	108	102	124	95	94	90
	National Tsing Hua University	343	334	281	223	196	
	National Cheng Kung University	386	336	354	281	283	
	National Chiao Tung University	401–500	401–500	401–500	389	327	
	National Yang Ming University	392	401–500	341	306	290	
	National Taiwan University of Technology and Science	401–500	401–500	401–500	351	–	
	National Central University	401–500	398	401–500	401–500	398	
	National Sun Yat-sen University	–	401–500	401–500	401–500	–	
ARWU	National Taiwan University	181	172	164	150	127	88.2
	National Tsing Hua University	346	317	308	297	314	
	National Chiao Tung University	440	327	322	327	313	
	National Cheng Kung University	384	367	350	262	256	
	Chang Gung University	–	–	426	408	406	
	National Central University	–	501	493	441	443	
	National Yang Ming University	479	471	498	449	447	
HEEACT*	National Taiwan University	–	185	141	102	114	83.9
	National Cheng Kung University		360	328	307	302	
	National Tsing Hua University		429	366	347	346	
	National Chiao Tung University		471	463	456	479	
	Chang Gung University		–	–	479	493	
	National Central University		–	–	483	–	
	National Yang Ming University		–	475	493	–	

Source: by author

* Starting 2007

Research outputs

According to the Taiwan Department of Education, the number of SCI papers produced each year by 11 recipients grew by 49 % and SSCI papers by 172 % between 2005 and 2010. The number of highly cited papers increased by 129 % within 5 years (see Table 6). However, the number of papers published in Nature and Science was declining slightly. It can be found that the total number of internationally published papers in SCI and SSCI has grown rapidly, except in Nature and Science.

Internationalization

In addition to increasing their volume of research papers, the recipients were expected to upgrade their infrastructure and facilities, to hire outstanding international faculty, and to collaborate with foreign universities in international academic programs. As the table shows, the number of international degree-seeking students has increased by 79 % from

Table 6 Publications of the 11 recipients

Research performance	2005 (Prior to the program)	2010 (The 5th year of the program)	Increase rate (%)
Number of SCI papers	11,320	16,906	49
Number of SSCI papers	589	1,589	170
Number of A&HCI	29	79	172
Nature & Science	15	14	−7
Number of HiCi papers in the last 10 years	294	673	129

Source: Department of Education

2005 to 2010, and of exchange students by 193 % (Table 7). In addition the number of international conferences held and academic collaborations in research has grown by approximately 2.5 times. When it comes to the recruitment of international scholars, there is a tremendous progress in the growth rate, up to 700 % (Table 8).

University and industry collaboration

One of the assessment indicators of the program is what percentage of research outcomes were transfered into industry and benefited society through university-industry links. In 2010, the total funding generated from collaboration between universities and industry at the 11 recipients was close to $679 million. The income generated from intellectual property more than tripled (Table 9).

Meta assessment

In order to measure its effectiveness and impact on Taiwanese higher education, the Research, Development and Evaluation Commission conducted a reassessment of the MOE's Excellence Program in terms of mission and goal, review criteria and process, and impact on Taiwan higher education, at the end of 2010. The study adopted both qualitative and quantitative approaches to collect opinions from eight of the 11 recipient universities and from four international scholars of higher education. A survey targeting on 138 top administrators from 11 universities and 30 reviewers was also conducted. All respondents were asked to fill out the 5-scale questionnaires and present their opinions regarding four categories, including goals, criteria, outcomes and impacts. The response rates by institutions and review panels are 42.8 and 36.7 % respectively (RDEC 2010).

Mission and goal

Over 80 % of respondents agreed that some of the missions and goals of enhancing internationalization and excellence of Taiwan's higher education, improving the infrastructure of universities, cultivating top talents and increasing the volume and quality of publications are appropriate. However, there is a lower level of agreement on the goal of setting up incubators on campus, with an average score of 3.9 in institutions and 3.5 in the review panel. There is no significance between institutions and review panel (Table 10).

Table 7 Number of international students of 11 recipients

Internationalization of international students	2005	2010	Growth rate (%)
Number of international students	4,033	6,973	79
Number of exchange students	629	1,843	193
Number of international conferences	180	405	125
Number of international collaborations	171	331	94

Source: Department of Education

Table 8 Number of international scholars of 11 recipients

Internationalization of faculty	2005	2009	Growth rate (%)
Number of top researchers serving as project leaders in research centers	220	431	1.95
Number of international scholars	182	1,276	700

Source: Department of Education

Table 9 Volume of university: industry collaboration of 11 recipients

Results of industry-university cooperation projects	2005	2010	Growth rate (%)
Funding generating from industry-university collaborations (including commissioned training programs)	528.8 (in million)	679.4 (in million)	28
Funds from enterprise sectors for industry–university collaborations (excluding Commissioned Training Program)	44.7 (in million)	55.7 (in million)	25
Amount derived from intellectual property rights	4.2 (in million)	15.8 (in million)	276
Numbers of patents and new products	320	736	137
Numbers of patent licenses and the licensed number of models	86	304	253

Source: Department of Education

According to Table 11, institutional respondents tended to agree on the statements of the need "to enhance quality of university research and innovation and international visibility" and "to enhance academic environment and quality" positively. Institutional respondents agreed more on items "to enhance quality of university research and innovation and international visibility" and "to enhance academic environment and quality" than others. The average scores on three statements regarding "outcomes of global rankings" are lowest. In other words, both types of respondent didn't consider "having top ranked universities" as one of the expected outcomes (Table 11).

Review criteria and process

Most respondents agreed that recipients of program funding should be reviewed in terms of teaching as well as research. Response from the institutions and the review panel shows

Table 10 Respondents' attitude toward the mission of the program

Items	Institutions		Review panel		Significance*
	Mean	SD	Mean	SD	
Qualitative					
(1) Internationalization and Excellence in higher Education	4.4746	0.6527	4.4545	0.5222	0.9238
(2) Quality improvement of organizational governance and management	4.2712	0.7151	4.1818	0.6030	0.6986
Average	4.3729	0.6893	4.3182	0.5679	–
Quantitative					
(1) Number of top academicians and Professionals	4.4310	0.6783	4.2727	0.6467	0.4774
(2) Number of academic outcomes and research output	4.3276	0.9250	4.3636	0.5045	0.9007
(3) Recruitment of top international scholars and Researchers	4.3509	0.7674	4.1818	0.6030	0.4931
(4) Academic exchanges and collaboration with domestic and foreign universities and research center	4.2281	0.7324	3.9091	0.7006	0.1877
(5) Number of University incumbent centers	3.9123	0.9118	3.5455	0.8202	0.2195
Average	4.2509	0.8235	4.0545	0.7050	–
Overall	4.2867	0.7879	4.1299	0.6757	–

Source: The RDEC (2010). * p value <0.05 means level of significance is obviously correlated

that the latter tended to be more negative about the review criteria. There is a significant difference between institutional and panel review in the items of E-classroom and IT infrastructure and Alumni performance (Table 12). As to the review team, procedures, and control model, many institutional respondents questioned the professionalism and qualifications of review panels and criticized aspects of the audit system, such as "submission of mid reports every three months", "number of on-site visits by external reviewers", and "no flexibility for funding allocation and accounting system" (Table 13 and Table 14). They even have different attitude toward "Number of on-site visits by external reviewers" (Table 15).

Impact on higher education

Most respondents agreed that "the program assisted recipients to enhance international visibility", in "developing academic features", and in "improving their ranks in global ranking". However, there is a slight divergence between universities and reviewers' attitudes towards "carrying out social responsibility and sharing the pubic with academic output". 86 % of institutional respondents thought they did, comparing to 72 % of reviewers. Both types of respondent also agreed that the program led to several problems such as "research is [esteemed] over teaching on campus", and "the gap in educational resources between recipients and non-recipients" is broadening faster than ever (Table 16). Generally speaking, the respondents from review panels are more pessimistic than those from institutions about the impact on Taiwan higher education.

Table 11 Respondents' attitude toward expected outcomes

Items	Institutions		Review panel		Significance*
	Mean	SD	Mean	SD	
(1) At least one university ranked top 100 in ARWU, QS and HEEACT global rankings within 10 years	3.5424	1.0879	3.8182	0.9816	0.4365
(2) At least one university ranked top 50 in ARWU, QS and HEEACT global rankings within 15–20 years	3.3390	1.0766	3.5455	0.9342	0.5539
(3) At least ten fields or research centers ranked top in Asia in ARWU, QS and HEEACT global rankings within 5 years	3.7119	1.1604	4.0909	0.5394	0.0978
(4) To enhance quality of university research and innovation and international visibility	4.5424	0.5966	4.2727	0.6467	0.1787
(5) To attract top academic researchers and professionals from the industry	4.2712	0.7388	4.0909	0.7006	0.4567
(6) To form substantial collaboration with foreign research academies and centers	4.2881	0.6708	3.9091	0.8312	0.1022
(7) To develop an objective assessment framework and granting model for institutions applying excellence projects	4.3051	0.7011	4.1818	0.9816	0.6179
(8) To enhance academic environment and quality	4.5593	0.5341	4.4545	0.5222	0.5510
(9) To integrate interdisciplinary research resources	4.2203	0.7208	3.8182	0.7508	0.0959
(10) To enhance overall national competitiveness	4.3898	0.6700	4.0000	0.7746	0.0883

Source: The RDEC (2010)

* p value <0.05 means level of significance is obviously correlated

Table 12 Respondents' attitude toward review criteria

Items	Institutions		Review panel		Significance*
	Mean	SD	Mean	SD	
Governance and management	4.0207	0.9663	4.1455	0.8259	–
Infrastructure (equipment, facilities, internet, student dorms, international student house, library, etc.)					
E-classroom and IT infrastructure	4.3621	0.6407	3.9091	0.7006	0.0378*
Average	4.5115	0.5764	4.3333	0.7773	–

* p value <0.05 means level of significance is obviously correlated

Table 13 Respondents' attitude toward review criteria

Items	Institutions		Review panel		Significance*
	Mean	SD	Mean	SD	
Research and Teaching					
(1) Internationalization	4.1186	0.7675	3.8182	0.6030	0.2241
(2) Financial resources	4.0169	0.8406	3.6364	0.5045	0.1521
(3) Alumni performance	4.1186	0.767	3.5455	0.6876	0.0241*
Average	4.1849	0.7703	4.0918	0.7192	–

Source: The RDEC (2010)

* p value <0.05 means level of significance is obviously correlated

Table 14 Respondents' attitude toward review panel

Items	Institutions		Review panel		Significance*
	Mean	SD	Mean	SD	
(1) Composition of review panel (academia, government, and industry)	4.0545	0.5242	3.8182	0.6030	0.1876
(2) Professionalism of review panel	3.8182	0.6963	4.0000	0.6325	0.4257
(3) Schedule and timing for on-site visits	3.8364	0.7395	3.9000	0.5676	0.7972

Source: The RDEC (2010)

* *p* value <0.05 means level of significance is obviously correlated

Table 15 Respondents' attitude toward review and control model

Items	Institutions		Review panel		Significance*
	Mean	SD	Mean	SD	
(1) Number of on-site visits by external reviewers	3.4068	0.7904	3.9091	0.5394	0.0172*
(2) Submission of mid reports every 3 months	2.8983	1.0119	3.1818	0.8739	0.3876

Source: The RDEC (2010)

* *p* value <0.05 means level of significance is obviously correlated

Table 16 Respondents' attitude toward the Impact on higher education

Items	Institutions		Review panel		Significance*
	Mean	SD	Mean	SD	
(1) Emphasis Research over teaching	2.9310	1.1373	3.2727	0.7862	0.3448
(2) Emphasis graduate education over undergraduate education	2.7458	1.1976	2.9091	0.8312	0.6671
(3) Emphasis sciences over social sciences and humanities	2.6607	1.2399	2.9091	0.9439	0.5322
(4) Broadening the gap in resources among institutions	3.1864	1.2659	3.2727	1.1909	0.8348
(5) Reduction of general education budget	2.4407	1.1028	2.5455	1.1282	0.7740
Average	2.7584	1.20155	2.9091	1.02355	–
(6) Enhancement of Excellence Campus	4.1864	0.8803	4.0000	0.4472	0.3014
(7)Strengthening institutional features and academic performance	4.3559	0.8461	4.0909	0.5394	0.1919
(8) Enhancing international visibility	4.4576	0.8371	4.2727	0.4671	0.4805
(9) Improving their ranks in global rankings	4.4915	0.8978	4.1818	0.6030	0.2771
(10) Carrying on more social accountability and academic duties	4.3051	0.8760	3.6364	0.6742	0.0193*
Average	4.40253	0.86425	4.04545	0.570925	–

Source: The RDEC (2010)

* *p* value< 0.05 means level of significance is obviously correlated

Discussion

Public concerns over goal achievement and teaching quality

The global competitiveness of universities has turned into a complicated issue of balancing the teaching and research missions of an institution. There has been widespread discussion of the appropriate use of various assessment instruments, including rankings, on overall higher education quality and an individual university's performance. Although the number of Taiwanese universities moving into the top 500 is steadily growing and the number of publications is increasing significantly, the excellence program provoked severe criticism over its indicators and purposes from Taiwan college presidents. Moreover, the Taiwan general public is quite concerned about the overall performance of a few selective institutions in both research output and teaching quality with a highly concentrated investment policy. The 11 universities have been expected to not only increase their research but also to improve teaching quality (Hou 2011a).

Besides, many non-recipients were worried that very research-oriented indicators might be adopted as the only criteria in the selection process for the second stage of the Excellence Program in 2011. On the other hand, the definition of "world class university" and "top research centers" is ambiguous. The MOE didn't identify clearly which global ranking can be used as evidence for goal-achieving. Most important of all, the public was very much concerned that teaching would be sacrificed due to the new reward systems. According to HEEACT program accreditation outcomes in the first cycle, the percentage of accredited programs in two recipients was lower than 90 % (Hou 2011a).

Rankings or not rankings

The survey above also found that most respondents disagreed on rankings, which are still having a considerable impact on Taiwan's universities. The fact that an increasing number of Taiwan universities have been moving into the top 500 in the global rankings demonstrates that the efficacy and success of the MOE Excellence program. More and more of Taiwan's institutions, including teaching-oriented universities, are being encouraged to use the performance indicators of the global rankings as a benchmark to set their institutional long-term goals, such as "Moving into Top 500". Many have changed their institutional policies in some aspects (Hou 2011a) .

Second, there is indeed a high correlation between the global ranking of institutions and their government funding. The more funding the institution gained, the higher its global ranking will be. This means that global ranking might likely marginalize teaching-type institutions, which will remain on the "knowledge periphery" in Taiwan higher education. The global ranking inevitably causes fiercer competition between research universities and triggers tensions and confrontations over the allocation of government resources between selected and non-selected institutions.

Hawkins advised that the excellence initiative in Taiwan should be reexamined to see what they have achieved thus far, if it was worth the continuous investment, and if the program can be restructured to better achieve the goals; or if there could be a "mini" excellence initiative to help the smaller HEIs or private institutions (2010, personal communication). At the same time, there should be money to encourage innovation and excellence in teaching independently from the excellence initiative (Salmi 2010, personal communication). In fact, Taiwan government has provided other resources for other institutions to permit teaching quality enhancement.

Conclusion

"Competitiveness" and "concentrated investment" are two principles for higher education policy-making in Asia. Asian excellence initiatives are already hunting for talent globally. Their ability to deliver supportive work environments and good infrastructure, and to offer agreeable salaries, makes them a formidable competitor to western institutions for the best people. If Asian nations still aim to develop one or more world class universities, they still have to fund only a few targeted schools with extra money to help reach that goal. Because it will be impossible for all schools to become world class universities, only a few schools will have a chance to become excellent (Morse 2010, personal communication).

This study finds that more funding the nations had, more output and outcomes they will gain. For example, China's increased funding has led to more output in papers, internationalization and excellence. However, the financial sustainability of these investments is a big challenge for Asian nations, because "striving to achieve excellence should be an on-going goal regardless of the world-class university idea" (Hawkins 2010, personal communication). For those who worry about the gap in quality and size, there will always be gaps in complex systems. The Taiwan case demonstrates that these worries about inequality are turning into realities in Taiwan society. Although the gap between leading and following universities may grow, it is believed that these nations need world-class universities and research centers. On the other hand, Taiwan's experience shows that controversy over "using rankings" or "not using rankings" to build up world-class universities still exists between institutions and the government. Furthermore, the selective research institutions in Taiwan are also expected to illustrate their good teaching quality, which will equip students with core competencies as well as ethical values.

Asian universities that act in this way will, over the medium term, become significant players on the world stage. They gradually realize that "research universities are more likely to prosper when their role is embedded in a national vision for the future of tertiary education" (Salmi 2011, p. 340). Therefore, they are urged to approach the problems in that order, not the other way around, regarding a high ranking as a result of excellence, not as a surrogate for achievement.

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