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The Variation of Universally Acknowledged World-Class Universities (UAWCUs) between 2010 and 2015: An Empirical Study by the Ranks of THEs, QS and ARWU

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Abstract

Due to certainty recognition in ranking systems, the commonly included top 100 universities are regarded as the Universally Acknowledged World-Class Universities (UAWCUs). From three university rankings-THEs, QS and ARWU from 2010 to 2015, the following conclusions can be drawn from this study: Firstly, 56 universities are commonly ranked in the top 100 by THEs, QS and ARWU in 2015, comparing with that of 47 in 2010; Secondly, comparison between 2010 and 2015 reveals that 44 of these higher ranked UAWCUs have kept on the group of top 100 universities in any ranking system. However, three lower ranked UAWCUs in 2010 have dropped out the group of top 100 universities in 2015, which are replaced by some progressed universities; Thirdly, both US and UK have nearly 3/4 and 2/3 of these UAWCUs in 2010 and 2015, respectively; Lastly, this paper denotes that consistently strives to build on its strong reputation for research excellence, consistently pursuing innovative research, delivering excellence in teaching through internationalization, obtaining support from the government would be the critical factors to promote UAWCUs to improve their performance and rankings.

Keywords: world-class universities, universally-acknowledged, ranking; variation

1. Introduction

In today's globalised world, there is an increasing number of universities throughout the world joined the battle for establishing world-class excellence. Many countries and regions also have implemented a number of strategic funding initiatives such as China's 985 Project, Korea's Brain Korea 21 and Germany's Centers of Excellence to facilitate their universities achieving this exclusive stature. Indeed, establishing world-class university not simply stand for pursuing academic excellence by boosting learning and research, but also promoting national development by creating advanced knowledge (Albach, 2009; Salmi, 2009; Hanaa, 2015). In the past decade, the term "World-class universities" has been used to describe these universities at the pinnacle of the global higher education hierarchy, which are playing the dominant role in comparative academic performance, and serving the needs of society (Salmi, 2011; Wang et al., 2013). Since the term "World-class universities" has become increasingly used and widely discussed in higher education discourse, due to the inherently subjective (Levin, Jeong, & Ou, 2006) and ambiguous nature (Li, 2012), there is no well established definition or statement about what exactly a World-class universities is.

Rather than self-declaration, the elite status of World-class universities relies on international recognition (Altbach & Salmi, 2011). To achieve this, university rankings have become an effective method to measure universities' academic performance and help to identify the universally recognized World-class universities. Numerous studies had examined functions and effects of world class university rankings (Van Raan, 2005; Aguillo et al., 2005; Hazelkorn, 2007; Rauhvargers, 2013). As Simon (2014) noted that, international university rankings seems "irresistible" because it helps not only to measure institutional success and reinforces the advantages enjoyed by leading universities, but also to be an useful instrument for internal analysis of university weakness which affects the judgments and decisions of many university leaders and faculties. Hazelkorn (2009) had also suggested that university rankings have affected all Higher Education Institutions (HEIs) by

highlighting reputational differentiation as rankings appear to strengthen or grant visibility to some Higher Education Institutions (HEIs) and expose perceive weakness at the system and institutional level. From governments' standpoint, university rankings is evidenced that government is operating as strategic choice for defining targets and set strategic goals, which in turn lead to positive policy changes at system level (Wang et al., 2013; Rauhvargers, 2011). Although university rankings have been highly publicized in recent years, several studies have also criticized that university rankings were justified doubt on ranking methodologies and usefulness, especially the suitability of the assessing criteria used, the validity of the results, the purpose for assessing, the effects of ranking were also generated fierce debates and plenty of discussions (Tight, 2000; Meredith, 2004; Van, 2005; Buela et al., 2007). Rhoads et al. (2014), a very vocal critic of university rankings, cautions about the limitations of them, University rankings focused heavily on evaluating one type of WCU-research universities and neglected some other types of colleges and universities which works against the advancement of diversified higher education systems and variable understandings of World-class universities.

Currently, there are more than fifteen international rankings in the world (Marope et al., 2013). However, six major global university ranking system are commonly used: Academic Ranking of World Universities (ARWU), Performance Ranking of Scientific Papers for World Universities released by Higher Education Evaluation and Accreditation Council of Taiwan (HEEACT Rankings), Leiden Ranking by Centre for Science and Technology Studies (CWTS); Webometrics Ranking of World Universities or Ranking Web of Universities (WRWU) published by Spanish National Research Council (CSIC); Times Higher Education World University Rankings (THEs), and Quacquarelli Symonds (QS) World University Rankings currently exist in the world and each of them features different criteria and ranks the world universities from different aspects (Mu-Hsuan, 2012). Among above ranking systems, the THEs, QS and ARWU attract most attention and enthusiasm, and therefore have been widely discussed whether on effectiveness or issue. For this reason, this study considers the THEs, QS and ARWU because of their characteristics and influences. Since there are over 16,000 higher education institutions worldwide, top 100 universities (less than 1%) in the commonly included top 100 universities should be recognized as the world-class universities due to their characteristics and superior performance. If we confine any universities among top 100 in a global university ranking as the world-class university(WCU), this paper defines the university commonly included in top 100 by the global university rankings-THEs, QS and ARWU as the "universally acknowledged world-class university" (Here after, "UAWCU").

This paper tends to address following research questions: 1) Which universities are universally acknowledged world-class universities (UAWCUs)? 2) What are characteristics of UAWCUs? 3) What are the distribution of UAWCUs among countries? 4) Why the rankings of some UAWCUs are fluctuated?

2. Research Methods

In order to find and analyze the current commonly included top 100 universities by the THEs, QS and ARWU, this paper combined the latest THEs, QS and ARWU top 100 universities' rankings by using simple summation to add each university's ranking up and list the overall ranking of top 100 university in ranked ordinal. All universities' ranking information such as ranks, scores, classifications are all available from the web pages of three ranking systems. Such approach allows dealing with the criticism of inconsistent ranking results because of different methodologies used, and therefore helps to produce a hybrid list of the commonly included top 10 universities. It is noted that all listed top 100 universities either in 2010 or 2015 are all commonly ranked in the top 100 by three ranking systems.

The following statements are illustration of three adopted ranking systems:

2.1 THEs (Times Higher Education World University Ranking)

Times Higher Education World University Ranking (THEs; www.timeshighereducation.com/) was originally known as *Times Higher Education-QS World University Rankings*, as its data was supplied by Quacquarelli Symonds, a London-based higher-education media company since from 2004. While in 2010, the THEWUR and the QSWUR were split into two independent ranking programs and the *Times Higher Education* started to appoint Thomson Reuters as its new data supplier and initiated new criteria. The THEs ranking currently combines 13 indicators and these indicators are categorized into following five areas: teaching (30%), research (30%), citations (32.5%), industry income (2.5%) and international outlook (5%).

2.2 QS (Quacquarelli-Symonds World University Ranking)

The Quacquarelli-Symonds World University Ranking (QS; www.topuniversities.com) was released by a private company, Quacquarelli-Symonds limited the ranking and listed the top 500 world universities annually. The QS focuses on evaluating four areas of a university: research quality, graduate employability, teaching quality, and

international outlook. Among these four dimensions, academic peer review was given the highest weighting which account for 40%; total of 40% weighting is placing for citation per faculty and student faculty; the weighting of employer review account for 10%; international faculty and international students account for 5% respectively.

2.3 ARWU (Academic Ranking of World Universities)

The Academic Ranking of World Universities (ARWU; www.arwu.org.) was firstly published in 2003 by a group of researchers at the Shanghai Jiao Tong University (Liu & Cheng, 2005). The ARWU has since attracted much interest from around the world as it identifies the best 500 universities from 41 different countries. Nowadays, the ARWU combines five criteria: quality of education, quality of faculty, research, output and size of institution. These criteria are measured using the following indicators: "Alumni" (10%) and "Award" (20%) evaluate the number of Nobel prizes, and Fields medals won by a university's alumni ("Alumni") or current faculty members ("Award"); "HiCi" (20%), "N&S" (20%) and "PUB" (20%), are all said to reflect the quality of research; "PCP" (10%) shows a subjective average of the scores obtained in the previous five category, divided by the number of current full-time equivalent academic staff members.

3. Research Findings

3.1 The Variations of the UAWCUs from 2010 to 2015

Both Table 1 and Table 2 provide two hybrid lists of commonly included top 100 universities in three ranking systems in the year of 2010 and 2015, respectively. It is easy to find that there were 47 UAWCUs in 2010, but this figure increased to 56 in 2015. Compared with that in group of 2015 UAWCUs, there are 44 UAWCUs in 2010 constantly kept in UAWCUs family of 2015, only excepted Washington University, St Louis, University of Minnesota and Sydney University. On the contrary, compared with that of 2010 UAWCUs, there are 12 fresh universities entered into the group of UAWCUs in 2015.

Table 1. Hybrid list of commonly included TOP 100 universities in 2010

Overall Ranking	List of Universities	Countries	Rankings in 2010		
			THE	QS	ARWU
1	Harvard University	US	1	2	1
2	Cambridge University	UK	6=	1	5
3	Massachusetts Institute of Technology	US	3	5	4
4	California Institute of Technology	US	2	9	6
5	Stanford University	US	4	13	3
6	Oxford University	UK	6=	6	10
7	Princeton University	US	5	10	7
8	Yale University	US	10	3	11
9	University of Chicago	US	12	8	9
10	Columbia University	US	18	11	8
11	University of California, Berkeley	US	8	28	2
12	Imperial College London	UK	9	7	26
13	Cornell University	US	14	16	12
14	Pennsylvania University	US	19	12	15
15	University College London	UK	22	4	21
16	Johns Hopkins University	US	13	17	18=
17	University of Michigan	US	15=	15	22
18	ETH Zurich	Switzerland	15=	18	23
19	University of California, Los Angeles	US	11	35	13
20	Tokyo University	Japan	26	24	20
21	University of Toronto	Canada	17	29	27
22	Duke University	US	24	14	35
23	North western University	US	25	26	29

24	Washington University	US	23	55	16
25	University Wisconsin–Madison	US	43	17	48
26	Kyoto University	Japan	57	25	26
27	University of British Columbia	Canada	30=	44	36=
28	University of California, San Diego	US	32	65	14
29	Carnegie Mellon University	US	20	34	58
30	McGill University	Canada	35	19	61
31	Edinburgh University	UK	40	22	54=
32	University of Illinois	US	33	63	25
33	Australian National University	Australia	43	20	59=
34	University of North Carolina at Chapel Hill	US	30	57	41
35	New York University	US	60	41	31
36	Melbourne University	Australia	36	38	62
37	Washington University, St Louis*	US	38	75=	30
38	Ecole Normale Supérieure, Paris	France	42	33	71
39	Brown University	US	55	39	65
40	King's College London	UK	77	21	63=
41	Manchester University & Umist	UK	87	44	30
42	Bristol University	US	68	27	66=
43	University of Minnesota*	US	52	96	28
44	Munich University	Germany	61	66	51
45	Heidelberg University	Germany	83=	51	49
46	Boston University	US	59	64	77
47	Sydney University*	Australia	71	37	92

Note. *The universities appeared in the group of UAWCUs in 2010, but disappeared in 2015.

Source: Data retrieved on April 20-22, 2016 from THEs (www.timeshighereducation.com/), QS (www.topuniversities.com) and ARWU (www.arwu.org).

Table 2. Hybrid list of commonly included TOP 100 universities in 2015

Overall Ranking	**List of Universities**	**Countries**	**Rankings in 2015**		
			THE	**QS**	**ARWU**
1	Stanford University	US	3	3=	2
2	Massachusetts Institute of Technology	US	5	1	3
3	Harvard University	US	6	2	1
4	Cambridge University	UK	4	3=	5
5	California Institute of Technology	US	1	5	7
6	Oxford University	UK	2	6	10
7	Princeton University	US	7	11	6
8	University of Chicago	US	10	10	9
9	ETH Zurich	Switzerland	9	9	20
10	Yale University	US	12	15	11
11	University College London	UK	14	7	18
12	Johns Hopkins University	US	11	16	16
13	University of California, Berkeley	US	13	26	4
14	Columbia University	US	15	22	8
15	Imperial College London	UK	8	8	31
16	Cornell University	US	18	17	13

17	Pennsylvania University	US	17	18	17
18	University of California, Los Angeles	US	16	27	12
19	University of Michigan	US	21	30=	22
20	University of Toronto	Canada	19	34	25
21	Duke University	US	20	29	31
22	North western University	US	25	32	27
23	Edinburgh University	UK	24	21	47
24	University of California, San Diego	US	39=	44	14
25	Tokyo University	Japan	43	39	21
26	New York University	US	30	53	27
27	Washington University	US	32	65	15
28	Melbourne University	Australia	33	42	44
29	King's College London	UK	27	19=	55
30	University of British Columbia	Canada	34	50	40
31	University of Illinois	US	36	59	29
32	McGill University	Canada	38	24	64
33	University Wisconsin–Madison	US	50	54	24
34	Manchester University & Umist	UK	56=	33	41
35	Carnegie Mellon University	US	22	62	61
36	Australian National University	Australia	52	19=	77
37	Ecole Normale Supérieure, Paris	France	54	23	72
38	Heidelberg University	Germany	37	66	46
39	Kyoto University	Japan	88=	38	26
40	Munich University	Germany	29	75	52
41	University of Texas at Austin**	US	46	77	37
42	Technical University Munich**	Germany	53	60	51
43	Bristol University	US	69	37	66
44	Brown University	US	51	49	75
45	University of North Carolina at Chapel Hill	US	63	79	39
46	University of Queensland**	Australia	60=	46=	77
47	Copenhagen University**	Denmark	82=	69	35
48	University of California, Davis**	US	44=	85=	57
49	Catholic University of Leuven (Flemish) **	Belgium	35	82	90
50	Utrecht University**	Netherlands	62	94	56
51	University of Warwick**	UK	80	48	92
52	Boston University	US	64	91	73
53	Helsinki University**	Finland	76=	96	67
54	Leiden University**	Netherlands	67	95	82
55	University of Groningen**	Netherlands	74	100	75
56	The Ohio State University - Columbus**	US	90=	99	67

Note. **The universities newly appeared in the group of 2015 UAWCUs compared with that of 2010 UAWCUs.

Source: Data retrieved on April 20-22, 2016 from THEs (www.timeshighereducation.com/), QS (www.topuniversities.com) and ARWU (www.arwu.org).

University of Texas at Austin, Catholic University of Leuven (Flemish), Utrecht University, University of Warwick and University of Groningen have shown more significant improvement of rankings in 2015 compared with that in 2010. By contrast, both Universities of Minnesota and University of Sydney have more significant decrease of ranking in the same period. Nevertheless, despite the overall ranking of University of Texas at

Austin has jumped 55 places, this improvement does not reflect its progress, it rather because University of Texas at Austin was not included in the THEs 2010-11 versions (THEs, 2010). While, as shown in Table 3, the other three universities continue their progress up the ranking and rise from the outside the UAWCUs to commonly recognized top 100 universities: KU Leuven is commonly ranked within the top 100 among all three ranking systems in 2015, comparing with that it was only ranked within the top 100 in one ranking system-QS in 2010; despite the slight decline in the QS and ARWU, the ranking of Utrecht University sharply increased from 143th in 2010 to 68th in 2011, and then steadily remained growth in the next four years (2011-2015); As same as KU Leuven, University of Warwick transformed into the UAWCUs within five years as the rankings both in the THEs and ARWU increased significantly.

Table 3. Rankings of seven most fluctuated ranks of universities from 2010 to 2015

Universities	Ranks	2010	2011	2012	2013	2014	2015
University of Texas at Austin	THE	>200	29	25=	27	28	46
	QS	67	76	68	71=	79	77
	ARWU	38	36	35	36	39	37
Catholic University of Leuven (Flemish)	THE	119	67	58	61	55=	35
	QS	86	68	82	77	82	82=
	ARWU	101-150	102-150	101-150	101-150	96=	90=
Utrecht University	THE	143	68	67	74=	79	62
	QS	83	80=	85	81	80	94
	ARWU	50	48	53=	52=	57	56
University of Warwick	THE	>200	157	124	141	103	80
	QS	53	50	58	64	61	48
	ARWU	151-200	151-200	151-200	151-200	151-200	92
Washington University, St Louis	THE	38	41	44	42	42	=60
	QS	75=	78	84	86	99	110
	ARWU	30	31	31	32	32	32
Universities of Minnesota	THE	52	42	47	46	46	=65
	QS	96	102	104	102	119	123
	ARWU	28	28	29	29	30	30
University of Sydney	THE	71	58	62	72	60	=56
	QS	37	38	39	38	37	45
	ARWU	92	96	93	97	101-150	101-150

Source: Data retrieved on April 20-22, 2016 from THEs (www.timeshighereducation.com/), QS (www.topuniversities.com) and ARWU (www.arwu.org).

3.2 Common Characteristics of UAWCUs

In recent years, the quest to create "world-class" universities has become increasingly important to higher education institutions and the government and even become a modern phenomenon. However, the characteristics that distinguish a world-class university have been elusive. As Li (2012) suggests that the concept of world-class university is "ambiguous, uncertain, and contested, varying from one context to the next". According to the classifications of institutions which are introduced by the QS, it has shed new light on revealing the common characteristics of the UAWCUs. The first key common characteristic of UAWCUs is that *all of these universities but Ecole Normale Supérieure Paris are fully comprehensive or a down to earth comprehensive university*. In fact, a more comprehensive research university is able to deliver a significant degree of inter-disciplinary research activity and encompass the wide range and depth of an institution's academic offering and therefore has to meet challenges of how to maintain high level of quality in teaching and research, a more focused university

by contrast can concentrate its efforts on a limited number of programs so that allowing a concentration of its budgets; while ranking results reveal that constructing comprehensive, research oriented university or become more comprehensive is critical for universities toward achieving world-class status. As White (1994) recommended that pursuing the goal of being comprehensive and research oriented is significantly more likely for those institutions in the transformation as it leads those institutions to have a wider range of positive outcomes such as enriching academic disciplines, engaging dynamic resources, encouraging research excellence, consolidating academic capacity and improving international recognition and reputation by revitalizing partnership. Hence, although this can be argued that maintaining the scale and breadth of capabilities for being comprehensive can be a time-consuming process with high cost spends, only small proportion of the universities in any one country will not establish the comprehensive research university or become more comprehensive in the next few decades.

The second feature of UAWCUs is that *public universities dominate the most shares of UAWCUs both in 2010 and in 2015*. However, reduction in government funding has not only challenged the numbers of US public universities, also lead European universities with low/no tuition fees to have fluctuated rankings. Since public universities are mostly government funded, they require the governments have long provided substantial funding to support teaching, researching and other educational services and activities. However, situation has completely changed in recent years when different countries' governments have declined funding to public universities which has resulted in risks and challenges for those high level world-class universities to maintain innovative research and high-quality teaching, and it therefore may affect rankings of public universities to shrank or fluctuate somewhat. For example, in response to economic recession, states government of America had reduced funding for public colleges and universities by 28% between 2008 and 2013. In this case, University of North California system was facing financial pressure and determines the specific amount to reduce each campus's individual operating budget, but this savings have had to reduce spending in various ways such as leading to an outflow of talented faculty and students, eliminating academic schools, departments, and programs; and reducing campus services, athletics, student scholarships, and research capacity (Turcotte, 2013). Due to the decline in State funding, the rankings of University of North Carolina at Chapel Hill indicates a significant fluctuation between 2010 and 2015 especially in the THEs and QS, as shown in Figure 1.

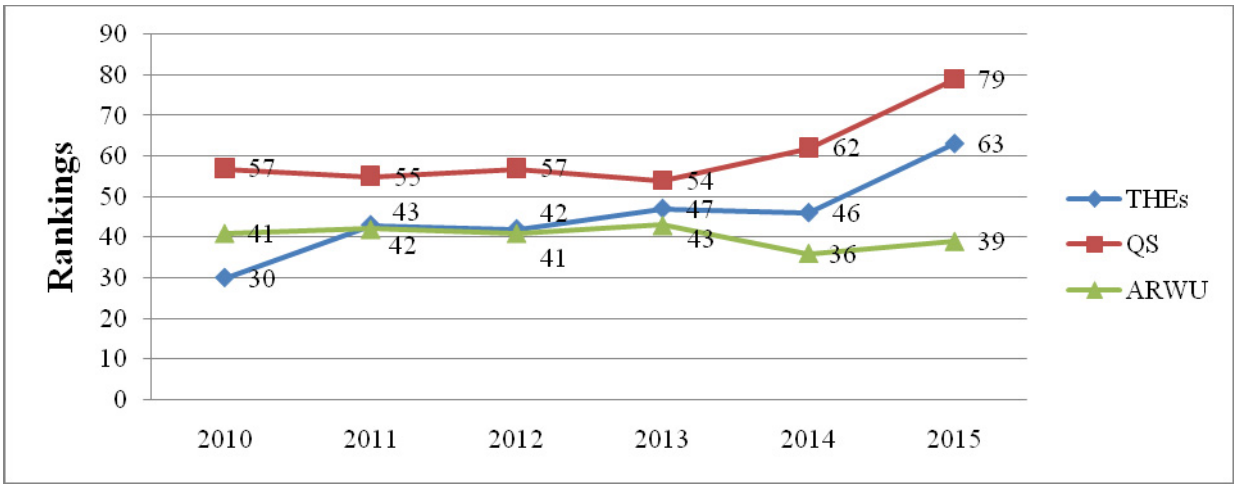

Figure 1. Rankings of University of North Carolina at Chapel Hill from 2010-2015

Source: Data retrieved on April 20-22, 2016 from THEs (www.timeshighereducation.com/), QS (www.topuniversities.com) and ARWU (www.arwu.org).

Analogously, decreasing public funding in most European countries also challenges those European public universities with low/no tuition fees and Finland is just as such case. According to Finish Ministry of Education and Culture (2015), "the spending on education and research has been cut by 10% between 2011 and 2014, amounting to 450 million Euros for the higher education sector since the public funding has been cut". EUA (2015) mentioned it in its report that despite Finland so far has shown comparatively levels of investments, and stable or positive funding trajectories, it reported serious concerns regarding current and upcoming funding on

higher education when governments decline funding. The cuts consequently pose a serious threat to the quality of teaching and research. University of Helsinki, for example, is no longer benefit from special funding from the Academy of Finland and Tekes (agency) for continue researching, and reduces its staff by 500 employees through retirement and choosing to leave open positions unfilled (University of Helsinki, 2016). The ranking of University of Helsinki therefore reflect a fluctuation between 2010 and 2015 especially in the THEs, which placed University of Helsinki in the world's top 100 contenders in 2011, while it has been ranked outside the top 100 in the next four years until 2015.

The last factor related to the UAWCUs refers to the history and scale of university and it is obviously can be seen that *most of UAWCUs have long a rather longer history* except University of California in Los Angeles, University of California in San Diego, Australian National University and University of Warwick are those university under 100 years old. That is to say there is a strong correlation between the age of universities and the performance on measures of world-class teaching and research in the category of "universally acknowledged world-class university". As Salmi (2009) mentioned in World Bank "*the challenge of establishing world-class universities*" report that world-class university such as Oxford and Cambridge in the United Kingdom and Harvard University in the United States often has a long history of superior achievement. However, the progress made by University of Warwick demonstrates that although it would be relative difficult, the possibility for a young university to be a world-leading university within a decade time may take place if it strives excellence in teaching, research, publication, citation, internationalization and industry links. As to the scale or size of an university, it finds that the size of a institution can affect institution experience as most of UAWCUs are large (≥12,000 students) or X-large (>30,000 students) scales excluding Massachusetts Institute of Technology, California Institute of Technology, Princeton University, Ecole Normale Supérieure of Paris and Brown University, which are small scale (<5,000 students) or medium size (5000-12000 students). As Frank and Meyer (2007) stated that over the past decades, university expansion is a modernized phenomenon which response to increased operational complexity, training young people to meet the demands of ever more intricate roles. From this perspective, expanding the size, activities and capacity of university into new areas seem to be opportunities to develop the university further as a world-class one. An example is provided by University of Warwick that since 1996/7 overall student numbers had grown from 17,507 to 29,793 in 2004/05, with a total growth of 58.8% and the number of postgraduate students would have a further 50% increase by 2015, potential changes to graduate and postgraduate students would result in continuing investment in pedagogic innovation and the provision of appropriate high quality teaching and learning spaces to accommodate these future needs (the University of Warwick, 2007). With expanding to undergraduate and postgraduate students, University of Warwick generates strategic opportunities such as promote the interdisciplinary aspects of our training through establishment of training center so that helps to promote knowledge transfer opportunities and improve interdisciplinary research quality. Therefore, it is evidenced that despite the cost of expansion is an important challenge to university, expanding the size of university is considered as a successful factor for institutions to become UAWCUs.

3.3 The Distribution of the UAWCUs among Countries

University ranking is a critical indicator that worth looking into the whole national higher education system in a given country, as well as highlight the quality of education and research. According to Figure 2, it is obvious that up to 2015, the numbers of UAWCUs have reached to 56 and the figure of countries possessed them have been 12. Likewise, UAWCUs originate from a very small number of countries, mostly North America and Western European nations. Among those countries, both US and UK dominated nearly 3/4 of the total number of UAWCUs in 2010, and all the other countries (Canada, Australia, Germany, Japan, Switzerland and France) together have only 12, around 1/4 of the total. It is noted that universities of both US and UK exclusively make up the entries of the top 10 universities, which are Stanford University, Massachusetts Institute of Technology, Harvard University, Cambridge University, California Institute of Technology, Oxford University, Princeton University and University of Chicago. Nevertheless, Columbia University has been ranked outside of the top 10 and ETH Zurich has climbed another place to the 9th. According to the QS ranking, ETH Zurich's continues to make steady progress to improve its already strong subjects in such filed-Earth and Marine Science, Environmental studies, Engineering-Electrical and Electronic, Computer Science and Information System, and those leading subjects of field just follow behind the top-class universities of both US and UK, such as Massachusetts Institute of Technology, Stanford University, Cambridge University and Imperial College London. Likewise, ETH Zurich has improved its comparatively weak "Student-to-faculty ration" score from 54.4 to 78.6.

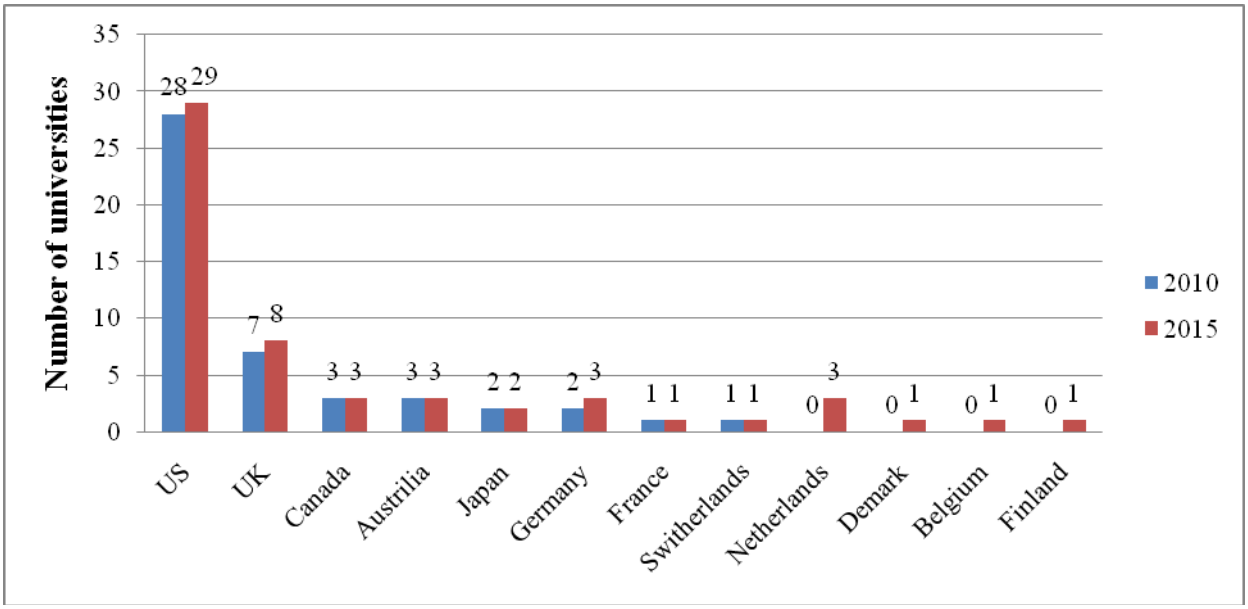

Figure 2. Changes in number of UAWCUs from different countries in 2010 and 2015, respectively

Although Japan is still the regional major force in world higher education, both of the two Japanese world-class universities make regressed by dropping ranks. The University of Tokyo, the Japanese top university, has taken a slight fall from 20th to 25th and Kyoto University is greatly down from 26th to 39th. As one of the strong world's economies, Japan has channeled extra support into a limited number of universities in order to build and remain academic excellence and international competitiveness, and it has been seen significant rises in the ranking by some of the beneficiaries such as Tokyo University and Kyoto University. However, Japanese universities are declining ranking position when compared to that of other Asian countries as well as to that of both US and advanced European countries because Japanese universities are facing finical issues in grants-in-aid. For example, Japanese national universities depend, to a large extent, on the government aid (subsidies and grants). In order to seek new competitive external financial resources, whereas due to a big decline in the Management Expenses Grants-a kind of funding for basic national university expense was caused by the reduction of salaries of public officers because of financing the reconstruction cost from the Great East Japan Earthquake in 2011, the growth rate gaps with its rival China, South Korea, and even with the United States and the European Union are gradually increasing (Brada et al., 2015, p. 46). Comparing with that of Japan, two of German best performing universities: Heidelberg University and Munich University have made a great progress and it shows big improvement in both ranks of the THEs and ARWU. The reason in the rankings which made by those two as well as the other two universities made them into the top 100 allay-Technical university Munich and University of Bonn is that most competitive universities in Germany are acquired extra funding under the government's Excellence Initiative. By launching the Excellence Initiative since 2005, it not only has injected substantial research vitality into German universities and universities therefore have their advantages when it comes to conducting research, but also has enhanced the international reputation of German universities for research (Chen et al., 2014, p. 40).

4. Discussion

Based on above findings, it is rather surprising that why some progressed universes like KU Leuven, Utrecht University and University of Warwick move into the ally of UAWCUs in a relative short time? What lessons can we learn from those benchmark universities? There are several factors to lead those universities to become a member of world-class university:

Firstly, lessons learned from KU Leuven that university consistently strives to build on its strong reputation for research excellence would help to improve the quality of research significantly. In order to build on its strong international reputation for research excellence, KU Leuven offers a wide variety of programs in English and these programs are supported by high-quality inter-disciplinary research carried out at both the university and its internationally acclaimed hospitals which ensures that students obtain academic competences while also developing a critical research-oriented attitude (KU Leuven, 2016). Likewise, KU Leuven invested heavily on

both local and international research. According to statistics from KU Leuven (2016), the university ranked among the European sixth in total projects and funding under the EU's large-scale Seventh Framework Program after Cambridge, Oxford, Imperial College, ETH Zurich, and University College London, and the university's research activities are propelled by steadily increasing research budget; in 2014, KU Leuven invested 426.5 million Euros in local and international research, a 2.03% increase over 2013. In additional to investment, building numerous on-going multidisciplinary partnerships with outside university research firms such as Interuniversity Microelectronics Centre (IMEC), Neuro-electronics Research Flanders (NERF) and iMinds also strengthen the university to achieve the high level of research (KU Leuven, 2016). Because KU Leuven consistently strives to build on its strong reputation of research excellence, researchers at KU Leuven are not only competitive to gain national research project, but also are competitive to gain project and funding from EU. Accordingly, among the prestigious ERC grants awarded by the European Research Council, so that KU Leuven researchers have been involved in a total of 81 ERC projects, placing the university eighth overall among European universities (KU Leuven, 2016).

Secondly, lessons learned from Utrecht University that consistently pursuit innovative research would also helps university to achieve a higher level of research performance. In fact, Utrecht University not only has a remarkable improvement of ranking because of better overall scores in the THEs, but also shows a significant increase in particular areas of "citations (research influence)" and "industry income (innovation)", both of which nearly doubled the score over the last five years. The high citation counts indicate that Utrecht University has high level of research activity and its distinctive approach leads to the development of high quality research articles, benefits and enriches society at international, regional and national levels. Nevertheless, the improvement of industry income score demonstrates that Utrecht University has a rather strong ability to capture knowledge transfer and to help industry with innovations, inventions and consultancy. The improvement of research impact and innovation of Utrecht University mainly lie in the university's consistently pursuing a goal aimed at ensuring that all key research decisions were based on scientific innovations and societal needs since the early 1990s. It can be attributed to the development of strategic alliance between leading institutions such as Academic Biomedical Centre, the UU Centre for Geosciences, the Center for Translational Molecular Medicine (CTMM), the Gate (Game research for training and entertainment) and Utrecht University itself that contributes to the success of Utrecht University's participation in national research and interdisciplinary cooperation, so that helps address social issues in the area of the environment/climate, health, education, life science and government (Utrecht University, 2012). In addition, since Utrecht University achieves above average results in national grant programs such as the NWO Innovational Research Incentives Scheme, Utrecht University has high level ability to support talented researchers by facilitating them during and/or exempting them from grant applications, and applies internal committee-based consultations for various programs (Utrecht University, 2012), which therefore leads the researchers at Utrecht University to increasingly contribute high quality research output and generate higher citation impact. With respect to utilization, Utrecht University also sticks to another core task-knowledge transfer in order to become more effective, innovative and contribute more to the society. In practice, it is clear to see that Utrecht University has already built an effective knowledge chain to strengthen knowledge valorization and entrepreneurship. This knowledge chain is based on development of multiple corporations and alliance between Utrecht University and different knowledge partners such as knowledge institutions and businesses, university and schools, government agencies, university museum, library, researchers, students and employees and Alumni (Utrecht University, 2012). Through the knowledge chain, Utrecht University links major knowledge partners to the R&D department at companies, institutions and institutes and works with knowledge partners to develop a "science park" with focus on active technology transfer, the availability of incubator and venture-capital funds and the protection and commercialization of knowledge through UU (Utrecht University) and UMCU (University Medical Center Utrecht)'s Utrecht holdings (Utrecht University, 2012). Therefore, it can be argued that because Utrecht University successes in the knowledge transfer and build an effective knowledge chain, the industry income has generated through external research activities increase.

Thirdly, lessons learned from University of Warwick that consistently delivering excellence in teaching through internationalization would help University of Warwick to improve its position. Comparing with some other UAWCUs like Oxford University or Harvard University, University of Warwick has been ranked one of the most progressive and successful universities for delivering the great research and teaching in a very short time. As Clark (2004) early noted that several critical factors to ensure the transformation for Warrick university to become a powerful model as the university is built upon a strengthened administrative capacity, a buildup of discretionary funds, a vigorous periphery of outreach structures and programs, a willingness of heartland departments to join in the pursuit of new ventures and relationships and finally a wrap-around entrepreneurial mentality that unities the university in a new direction of development and presents a distinctive outlook

different from traditional modes. While, except above factors, internationalization can be another critical factor to lead the University of Warwick to improve its performance. The University of Warwick is indeed an internationalization oriented university, internationalized initiatives such as arranging student and staff mobility, engaging the faculty members in university internationalization, internationalizing the curriculum, developing of a global mindset, establishing academic partnerships with foreign universities and participating in the global university networks and consortia can all be found in the path for University of Warwick to become internationalization in the past few years (Turcan & Gulieva, 2014). These internationalized initiatives attract not only academic professions who are among the very best in their fields so that ensure University of Warwick producing stronger research output, but also students who have intercultural skills, which turn to fulfill diverse cultural employers' satisfactions. In short, internationalization at University of Warwick is dedicated to strengthening its position in the global knowledge community and increases its competitiveness to compete with other universities nationally and globally.

Lastly, lessons learned from Netherlands that Government is a "backbone" to support university to become a member of UAWCUs. As Figure 2 noted that the most remarkable improvement of countries is made by Netherlands comparing with some other countries with UAWCUs. In fact, as represent in the Table 4, 9 out of 13 Dutch research universities made it into the top 100 in at least one ranking system. Among those universities, Utrecht University, Leiden University and University of Groningen continue to improve their performance and are commonly ranked in the top 100 among three ranking systems. It is also observed from the Table 4 that although the ranking of other six top 100 Dutch universities are fluctuated, there is indeed evidence of progress across those universities. Accordingly, University of Amsterdam and Delft University of Technology have a rather higher possibility to turn into UAWCUs in the next decade than other universities of Dutch. This is because these two universities have already made it into the top 100 in the THEs and QS and also shows a steady increase of ranking among the two ranking systems. It is predicted that if these two universities are able to improve the performance in the ARWU such as improving the quantity and quality of research output for example contributing more highly-cited publications, these two universities are supposed to have a "jump of position" and therefore become the members of the family of UAWCUs.

Table 4. Rankings of the top 100 Dutch universities from 2010-2015

Universities	Ranks	2010	2011	2012	2013	2014	2015
Utrecht University	THE	143	68	63	73	79	62
	QS	83	80	85	81	80	94
	ARWU	50	48	53	52	57	56
Leiden University	THE	124	79	64	67	64	67
	QS	82	88	75	74	75	95
	ARWU	70	65	73	74	77	82
University of Groningen	THE	170	134	89	98	117	74
	QS	120	115	109	97	90	100
	ARWU	101-150	102-150	101-150	92	82	75
VU University Amsterdam	THE	139	159	140	144	136	154
	QS	171	179	177	181	171	176
	ARWU	101-150	102-150	101-150	101-150	100	98
University of Amsterdam	THE	165	92	83	83	77	58
	QS	56	63	62	58	50	55
	ARWU	101-150	102-150	101-150	101-150	101-150	101-150
Delft University of Technology	THE	151	104	77	69	71	65=
	QS	108	104	103	95	86	64
	ARWU	151-200	151-200	201-300	201-300	201-300	201-300
	THE	144	75	70	77	73	47=

Wageningen University	QS	178	175	161	150	151	135
	ARWU	101-150	151-200	101-150	101-150	101-150	101-150
	THE	159	157	72	73	72	71
Erasmus University	QS	99	103	99	92	90	126
Rotterdam	ARWU	151-200	151-200	151-200	151-200	151-200	151-200
	THE	>200	197	115	98	101	88=
Maastricht University	QS	111	109	107	121	118	169
	ARWU	301-400	201-300	201-300	201-300	201-300	201-300

Note. Universities are listed in the top 100 among at least ONE of three ranking systems.

Source: Data retrieved on April 20-22, 2016 from THEs (www.timeshighereducation.com/), QS (www.topuniversities.com) and ARWU (www.arwu.org).

The successful improvement of research universities in Netherlands depends on several critical factors, but most important factor is because of strong government support. Firstly, Dutch government provides substantial funding to public research university, and its national funding system of Netherlands encourages cooperation and efficiencies among the Dutch universities so that promote sustained research excellence. It is noticed that despite the national government of Netherlands is still the main source of funding of the Dutch universities and that flows of funding was cut back by the new cabinet in the recent years, because of a hybrid financing system, a shift in the funding of research leads the Dutch universities to acquire substantial funding from other two streams of funds for teaching and research purpose (Geuna & Martin, 2003). Comparing with the first flow of funds-direct government funding on the basis of lump-sum financing, the second flow of funds focuses specifically on the research activities of the Dutch universities and research facilities via Netherlands Organization for Scientific Research (Dutch: Nederlandse Organisatie voor Wetenschappelijk Onderzoek: NWO) and the Royal Netherlands Academy of Arts and Sciences (Dutch: Koninklijke Nederlandse Akademie van Wetenschappen, abbreviated: KNAW) which are distributed on the basis of project and program proposals so that directly benefit the researchers, research projects and research programs (Duijf, 2009); and the third flow of funds concern contract research and teaching carried out for government, non-profit organizations, private companies, charitable boards and the European community (Canton, 2001, p. 19).

Secondly, Dutch government also releases a high degree of autonomy to Dutch public research universities so that helps university to develop on its own track. As highlighted in the study "University Autonomy in Europe I", conducted by the European University Association in 2009 that as same in the Finland, Switzerland and UK, the Dutch universities follow a dual governing structure which encompasses two board-type bodies-the one is the executive board which comprises the President and Vice-President and the rector, and the other one refers to supervisory board which includes only external members selected by the ministry and they are responsible for selecting and monitoring the executive board, which in turn are fully integrated in all strategic decision-making process (Estermann et al., 2011, p. 27). It is noted that this corporate governing structure not only brings direct benefits to the Dutch universities such increasing ability for universities to recruit independently, promoting and developing academic and non-academic staff, increasing number of students, promoting student selection independently, but also ensures the Dutch universities having a clear and stable profiles to achieve their missions in the best possible way by improving leadership and governance and improving quality of standards (Estermann & Nokkala, 2009).

Thirdly, encourages university to merge with technical or "professional" institutions and corporate with research institutions under government simulation also have resulted in economies of scale that allows Dutch universities to create flexibility and, strengthen research and teaching. An example is provided by Wageningen University which merged with the Dienst Landbouwkundig Onderzoek (DLO) in 2006 and the applied science institution Van Hall Larenstein was merged into Wageningen University in 2007. Although Wageningen University and Van Hall Larenstein were disengaged in 2012, the outcome of merger with DLO leads Wageningen University to move toward an entrepreneurial university, so that encourage the university to create a better academic institution to address the issues of commercializing research and transferring knowledge and technologies to the market (Fayolle & Redford, 2014, p. 262). Another example is made by Delft University of Technology which develops partnerships with a number of research institutions such as the Reactor Institute Delft (RID), the Research Institute for Housing and the International Research Centre for Telecommunications-transmission and

Radar IRCTR (TU Delft, 2016), and collaborations help universities strive for excellence in research and teaching.

Lastly, internationalization is an important part in policy stimulation which is considered to be key priorities to promote Dutch universities. According to a recent study which is conducted by Vereniging Hogescholen (Netherlands Association of Universities of Applied Sciences) and the VSNU (Association of Universities in the Netherlands), internationally the number of mobile students has risen from 1.7 million (1994) to 4.3 million (2010-11), representing 2.4% of the total number of the total number of students. In 1999-2000 the Netherlands received 0.68% of mobile students worldwide and this figure was doubled in 2010-2011. In terms of tertiary education, since English-taught programs for each academic year has increased year by year, there is a steady growth in the number of international students enrolled in Dutch research universities and applied science universities between 2006 and 2013, as shown in Figure 3. In addition, outgoing mobility of staff and students also rise significantly in both research and applied sciences university (VH-VSNU, 2014). The figures reveal that internationalization has played an increasingly important part in reforms of higher education system in the Netherlands and such internationalized initiatives-spanning internationalization activities, strategic integration, and policy stimulation are considered to be key priorities to promote Dutch universities to boost its strength and competitiveness (De Haan, 2013).

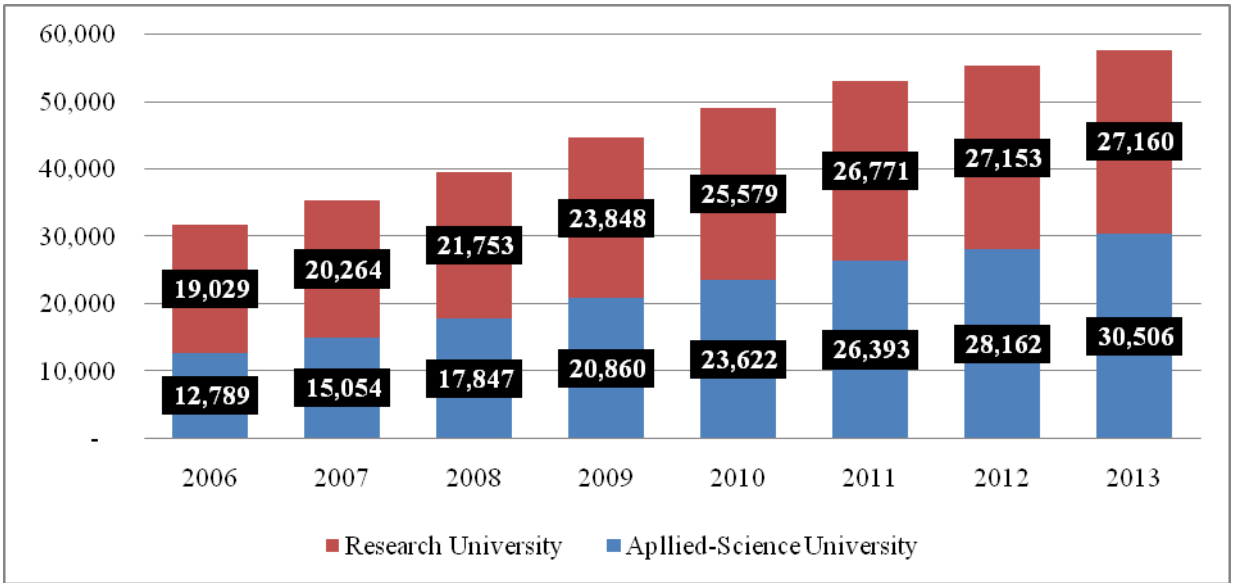

Figure 3. Enrolment of international students in the Netherlands

Source: VH-VSNU (2014), p. 30. Retrieved from: http://www. vereniginghogescholen.nl/ publicaties-en-verenigingsafspraken/ publicaties-gesorteerd-op-verschijningsjaar-1/2014-1/20eight4-int ernationalization-vision-vsnu-vereniging-hogescholen-2014/file

5. Concluding Remarks

This paper addresses the following issues: since the three different ranking systems THEs, QS and ARWU have displayed a widely variable results for the top 100 universities and the obvious reason for this discrepancy is the use of different ranking methodologies, this paper uses simple weighted average method to aggregate rankings of commonly ranked top 100 universities by the THEs, QS and ARWU between 2010 and 2015, in order to minimize the impact of methodologies, and to compare and analyze changes in the UAWCUs. It is noted that most of UAWCUs maintain their leading positions without significant rise or decline of rankings in half a decade. However, it is also noted that three universities, i.e., Washington University in St Louis, Universities of Minnesota and University of Sydney have dropped out of the UAWCUs family as their rankings have fallen out of the top 100 in one particular ranking system. On the other hand, due to the outstanding progress made by Catholic University of Leuven (Flemish), Utrecht University, University of Warwick, rankings of these universities are increased sharply and significantly. It can conclude that the changes in rankings of UAWCUs indicate both opportunities and challenges: a university has possibility to become a UAWCU if it continues to

make steady progress in teaching and research, but a traditional UAWCU may also have the possibility to lose its leading position if it can't keep its merits as ever. More specific conclusions can be drawn as followings:

Firstly, most of current UAWCUs have relative stable rankings in the past 5 years, among which Catholic University of Leuven (Flemish), Utrecht University, University of Warwick have shown rather big improvement of rankings as those universities have made an outstanding progress by striving to build on its strong international reputation for teaching and research excellence, ensuring that all key research decisions were based on scientific innovations and societal needs and pay more attention to implement internationalized initiatives.

Secondly, in addition to Ecole Normale Supérieure Paris, all of UAWCUs are full comprehensive or comprehensive research-intensive universities. Since comprehensive research-intensive university is able to deliver a significant degree of multi- and inter-disciplinary research activity and encompass the wide range and depth of an institution's academic offering, establishing comprehensive research-intensive university is a critical path to build the world-class university. Likewise, most of the UAWCUs are public financially aided, except few private universities in the US. However, reduction in government funding has not only challenged some US public universities, also lead some European universities with low/no tuition fees to face finical issues. In addition, UAWCUs may refer to the age and size of a university. There is a strong positive correlation between the age of universities and the performance on measures of world-class teaching and research in the category of UAWCUs. Most of them are large or X-large size, which demonstrates that expansion of university is one of pathways to become a UAWCU.

Thirdly, the US and UK continue to dominate the number of UAWCUs, but Netherlands has the most remarkable improvement. Currently, the Netherlands has 3 UAWCUs and 6 universities are ranked by at least one of three ranking systems within the world's top 100 universities.

Finally, lessons learned from the progressed UAWCUs that consistently strives to build on its strong reputation for research excellence, consistently pursuit innovative research, consistently delivering excellence in teaching through internationalization would be the critical factors to promote those university to improve their performance and rankings. Also, lessons learned from Netherlands that government plays an important role to support public research universities to improve.

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