Sustainability and Indicators of Newly Formed World-Class Universities (NFWCUs) between 2010 and 2018: Empirical Analysis from the Rankings of ARWU, QSWUR and THEWUR

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Abstract: In the 21st century, sustainability and indicators of world-class universities have come within the scope of an academic cottage industry. The complex problem of university sustainability implies a big challenge for countries and educators to implement important strategies in an integrated and comprehensive way. This paper highlights and analyzes the sustainability indicators of universities included as newly formed world-class universities (NFWCUs) in the top 100 from 2010 and 2018. The integration of three global ranking scales—the Academic Ranking of World Universities (ARWU), the Quacquarelli–Symonds World University Ranking (QS) and the Times Higher Education World University Rankings (THEs)—allows us to minimize the impact of the methodology used. This study integrates regression analysis by using statistical grouping, case studies and normative analysis. Our principal findings are as follows: among the commonly ranked top 100 universities in 2018, the ARWU, QS and THE counted 57, compared with 47 in 2010. Thus, comparing 2010 and 2018 shows that 44 of the universities appeared simultaneously in ARWU, QS and THE rankings and maintained a sustainable position in any ranking system in the family of top 100 groups. Three lower-ranked NFWCUs in the hybrid list for 2010 lost their ranking and did not appear in the group of top 100 universities in 2018, which are covered by some catch-up and young universities. The NFWCUs were from US, Australia, China, Singapore, Germany and Belgium. By systematic comparison, the US and UK continued to dominate the stability of NFWCUs in 2010 and 2018. The key sustainability indicators include a high concentration of talent, abundant resources to offer a rich learning environment and conduct advanced research. Generally, the factors were negatively associated with ranking suggesting that a higher score result in top ranking and vice versa. Teaching, research, citation and international outlook were negatively correlated with THE ranking in 2018. Similarly, Alumni and PUB were negatively associated with ARWU ranking in 2018. All factors except international student ratio were significantly correlated in QS ranking either in 2010 or 2018, where negative association was observed. The significant contribution of our study is to highlight that for the sustainability of universities, it is necessary to have an increasing emphasis on the effectiveness and efficiency of government-supported research, stability of investments and more approaches to employ international initiatives. The results also confirm the appropriate governance, developing global students and place emphasis on science and technology as additional factors in the approaches of pathways to NFWCUs, with delivery of outstanding educational programs and comprehensive internationalization as a key indicator for performance improvement and global university ranking systems.

Keywords: world-class universities; newly-formed; sustainability; rankings; indicators; initiatives

1. Introduction

Over the past few decades, the concept of world-class universities (WCU), also called globally competitive, elite, early formed or traditional universities, has emerged. At present, this term has become a catchphrase, not only in terms of improving the quality of learning and research in higher education but also for sustainability and developing the capacity to compete explicitly in the global higher education marketplace [1–5]. Consequently, since the appearance of global university rankings in 2003, the goal of establishing and changing universities to WCU is to be able to compete in the global knowledge economy [6,7]. Furthermore, the aim is to train creative human resources and advance national development through the acquisition, adaptation and creation of an advanced knowledge-based economy. However, in many ways the development of higher education has facing international and domestic pressures. In today's globalized world, several countries have removed hurdles to join a global battle to establish their institutions as WCU and to promote the knowledge-economy society [8,9]. At the same time, establishing world leading position has been ambition of both government and top universities.

Meanwhile, countries in the western world, particularly the United States (US) and the United Kingdom (UK) and several Asian countries are launching programs for university authority, structure, system and organizational goals to enhance the sustainability and competitiveness of their universities. According to Hezelkorn and Li, assuring world-class university status is the wish for every nation [8]. Subsequently, a variety of reforms and development strategies at both the national and institutional level have been defined and observed. These reforms have also been strengthened and intensified with the propagation of international league tables [7,10–13]. According to Mok, to help their universities achieve this exclusive status, many countries and regions have also implemented a number of funding initiatives.

Generally speaking, high-profile university excellence initiatives are becoming increasingly popular research and development policies globally. These initiatives were institutionalized in more than 28 nations from 1995 to 2017, including in Europe, Latin America and Asia. Such initiatives include Germany's Excellence Initiative; Japan's Centers of Excellence for the 21st Century; South Korea's BK21; China's 211, 985 and 2.0 Projects; Singapore's Research Centers of Excellence; and Australia's ARC Centre of Excellence. The aim is to help their countries and elite universities achieve global competitiveness and higher-quality colleges and universities [14,15]. Again, according to Mok and Salmi, higher education worldwide has been experiencing a continuous trend of transformation shaped by different types of international drivers which operates in a constant flux of globalization. With the strong intention to rank highly in global university leagues, governments are exerting serious efforts to boost their universities global competitiveness. The goal for establishing WCU and changing existing universities to WCU is to be able to compete in the global knowledge economy [16]. Thus, it is important not only to improve the quality of research and teaching but also more significant to develop the competency to compete in the global market economy [17,18]. The term "excellence" has gained in relevance in recent years to sustainability of higher education which are oriented to international ranking criteria. Given this, the quest for WCUs can be understood as an institution that transcends culture and education [19]. They are a "point of pride and comparison among nations that view their status in relation to other nations" [18,20]. In this sense, developing WCU is both a national and local strategy in a worldwide context and sensitive to universal referents and objectives. Several reports confirm that there is no clear definition and statement about the context of what constitutes a world-class university [9,14,21]. Three complementary sets of dimensions of action are in play and can be found in most NFWCUs in the last eight years: favorable governance features that encourage strategic vision, innovation and flexibility; abundant resources to offer a rich learning environment and conduct advanced research; and a high concentration of talent [22,23].

Indeed, all universities are desirous of achieving world-class status; however, the paradox of WCU, as Altbach has succinctly and accurately observed, is that "everyone wants one, no one knows what it is and no one knows how to get one." Thus, while the goal of WCU status is clear the

definition of world-class status is not. Therefore, a set of complementary factors are needed to define the sustainability of NFWCUs [24,25]. In line with the work of these authors, the aim in paths of governance to transform WCU is rooted not just in thoughtful reflections but also in the symbolic role of such higher education institutions (HEIs). The facts tell us that the path for WCU is not something that we can fix overnight. In addition, it is not something that universities can proclaim themselves, as Salmi point out: "becoming a member of the exclusive group of WCU is not achieved by self-declaration; rather, elite status is conferred by the outside world on the basis of international recognition" [5,11]. We have to learn from the institutional characteristics of both early and newly formed WCU as a starting point [26,27]. The global university rankings make competition between states visible and thus are commonly recognized as indicators of success due to excellence-driven policy goals [28]. Hence, strong engagement toward becoming WCU is also a trend nowadays.

Since the 2000s, a new era in HEIs is characterized by global competition in which university ranking systems have assumed importance. Since the emergence of global university rankings in 2003, the interrelated connection between WCU and university rankings has been a heated topic around the world. Thus, global university rankings have become a useful measure of university competitiveness and are commonly used to undertake quality assurance of higher education systems, their strength and weakness, internal analysis, academic performance of top-ranked higher education and their variations [29,30]. It has been found that ranking systems often serve as a proxy for world- class status and despite of many issues with rankings, most are driven by the purpose and concept of university quality. Various methodologies are used in these ranking systems and their influence is striking. Ranking has become unavoidable and it will remain part of academic life.

The ranking of universities has affected HEIs, as ranking appears to strengthen or grant visibility to some universities and expose perceived challenges at the system and institutional level [19,31–33]. Ultimately, the governments of several countries have made a strategic choice for relative targets and formed new visions and missions, university structures and functions, thus eventually turned to lead HEI policy change from the national system level to form top-ranked universities [6,34,35]. According to Teodoro (2019) the compilation and use of university rankings is a widely debated issue. There was some previous interest in this field: in 2003 the Academic Ranking of World Universities (ARWU) by Shanghai Jiao University was published and then the National Taiwan University Ranking (NTU), the University Ranking of Academic Performance (URAP), the Centre for Science and Technology Studies, Leiden Ranking and Scimago Institutions Rankings. Other rankings take into account dimensions not exclusively related to research data, as they incorporate opinion surveys, such as the Times Higher Education World University Rankings (THE) and the Quacquarelli–Symonds World University Ranking (QS). The Multidimensional Global University Ranking (UMultitank) endeavors to resolve some of the criticism commonly leveled at the above rankings.

Rankings have been the object of much criticism [16,19,36]. Composite rankings have numerous weak points, as indicated by several authors. There are numerous major global and national ranking systems that describe the performance of universities in the world; among them, we chose three prominent systems: the Academic Ranking of World Universities (ARWU), the Quacquarelli–Symonds World University Ranking (QS) and the Times Higher Education World University Rankings (THE), which are the most cited and commonly used [18,37]. World rankings aspire to include the most relevant universities worldwide. Thus, composite rankings summarize several weighted indicators and assign one score, which is then used to offer a classification. Rankings should be used with caution, taking into account how they are developed [38].

Approaches to Common Composite of World University Ranking Systems

Rankings provide great insight into the strength and shifting fortunes of individual research universities, although the compilation and use of university rankings is currently a widely debated issue. University rankings, despite their limitations, have been considered to be important by many stakeholders [37]. It is evident that many, though not all, institutions of higher education take rankings

seriously for the purpose of accountability, evaluation and strategic planning. At the individual level, rankings are potentially useful in providing a comparable and clear summary of information for students to select appropriate universities and destinations for their education. At the institution level, global rankings have become a marketing feature in university activities [39]. Rankings strongly influence the behavior of universities, as their presence in ranking tables alone heightens their profile and reputation, encouraging the collection and publication of reliable national data on higher education. Internationally, rankings provide an informal measure of a country's ability to compete in a knowledge-based world economy due to the emphasis on research output. Therefore, several authorities and universities have put forward policies for creating WCU and take university rankings seriously. According to Pusser and Marginson, rankings are an essential sustainability instrument for the exercise of power in the service of dominant norms in global higher education.

It is clear that rankings continue to grow in popularity and gain interest by policy makers. While the world is obsessed with rankings, there are several cautions voiced against them. Rankings have been the object of much criticism with regard to the measurement indicators, the institutions being measured and the diversity of features to make comparisons [40]. A consensus has emerged and there are plenty of discussions in the literature that despite the wide diffusion of university rankings in recent years, their methodology and usefulness are not exempt from critics, especially the validity of the results and suitability of the variables used. Several studies have also criticized that the selection of indicators and their weighting, data processing and transparency are strongly questioned. Again, every ranking is based on the availability of comparable data and is built on the subjective judgment (over indicators and weightings) of its compilers. In addition, the indicators used promote the presence of a minimal number of research institutions from peripheral countries and neglect some other types of college and universities. [7,29]

University ranking systems provide a comparative analysis of university performance and characteristics at a global level, regional level (e.g., Europe, Latin America), national level (e.g., US), development level (e.g., developing countries) and particular group level but several ranking systems are available for several purposes and only a few attract many and are commonly recognized. In line with the above, this study considers the three rankings of ARWU, QS and THE due to their reputation, characteristics, influence and limitations. There are more than 28,077 (http://www.webometrics.info/en/node/54) HEIs all over the world and the top 100 universities account to 0.004%, which should be recognized worldwide due to their sustainable performance indicators and academic excellence (www.topuniversities.com). This paper addresses the gap in sustainability indicators of NFWCUs in the last eight years. Then, if we agree that any universities listed on the top 100 in the global ranking systems of ARWU, QS and THE as world-class, this research will define those that have fresh appeared as newly formed (or progressive-type) world-class universities (NFWCUs).

2. Research Objectives and Goals

The general goal of this study is to examine sustainability indicators and establish present evidence on the empirical distribution of and contributions across NFWCUs in the last eight years according to the top world ranking systems of ARWU, QS and THE. In today's globalized world, higher education institutions worldwide are in a period of difficult transition and transformation shaped by different types of internal drives. This situation is mostly affected by globalization, the advent of massification, undefined relationships between the state and universities and current technologies, among other factors [41]. In this view, an increasingly pressing agenda and priority of many governments is to make sure that their elite universities are operating at the cutting edge of intellectual and scientific development [42]. In the 2000s, several countries joined the global pursuit of building WCU in the knowledge society [43,44] and currently, several countries are creating WCU as an essential part of their higher education reform [45]. In recent years, building a sustainable world-class university has been the dream of some nations and emerging approaches have attracted attention from scholars. However, up to now few countries have had the possibility to turn the dream into reality.

According to Peter Senge, within the unpredictable future business environment and accelerated development of the knowledge economy, universities need to increase their knowledge generation and knowledge transfer in society. Universities should strive to become learning organizations [46–48]. They must enlarge their focus on research and their traditional mission of teaching and learning. Universities should adopt a new paradigm to monitor the needs of different stakeholders. This means they should create adaptation knowledge to produce generative knowledge and to become learning organizations and at this stage the government should become a strategic driving force [3,48] for universities and a powerful integrator. Since all main functions of a university are related to knowledge transformation and distribution, the university becomes a knowledge-intensive organization dominated by intellectual capital [49].

Since the beginning, the university has always been a cultural and moral symbol of social communities. The perspectives, preoccupations, activities and goals of universities have significantly changed over time, as have their roles and strategies. Nowadays, universities are viewed as knowledge providers, innovation facilitators, promotors of entrepreneurial talent, economic and civic leaders and mostly knowledge pioneers of the creative commons [49]. Countries around the world have faced and continue to face challenges in global university ranking competitiveness and the increased importance of having top listed universities.

Higher education governance continues to grapple with increased competition under pressure from the curriculums they offer and the university ranking systems used. In developing countries, higher education faces several challenges, such as inadequate funding, outdated curriculums and governance structure. Whereas many developed countries have made changes in their higher education system to deal with the growing pressure of global competitiveness of universities across the world, developing countries continue to lag behind [50]. In many developing countries, the lack of reformation and innovative changes in management practices and governance models in higher education is stifling high-quality teaching, reputation, productive faculty, excellent students, flexible administration, full funding and internal engagement.

The literature indicates that WCU involves a complementary set of three factors. These factors can be observed in most top-ranked universities. Typically, these factors are a high concentration of talent among both faculty and students; abundant resources to support a rich learning environment and conduct advanced research; and constructive governance features that encourage strategic vision, innovation and flexibility to enable institutions to make autonomous decisions and manage resources without being burdened by bureaucracy [27].

In the rest of the world, world-class universities have in general kept pace with reforms in governance structures and academic systems. A number of researchers [46,51,52] have analyzed the contributions of university governance and educational systems to a world-class reputation. Most handful of recent scholars indicate that the key determinants that have a strong influence on the development of world-class universities include excellence in research, productive faculty, excellent students, flexible administration, adequate facilities, full funding and international engagement. According to the definition of world-class universities by Philip G. Altbach, the criteria include governance structure and productive faculty. Therefore, when we try to understand the paths of governance for NFWCUs, we must keep in mind that each nation is unique, and its universities can survive and prosper if they meet the needs of the society.

In the 21st century, the top universities are under tremendous pressure and have upgraded to world research once in a relatively short time. They have made many policies at unprecedented speed. Other universities and their governing agencies have also set such an aim. The movement for NFWCUs has become a national role, with the investment of many resources. The question is, can universities transform into NFWCUs only with a strong will and high financial investment? The answer is unknown. In line with the criteria above, the central objective of this study is to assess the driving indicators for variations and contributions of NFWCUs based on characteristics and

distributions among countries. Further, the study suggests common measurable strategies applied by these universities to achieve success.

3. Research Questions and Methodology

To guide our inquiry related to this paper and reach the main findings, this study integrates research methods using statistical groupings, case studies and normative analysis. The following research questions were used to guide our study:

RQ1: What are the newly formed world-class universities (NFWCUs)?
RQ2: What are the common shared sustainability indicators of NFWCUs?
RQ3: What are their variations and contributions in the future?
RQ4: What are the research productivity and government initiatives? Specifically, how have these governments and HEIs construct and transformed to become globally competitive.

Although there still are no generally accepted definitions or clear standards for quantified assessment of world-class universities in the world, there are various indexing systems for assessing universities. Each has its own motives and purpose as well as shortcomings and limitations. It is therefore a focus on being world-class universities has become synonymous with relative efforts by universities to move upwards in the international league tables. Thus, league tables are taken as symbolic and powerful indicator to prove striving to NFWCUs.

To achieve the aims of the research questions and develop explanations of NWFCUs as a social phenomenon, according to Liu (2015) and Teodoro (2018) this study adopted a qualitative research design. Qualitative research entails opinions, feelings and experiences. It aims at describing social aspects as they occur and taking a holistic approach, thereby extricating critical experiences from NFWCUs and facilitating the optimization of excellence sustainability and indicators in the last eight years by providing suitable suggestions. According to Pusser and Marginson (2013), rankings are an important element in global higher education. In our current study, we use three known rankings with their relative indicators. By synthesizing these rankings, NFWCUs are obtained. This reduces the heterogeneity of single rankings and weaknesses as indicated by Soh (2017b). Keeping in mind that every ranking has some statistical problems, this study implements and integrates four research methods: case studies, statistical groupings, comparative analysis and normative analysis. The integration of these four research methods with the global ranking systems of ARWU, QS and THE provides an opportunity to build a greater assortment of divergent views on the issue studied, increase the credibility of the study and offer stronger inferences. Taking this into consideration, this is the important reason why this study integrates four research methods.

3.1. Methods of Data Collection

Our study retrieved data from three databases that are most publicly visible and well recognized globally for university rankings: ARWU, QS and THE, in which the factors used to determine university rankings are provided. It was evident that each ranking system has unique factors, hence this study compared university rankings among the three databases. To be included in the study, a university must appear among the top 100 universities in all three ranking systems. The universities were selected from 2010 and 2018.

The first step is to obtain data from ARWU, QS and THE using the values of indicators they use and global scores; after that, we input the top 100 universities that appear in all three ranking systems. Finally, universities with all characteristics are identified and analyzed by a regression model.

We selected NFWCUs according to a set of relative criteria to find current NFWCUs from the last eight years (2010–2018) based on the ARWU, QS and THE ranking systems. We then combined the current data from ARWU, QS and THE on the top 100 universities ranked previously by using their summation and total mean so as to know the order of overall top-ranked universities and a hybrid list

of NFWCUs. Finally, the overlapping part was synchronized to drive classifications, disparities and distributions among countries.

It should be noted that all university ranking information related to institutional practices are available from the web pages of the three ranking systems: http://www.shanghairanking.com/, https://en.wikipedia.org/wiki/ and the NFWCUs' home pages. By considering the adopted system, the four methods were used to integrate the three ranking systems to produce a hybrid list of current NFWCUs in the last eight years. The timeframe appeared to be a period during which the governance of several universities-initiated excellence initiatives. Moreover, such an approach allowed us to deal with the criticism of inconsistent ranking results because of different methodologies used by the three selected systems; if we simply look a single ranking list, it is not enough to fully judge the quality and level of a university, so it seemed that integrating the top three ranking systems to evaluate the sustainability indicators of NFWCUs would be more comprehensive for this study. Following the above-explained methods, a summary of the process and the population of the study and sample design are illustrated as follows.

3.1.1. Academic Ranking of World-Universities (ARWU)

The Academic Ranking of World Class University (ARWU; www.arwu.org) undertaken by Centre for World-Class Universities of the Institute of Higher Education of Shanghai Jiao Tong University, China (hence often known as Shanghai Jiao Tong Ranking). It was firstly started in 2003 as the first world global ranking of universities. Thus, the origin was to establish the global standing of top Chinese universities but soon attracted world attention. This ranking has attracted much interest from around the world as it ranks the best world's 500 top universities from 41 different countries annually. Since 2009, the Academic Ranking of World Universities (ARWU) has been published and copyrighted by Shanghai Ranking Consultancy, a fully independent organization on higher education intelligence. Although the initial purpose of ARWU was to find the global strength standing of top Chinese universities, it has attracted a great deal of attention from universities, governments and public media worldwide. Moreover, a survey on higher education published by The Economist in 2005 commented ARWU as the most widely used annual ranking of the world's research universities. The significant influence of ARWU is that its methodology is scientifically sounds, stable and transparent. Its content is widely cited and employed as a starting point for identifying national strengths and weakness. [36,45,53]. Being as the first digital instrument of its kind, it is one of the causes of some of the key features of global academic competition as we know it today.

3.1.2. Quacquarelli-Symonds World-University Ranking (QS-WUR)

The Quacquarelli-Symonds World-University Ranking (QS; www.topuniversities.com) is an annual publication of university rankings. Previously known as Times Higher Education-OS World University Rankings, being similar in many ways; this is a global career & education company specializing in education and study abroad. From 2004 to 2009 THE and QS jointly published the same rankings. The fundamental criteria used were research, employability, teaching & internationalization. However, in 2010, after separating from THE, QS continued with virtually the similar criteria for its annual rankings, on the whole with some changes in the weight of the requirements ranks about 700 of the world's top universities [33,54]. Being the only international ranking to have received International Ranking Expert Group(IREG) approval, the QS is viewed as one of the three most-widely ready university rankings in the world [55,56].

3.1.3. Times Higher Education World University Ranking (THE-WUR)

Times Higher Education World University Ranking (THEs; www.timeshighereducation.com/). Is an annual publication of university rankings. Actually, as early as 2004 Times Higher Education (THE) partnered with Quacquerelli Symonds (QS)-QSWUR to publish a new set of world university rankings. However, by in 2010, THE & QS ended their partnership, as each one deciding to release

its ranking with two independent programs. In 2010, THE using new data supplied by Thomson Reuters (a business data provider headquartered in New York) published its rankings using a different methodology. THEs currently uses 13 performance indicators grouped in 5 areas of indicators, most of the data that are being provided by the institutions. Thus, ranks world's 400 top universities annually comprise of the world's overall subjects and reputational rankings. THE is often considered as one of the most widely observed university rankings and praised for having a new, improved ranking methodology. THE ranking is criticized however on having and relying on subjective reputation survey. [53]. Table 1 provides details on the indicators and weight for each three ranking methodology used in this study.

Table 1. University ranking methodology and sustainability indicators.

Ranking Name	Publisher/Commencing YEAR	Indicator and Weight	Website
ARWU	Institute of Higher Education of Shanghai Jiao Tong University, 2003	Alumni (Alumni with Nobel and Field Medals), 10% Award (Nobel and Field Medal winners), 20% HiCi (Researchers cited by Thomson Scientific), 20% N&S (articles published in *Nature* and *Science*), 20% PUB (articles indexed in SCI and SSCI), 20% PCP (faculty average score in above 5 items), 10%	http://www.shanghairanking.com/aboutarwu.html
QS-WUR	Quacquarelli Symonds, 2004	Reputation, 40% Employer reputation, 10% Student-to-faculty ratio, 20% Citations per faculty, 20% International faculty ratio, 5% International student ratio, 5%	http://www.topuniversities.com/university-rankings-articles/world-university-rankings/qs-world-university-rankings-
THE-WUR	Times Higher Education, 2010	Teaching (30%), Research (30%), Citations (32.5%), Industry income (2.5%) International outlook (5%)	http://www.timeshighereducation.com/

4. The Conceptual NFWCUs Context and Analytical Framework

References to the sustainability of NFWCUs immediately imply allusion to catch up, the most progressed type, the prominent among the easily formed within the state or national higher education institutions. The NFWCUs constitute almost universally within the English-speaking countries, post-secondary institutions that constitute aiming the pinnacle of either a state or national higher education system, of those have overlapped to excel, among others. This understanding usually depicts the largest and most elite huger regarded universities within the countries and a more substantial set of commonly acknowledged universities [57]. These can be seen as, designation, visibility, differentiation, validity and the various discourses around NFWCUs in Asia and Latin American higher education institution context were vocal critics analyzed in Reference [2]. These can be perceived as several Asian countries drive to the formation of WCUs.

Expounding on different phrases of "prestigious institutions" as a research university, "world class" and "Newly Formed World-Class Universities" (NFWCUs): Altbach, [2] articulate world-class universities as leading universities in the countries, largest producer of graduate students, research and publications. They are held high national esteem and play an important role in national capacity building and innovation effort and commonly included in the top-ranked universities. In century ago, only well-deserved universities such as Harvard Universities and Oxford University that were recognized as "Early Formed World-Class Universities" "EFWCUs." However, recently, several

universities are catching up to future the quest and catch up in of top 100 global university rankings. Invariably, in this study, the word "NFWCUs" used to mean, universities which are "fresh-appeared" "catching up" or "progressive type" are described based on the commonly ranking list of top 100 in the world's top three ranking systems. They are universities newly listed in the current top 100 ranked by the global university ranking of ARWU, QS and THEs in the past eight years (2010-2018). This broad conceptual framework of NFWCUs as enunciated here is deemed relevant for this study and adopted for the study of global NFWCUs. Therefore, early universities and NFWCUs shed some light on the sustainable worldwide movement to create WCU. By tracing the university ranking systems, the NFWCUs has a global phenomenon of strong reputation and influence on the development of higher education including productive faculty, excellent students, flexible administration, international engagement and plentiful funding mechanisms.

Although, the discussion as regards to developing WCUs involves integrated part assessment of teaching and research in global world rankings. In this paper, variation refers to the sequence with changes divergence in the range of sequences in global rankings of the WCUs regarding characteristics, data and functions. Since there are over 28,077 distribution and variations of colleges and universities ranked all over the world but the top 100 worldwide listed institutions in the three global ranking system are very few (cover around 0.004%). Therefore, there are certain limitations in the rankings of various universities and they are widely criticized, whether the top universities in the rankings must be the world's top universities still have doubts. However, in different university rankings, based on different ranking indicators and weight, have steadily ranked in the world for many years due to their institutional practices, characteristics, visible achievements and superior performances in the commonly included top higher education institutions (HEIs). Following this notion and by considering the world common ranking systems (ARWU, QS and THEs) in this paper the variation of the NFWCUs will mean disparities among the list of top-ranked HEIs in the global ranking systems from the last eight years (2010 and 2018) respectively. The NFWCUs contributions entail the role, impact and achievements in educational, social, economic and cultural arena in their countries—the literature on variation and contribution of NFWCUs in particular and universities. Today, there is a global debate on the importance of WCUs as a critical element for a quality generation in skills for a knowledge-based economy. Critical to national competitiveness and sustainable development in today's competitive global economy—NFWCUs described as the core, key and forces to build an inclusive and diverse knowledge society the subject of this paper. Figure 1: then summarises and indicates the conceptual framework of the study and showing the sustainability indicators in the three rankings.
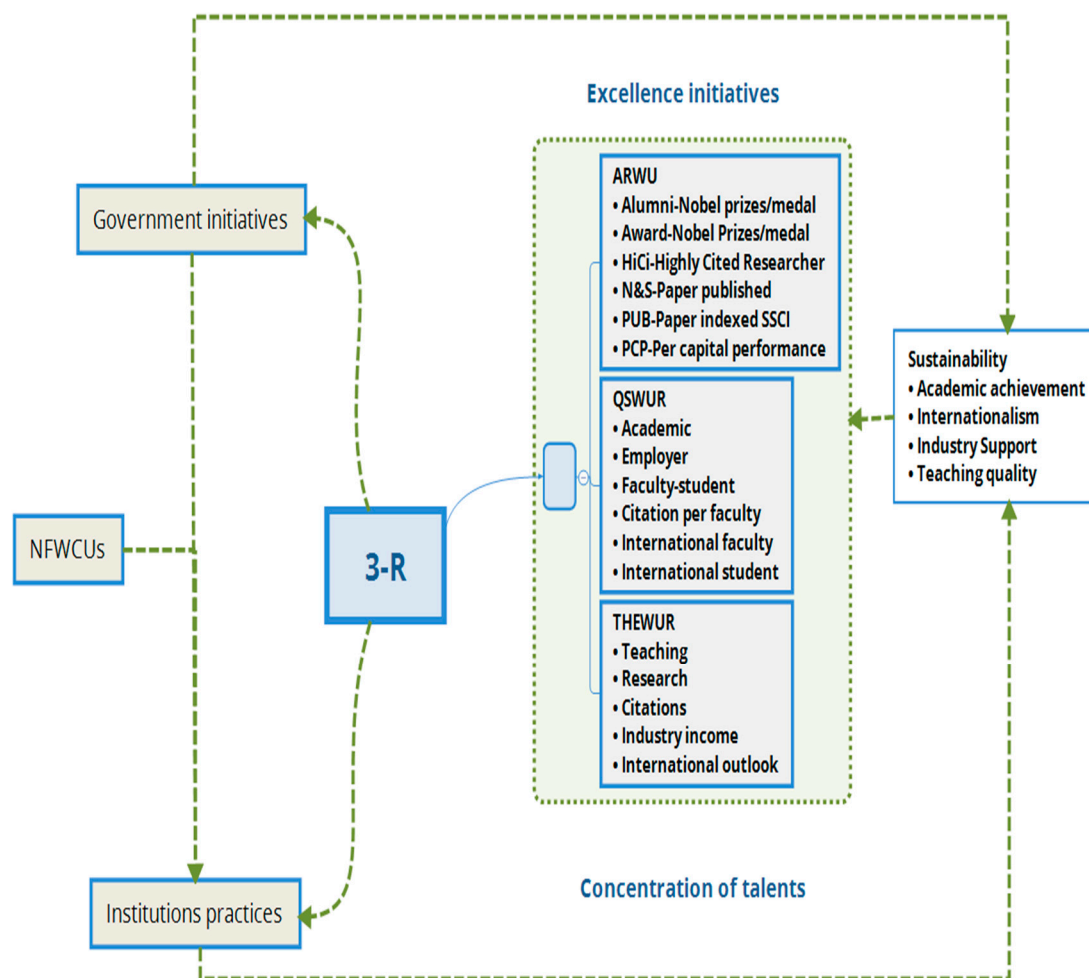
Figure 1. Conceptual Frame Work.

Data Analysis Tool

The data was analyzed using computer program-Statistical Package for the Social Sciences (SPSS v22.0). Then, the regression analysis for overall sustainability and indicators affecting university ranking from ARWU, QS and THE was based on the following regression equation:

$$ARWU = \beta 0 + \beta_1 * (alumni) + \beta_2 * (award) + \beta_3 * (HiCi) + \beta_4 * (N\&S) + \beta_5 * (PUB) + \beta_6 * (PCP) + SE$$

$$QS = \beta 0 + \beta_1 * (ACADREP) + \beta_2 * (EMPREP) + \beta_3 * (STUDFAC) + \beta_4 * (citations) + \beta_5 * (INTFAC) + \beta_6 * (INTSTUD) + SE$$

$$THE = \beta 0 + \beta_1 * (teaching) + \beta_2 * (research) + \beta_3 * (citations) + \beta_4 * (INDINC) + \beta_5 * (INTOUT) + SE$$

Key: $\beta 0$ = constant; β_1, β_2, $\beta_3 \ldots$ = regression coefficient; SE= standard error

Figure 2 Summarizes and indicates detailing steps and the process of data, raking indicators, characteristics and analysis process of the data, where by data grouping, normative analysis, case study and regression analysis appeared to reach the results of weightings on factors affecting ranking.
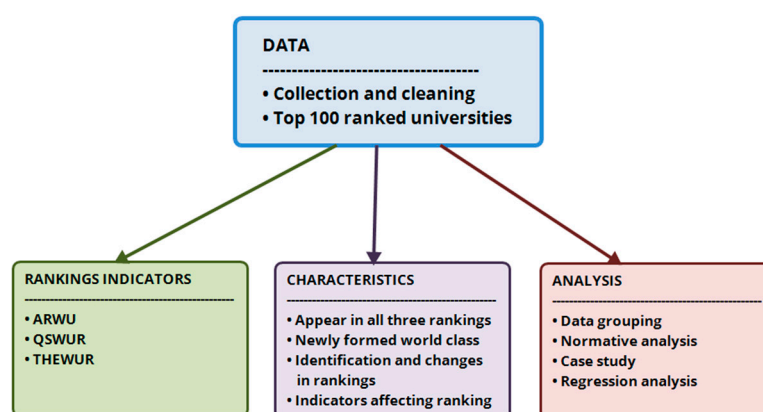
Figure 2. Summary of the process of data collections.

5. Results of the Study

5.1. Sustainability and Indicators of NFWCUs in the Last Eight Years

To address the research question, Tables 2 and 3 summarize the latest findings of the ARWU, QS and THE, comprising data from 2010 and 2018. Taking into consideration the hybrid list of top 100 universities in each ranking, the comparative analysis shows that there were only 47 NFWCUs in 2010. However, the number increased, reaching 57 in 2018. In addition, taking the hybrid list of 2018 NFWCUs, the figure indicates that 44 universities continuously maintained their status among the top 100 in the past eight years but three declined in rank and dropped out of the NFWCU family in 2018: Ecole Normale Supérieure in France and Brown University and the University of Minnesota in the United States. As for 2010 NFWCUs, the trend shows that 13 universities appeared in the hybrid list in 2018 as fresh replacements in the latest group over the past eight years.

As mentioned above, the top 47 universities in 2010 were in seven countries: US, Australia, Canada, France, Germany, Switzerland and UK (Table 2). Generally, US universities dominated the top 47 universities that met the criteria of being in the top 100 in 2010 according to ARWU, QS and THEs. The US universities comprised more than two-thirds, with 37 universities, followed by UK (14.9%), while the rest had less than 10%. Similarly, the US still dominated the top 57 universities in 2018 with 30 (42%) universities (Table 3), followed by the UK (14%) and Australia (9%), with 8 and 5 universities, respectively. Other countries with top 57 universities included Canada (3), Germany (3), China (2), Japan (2), Singapore (2), Belgium (1) and Switzerland (1). Notably, three universities were dislodged from the top 57 in 2018 compared to 2010, two in the US (Brown University and University of Minnesota) and one in France (Ecole Normale Supérieure).

Table 4 shows the most improved 13 universities in 2018 that did not appear in the top 100 in 2010. The US showed the most improvement, with five universities (38.5%), followed by China, Singapore and Australia at 15.4% and finally Belgium and Germany, each with a single university (7.7%). US universities have dominated the top positions globally, hence this study focuses on two Asian and European countries that have had more improvement lately in terms of global ranking. Consequently, 13 NFWCUs in the US, Australia, China, Singapore, Germany and Belgium are the main focus of the study.

Table 2. The combined list of commonly included the top 100 universities in 2010.

Overall Ranking	Institution	Country	Rankings in 2010		
			ARWU	QS	THE
1	Harvard University	US	1	2	1
2	Cambridge University	UK	5	1	6=
3	Massachusetts Institute of Technology	US	4	5	3
4	California Institute of Technology-Caltech	US	6	9	2
5	Stanford University	US	3	13	4
6	Oxford University	UK	10	6	6=
7	Princeton University	US	7	10	5
8	Yale University	US	11	3	10
9	University of Chicago	US	9	8	12
10	Columbia University	US	8	11	18
11	University of California-Berkeley	US	2	28	8
12	Imperial College London	UK	26	7	9
13	Cornell University	US	12	16	14
14	Pennsylvania University	US	15	12	19
15	University College London	UK	21	4	22
16	Johns Hopkins University	US	18=	17	13
17	University of Michigan-Ann Arbor	US	22	15	15=
18	Zurich-ETHZ	Switzerland	23	18	15=
19	University of California, Los Angeles	US	13	35	11
20	University of Tokyo	Japan	20	24	26
21	University of Toronto	Canada	27	29	17
22	Duke University	US	35	14	24
23	Northwestern University	US	29	26	25
24	University of Washington	US	16	55	23
25	University of Wisconsin-Madison	US	48	17	43
26	Kyoto University	Japan	26	25	57
27	University of British Columbia	Canada	36=	44	30=
28	University of California-San Diego	US	14	65	32
29	Carnegie Mellon University	US	58	34	20
30	McGill University	Canada	61	19	35
31	Edinburgh University	UK	54=	22	40
32	University of Illinois	US	25	63	33
33	Australian National University	Australia	59=	20	43
34	University of North Carolina at Chapel	US	41	57	30
35	New York University	US	31	41	60
36	Melbourne University	Australia	62	38	36
37	Washington University, St. Louis	US	30	75=	38
38	Ecole Normale Supérieure, de Paris *	France	71	33	42
39	Brown University *	US	65	39	55
40	King's College London	UK	63=	21	77
41	Manchester University & Umist	UK	30	44	87
42	Bristol University	US	66=	27	68
43	University of Minnesota *	US	28	96	52
44	München University	Germany	51	66	61
45	Heidelberg University	Germany	49	51	83=
46	Boston University	US	77	64	59
47	University of Sydney	Australia	92	37	71

Note. * The universities appeared in the group of NFWCUs in 2010 but disappeared in 2018. Source: Data retrieved on 10–30 September 2018 from THEs (www.timeshighereducation.com/), QS (www.topuniversities.com) and ARWU (www.arwu.org).

Table 3. Combined list of commonly-included top 100 universities in the year 2018.

Overall Ranking	Institution	Countries	Globe Rankings in 2018		
			ARWU	QS	THE
1	Stanford University	US	2	2	3
2	Harvard University	US	1	3	6
3	Massachusetts Institute of Technology-MIT	US	4	1	5
4	Cambridge University	UK	3	5	2
5	Oxford University	UK	7	6	1
6	California Institute of Technology-Caltech	US	9	4	3
7	Princeton University	US	6	13	7
8	University of Chicago	US	10	9	9
9	Zurich-ETHZ	Switzerland	19	10	10
10	Columbia University	US	8	18	14
11	Imperial College London	UK	24	8	8
12	University College London	UK	17	7	16
13	Yale University	US	12	16	12
14	Cornell University	US	12	14	19
15	University of Pennsylvania	US	16	19	10
16	Johns Hopkins University	US	18	17	13
17	University of California-Berkeley	US	5	27	18
18	University of California-Los Angeles	US	11	33	15
19	Duke University	US	26	21=	17
20	University of Michigan-Ann Arbor	US	27	21=	21
21	Northwestern University	US	25	28=	20
22	University of Toronto	Canada	23	31	22
23	University of Edinburgh	UK	32	23=	27=
24	University of California-San Diego	US	15	38=	31
25	Tokyo Kasei University	Japan	22	28=	46
26	Tsinghua University	China	45	25	30
27	University of Washington	US	14	61	25=
28	New York University	US	32	52	27=
29	University of Melbourne	Australia	38	41=	32
30	King's College London	UK	56	23=	36
31	National University of Singapore	Singapore	85	15	22
32	Peking University	China	57	38=	27=
33	University of Manchester	UK	34	34	54=
34	University of Wisconsin-Madison	US	28	55	43
35	University of British Columbia	Canada	43	51	34=
36	Australian National University	Australia	69	20	48
37	McGill University	Canada	70	32	42
38	Kyoto University	Japan	35	36=	74=
39	University of Illinois at Urbana-Champaign	US	41	69	37
40	Technical University of München	Germany	48	64	41
41	University of München	Germany	53	66	34=
42	University of Texas at Austin	US	40	67	49
43	Nanyang Technological University	Singapore	96	11	52
44	University of Heidelberg	Germany	47	68	45
45	Carnegie Mellon University	US	91	47	24
46	University of North Carolina at Chapel	US	30	80	56=
47	University of Queensland	Australia	55	47=	65
48	Washington University in St. Louis	US	20	100	50=
49	University of Sydney	Australia	68	50	61
50	Georgia Institute of Technology	US	79	70	33
51	University of Bristol	UK	74	44	76
52	Catholic University of Leuven	Belgium	86	71=	47
53	Boston University	US	70	81	70=
54	Monash University	Australia	91	60	80=
55	Pennsylvania State University	US	74	93=	77
56	Rice University	US	70	89	86=
57	Ohio State University	US	94	86	70=

Source: Data retrieved on 10–30 September 2018 from THEs (www.timeshighereducation.com/), QS (www.topuniversities.com) and ARWU (www.arwu.org).

Table 4. Newly-formed world-class universities of 2018 from the selected three rankings of ARWU, QS and THE.

Institution	Country	2010			2018		
		ARWU	QS	THE	ARWU	QS	THE
Tsinghua University	China	151–200	54	58	45	25	30
National University of Singapore	Singapore	101–150	31	34	85	15	22
Peking University	China	151–200	47	37	57	38	27
Technical University of München	Germany	56	58	101	48	64	41
Nanyang Tech. University	Singapore	301–400	74	174	96	11	52
Georgia Institute of Technology	USA	101–150	106	27	79	70	33
Catholic University of Leuven	Belgium	101–150	86	119	86	71	47
Monash University	Australia	151–200	61	178	91	60	80
Pennsylvania State University	USA	43	98	109	74	93	77
Rice University	USA	99	115	47	70	89	86
Ohio State University	USA	59	125	66	94	86	70
University of Queensland	Australia	101–150	43	81	55	47	65
University of Texas at Austin	USA	38	67	>200	40	67	49

Source: Data retrieved on September 10–30, 2018 from THEs (www.timeshighereducation.com/), QS (www.topuniversities.com) and ARWU (www.arwu.org).

Identifying clusters and comparing the findings of the ranking systems for 2018, Monash University, Tsinghua University and Nanyang Technological University have shown significant improvement in performance in recent years compared with their previous rankings in 2010. The trend indicates that the Ecole Normale Supérieure, Brown University and the University of Minnesota have shown rapid fluctuation in ranking for the past eight years. Despite the significant improvement of Tsinghua University and Nanyang Technological University, the progress does not reflect a substantial achievement in the ARWU ranking. As indicated in Table 5, Peking University ranked in the top 100 by both THE and QS in all years and had slight progress in ARWU ranking in the past three years. Brown University was included in all versions for six consecutive years, and then steadily dropped from the family of NFWCUs in 2017 and 2018 (101th to 150th). Due to the rapid decline, it was not included in the ARWU ranking for the past two years. Peking University, Tsinghua University and Nanyang Technological University have consistently continued their performance and variation in the rankings, hence transformed to NFWCUs after slightly increasing in ARWU rankings for the last three years. In all versions (2010–2018), the one ranking of QS has had all NFWCUs in the last eight years, reflecting an improvement compared with the other global rankings of ARWU and THE.

The results indicate that among the 5 hypothesized factors affecting THE ranking in the last 8 years included in the model, only 4 were found to have significant influence on THE ranking in 2018. These include teaching (−0.741 *), research (−0.999 **), citations (−0.807 *) and international outlook (−0.293 *) in which all factors are negatively associated with THE rankings (Table 6). The reason for the 2010 is in relation to the substantial progress in the formation of the NFWCUs in the last eight years. All the variable has negative effects on rankings in 2010 except research. All the variables affecting the ranking explain 45% and 95% variation in the model in 2010 and 2018, respectively.

Table 5. Hybrid list of sustainability and fluctuated universities from 2010 to 2018.

Institution	Ranks	2010	2011	2012	2013	2014	2015	2016	2017	2018
Monash University	ARWU	151–200	151–200	101–150	101–150	101–150	101–150	79	78	91
	QS	61	60	61	69	70	70	67	65	60
	THE	178	178	117	99	91	83	73	74	80
Tsinghua University	ARWU	151–200	151–200	151–200	151–200	101–150	101–150	58	48	45
	QS	54	47	48	48	47	47	25	24	25
	THE	58	58	71	52	50	49	47	35	30
Nanyang Technological University	ARWU	301–400	201–300	201–300	201–300	151–200	151–200	101–150	101–150	96
	QS	74	58	47	41	39	39	13	13	11
	THE	174	174	169	86	76	61	55	54	52
Peking University	ARWU	151–200	201–300	151–200	151–200	101–150	101–150	71	71	57
	QS	47	46	44	46	57	57	41	39	38
	THE	37	37	49	46	45	48	42	29	27
Ecole Normale Supérieure de Paris	ARWU	71	69	73	71	67	72	87	69	64
	QS	33	33	34	28	24	24	23	33	43
	THE	42	42	59	59	65	78	54	66	182
Brown University	ARWU	65	65	65	67	74	75	90	101–150	101–150
	QS	39	39	42	47	52	52	49=	49	53
	THE	55	55	49	51	52	54	51	51	50

Source: Data retrieved on 10–30 September 2018 from THEs (www.timeshighereducation.com/), QS (www.topuniversities.com) and ARWU (www.arwu.org).

Table 6. Regression coefficients for factors affecting THE ranking.

Factors Affecting THE Ranking	Coefficient	SER	Coefficient	SER
	←2010→		←2018→	
Constant	318.6	152.8	262.0	37.86
Teaching	−3.115	3.981	−0.741 *	0.305
Research	2.536	3.139	−0.999 **	0.288
Citations	−1.487	1.815	−0.807 *	0.318
Industry Income	−0.792	1.459	−0.072	0.109
International Outlook	−0.570	0.822	−0.293 *	0.106
R Squared	0.45		0.95	

*, ** Significant at $p \leq 0.05$ & $p \leq 0.001$, respectively, THE = Times Higher Education.

Thus, the results of regression coefficient in ARWU, indicate that among the 6 hypothesized factors affecting ARWU ranking in the last 8 years included in the model, only 2 were found to have significant influence on ARWU ranking in 2018. These include Alumni (−0.845 *) and PUB (−0.922 *), in which all factors are negatively associated with ARWU rankings Table 7. All the variables had negative effects on university rankings in 2010 and 2018. The independent variables account for 83% in 2010 and 96% in 2018 variation in ARWU ranking.

Table 7. Regression coefficients for factors affecting ARWU ranking.

Factors Affecting ARWU Ranking	Coefficient	SER	Coefficient	SER
	←2010→		←2018→	
Constant	596.1	191.4	235.6	29.42
Alumni	−0.382	2.172	−0.845 *	0.289
Award	−3.618	3.172	−0.913	0.417
HiCi	−1.191	1.722	−1.395	0.672
N&S	−3.881	3.678	−1.196	0.622
PUB	−4.551	2.453	−0.922 *	0.34
PCP	−4.599	4.517	−0.631	0.367
R Squared	0.83		0.96	

* Significant at $p \leq 0.05$, HiCi = Researchers cited by Thomson Scientific, N&S = Articles published in the Nature and Sciences, PUB = Articles indexed in the SCI and SSCI, PCP= Faculty average score, ARWU = Academic World of World-University.

The results of regression coefficient in QS ranking, indicate that among the 6 hypothesized factors affecting QS ranking in the last 8 years included in the model, 4 factors were found to have a significant influence on QS ranking in 2018. These includes employer reputation (−0.561 *), student-to-staff ratio (−0.357 ***), citation per faculty (−0.565 **) and international faculty ratio (−0.294 **) as reveals in Table 8. It was also observed that two variables that are academic reputation (−2.535 **) and the student-to-staff ratio (−0.755 **), had negative effects on university rankings in 2010. The independent variables accounted for 95% and 99% in 2010 and 2018, respectively on the variation on QS ranking.

Table 8. Regression coefficients for factors affecting QS ranking.

Factors Affecting QS Ranking	Coefficient	SER	Coefficient	SER
	←2010→		←2018→	
Constant	372.1	50.2	232.4	8.86
Academic reputation	−2.535 **	0.477	−0.609	0.267
Employer reputation	0.195	0.305	−0.561 *	0.199
Student-to-faculty ratio	−0.755 **	0.186	−0.367 ***	0.039
Citations per faculty	−0.625	0.268	−0.565 ***	0.081
International faculty ratio	0.098	0.191	−0.294 **	0.060
International student ratio	−0.330	0.142	0.022	0.080
R Squared	0.95		0.99	

*, **, *** Significant at $p \leq 0.05$, $p \leq 0.01$ & $p \leq 0.01$, respectively, QS = *Quacquarelli Symonds*.

The most current challenge for young universities trying to achieve distinguished global recognition is their internationalization. Based on regression analysis on THE several universities are ranked top in 2018 however their international profile which includes factors such as international students and faculty member is still low compared with top US and UK universities.

5.2. Shared Elements for Sustainability of NFWCUs

5.2.1. Institutional Practices and Sustainability of World-Class Universities

Around the world, there is great interest on the part of governments in the capacity and performance of elite research universities within national higher education and global ranking systems [26]. In some ways, the level of interest and initiatives varies and in many countries the motives vary and the measures are different [42,58]. Some countries (notably England and the United States) have a widespread influence due to well-established elite HEIs and research institutes founded several years ago and recently ranked at the top level. Other countries, such as Germany, China and Japan, are focusing on promoting some of their existing universities to become WCU. Some are motivating and appraising the global status of their leading national institutions, while Vietnam, India and Malaysia are focusing on building and designing new institutions at the highest national level to gain a global reputation. Mostly second-world economies such as Canada, Australia, New Zealand and South Africa are seeking to break out from national policies and frameworks of funding in an effort to rise. Reflecting changes in recent years, some efforts have been implemented by both developed and developing countries.

Governments and institutions throughout the world have significantly implemented various policies, huge projects and substantial initiatives to translate the governance, function, missions and performance improvement of universities for global rankings [48]. The literature holds that to achieve success as WCU, the quality of teaching and research needs to be given room to innovate through faculty, programs, curricula and enrollment. Considering several important trends today, US-based research accounts for two-thirds (65%), while Asian countries account for around 8.5%. Research capacity has successfully strengthened HEIs in countries such as China, Taiwan, India, Korea and Singapore. Oxford and Cambridge Universities in the UK and Harvard University in the US demonstrate a long history of superior performance. For young universities to transform to WCU may take a decade if most focus on excellence in teaching, research, publications and internationalization. By contrast, the size of

the institution can affect its practices, as most of the early formed WCU are large (≥12,000 students) to extra-large (>30,000 students) in size. It has been reported that the lack of a comparative level of investment and positive initiatives poses a severe threat to institutional practices. Considering Martin Trow's theory on the development stages of higher education, the gross enrollment ratio (GER) is <15% for elite education, 15–50% for mass education and >50% for universal education. The NFWCUs ushered in an era of mass education, as the number of students increased, hence the GER is more than 26.5%. Singapore NFWCUs stand out as an example of a country's that uses internationalization strategy to drive its higher education sector. Thus, by embedding it into core institution missions, expanding participations and align curriculum and institution in order to attract highly talented faculty and students, produce globally impactful research and increase global competitiveness.

5.2.2. World-Class Universities and Government Initiatives

In the ongoing development of newly formed world-class universities (NFWCUs) in most of the desirable countries around the world, as competition for status, several initiatives are implemented to enhance and pursue academic excellence and promote national development. One such effort is huge budgetary allocation of government funding, often in the form of HEI loans and scholarships, projects, mechanisms and reforms [28]. Further, against the background of global competition in science and technology, the pace for governments to develop world-class universities is accelerating. Similarly, world-class universities have undergone fast expansion of development. Governments have supported this growth by introducing reforms in HEIs, such as in governance, taking examples from developed countries such as China. In 2015, the Chinese government released the Developing World-Class Universities and First-Class Disciplines project, known as World-Class 2.0. In 2017, the Ministry of Education announced a list of colleges and universities that replaced Projects 211 and 985, aiming to become a global higher education center.

The literature holds that during the past two decades, previous projects created significant research capacity and contributed to improvements of universities in global ranking systems. With much success, China reached 136 schools in the top 1250 of the US News 2018 rankings, second only to the US, with 221 schools. China currently is also second to the US in some papers and citations in science, although governance and new initiatives are more pragmatic. With the new strategy, the initiatives put great emphasis on top-notch talent education. In short, some studies have found that several countries continue to open up their educational opportunities to other parts of the world.

Recently, some measures have been implemented to improve the quality of NFWCUs. In this context, European and Asian countries has made substantial excellence initiatives and investments in the quality of its higher education institutions. Recently, the Chinese government launched the Belt and Road (B&R) initiatives, which focus on international trade among 65 countries spanned by a common road. The statistics indicate that the B&R project contributes significantly to an increase in the number of international students in the seven countries along the B&R route. Statistics show that in 2003 to 2004, about 25,000 students from B&R counties studied in China. At the end of 2016, the number increased to 200,000, with an average of 22.0% increase per year from 2003 to 2014 from seven top countries: Kazakhstan, Indonesia, Russia, India, Pakistan, Vietnam and Thailand.

Public universities dominate a wide range of performance in the global ranking systems. The federal government in the US has become more comprehensive in a wide range of research and international recognition toward achieving world-class status. Government initiatives and substantial funding affect some of the rankings in American universities and fluctuate compared with those with high-quality support for research, teaching and educational services. Washington University in St. Louis, Missouri, has shown unstable performance, as indicated in Figure 3. The ranking has reshaped the practices of US universities and competition for positions in the ranking has intensified along with competition for resources, especially in the decentralized US system.
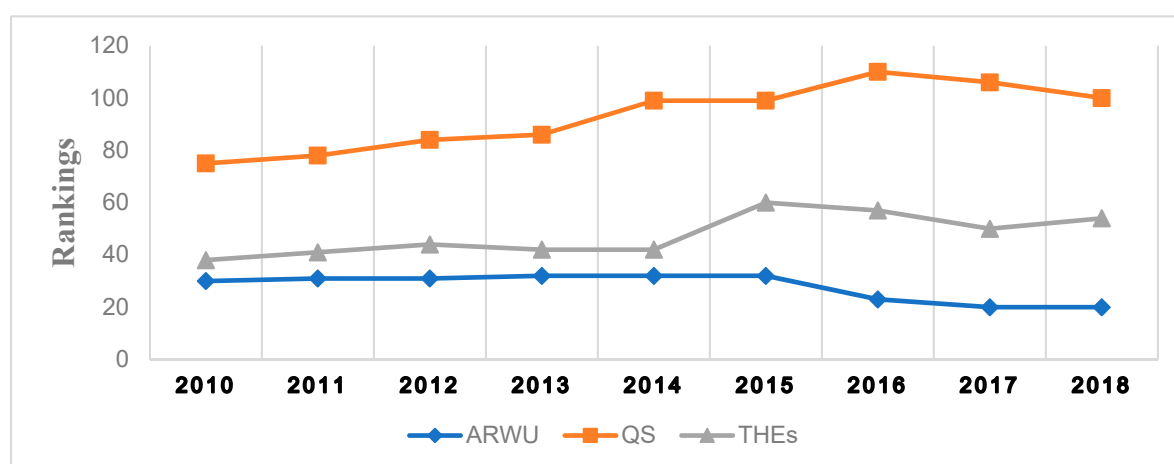
Figure 3. Rankings of Washington University in St. Louis from 2010 to 2018. Source: Data retrieved on 10–30 September 2018 from THEs (www.timeshighereducation.com/), QS (www.topuniversities.com) and ARWU (www.arwu.org).

The results of variation and disparities of university rankings from 2010 to 2018 where by Singapore, China and Belgium have shown a sharp increase and most progress in numbers of NFWCUs in the global list of leading universities as presented in (Table 9). Singapore, China and Belgium stand out as the most improved countries. The main losers are the USA, UK and France with significantly declining in numbers. In ARWU ranking USA and France, lost 7 and 3 universities while compared to QS ranking UK lose 3 and France 2. In the same case, UK and France dropped in THEWUR by 10 and 3 universities respectively. To large extent, it is inevitable that the progress in some countries forces the exit of universities from other countries. It appears that Switzerland, Australia and Germany sustained NFWCUs with high level of funding and excellence initiative.

Table 9. Sustainability per country and evolution in ranking systems between 2010 and 2018.

		2010			2018			Marginal Changes		
S/N	COUNTRY	ARWU	QS	THE	ARWU	QS	THE	ARWU	QS	THE
1	USA	53	31	53	46	31	43	−7	0	-10
2	UK	10	19	14	8	16	12	−2	−3	−2
3	Switzerland	4	3	4	5	4	3	+1	+1	−1
4	Canada	4	4	4	4	4	4	0	0	0
5	Japan	5	6	2	3	5	2	−2	−1	0
6	Australia	4	8	5	6	7	6	+2	−1	+1
7	France	3	2	3	0	0	0	−3	−2	−3
8	Germany	6	4	3	4	4	10	−2	0	+7
9	Singapore	0	0	0	2	2	2	+2	+2	+2
10	China	0	0	0	3	6	2	+3	+6	+2
11	Belgium	0	0	0	2	1	1	+2	+1	+1

THEs (www.timeshighereducation.com/), QS (www.topuniversities.com) and ARWU (www.arwu.org).

5.2.3. Sustainable and Catching-Up Countries

In response to US universities, the success factor for global competition is differentiating the mission between universities. The variety of catching-up countries include Germany, France and Japan. These countries are likely to have disparities in global university rankings (as illustrated in Figure 4) because of the languages they use. In the Japan case, half of the drop is linked to financial crisis and which have prevented additional funding expected for making significant progress on the internationalisation activities [26].
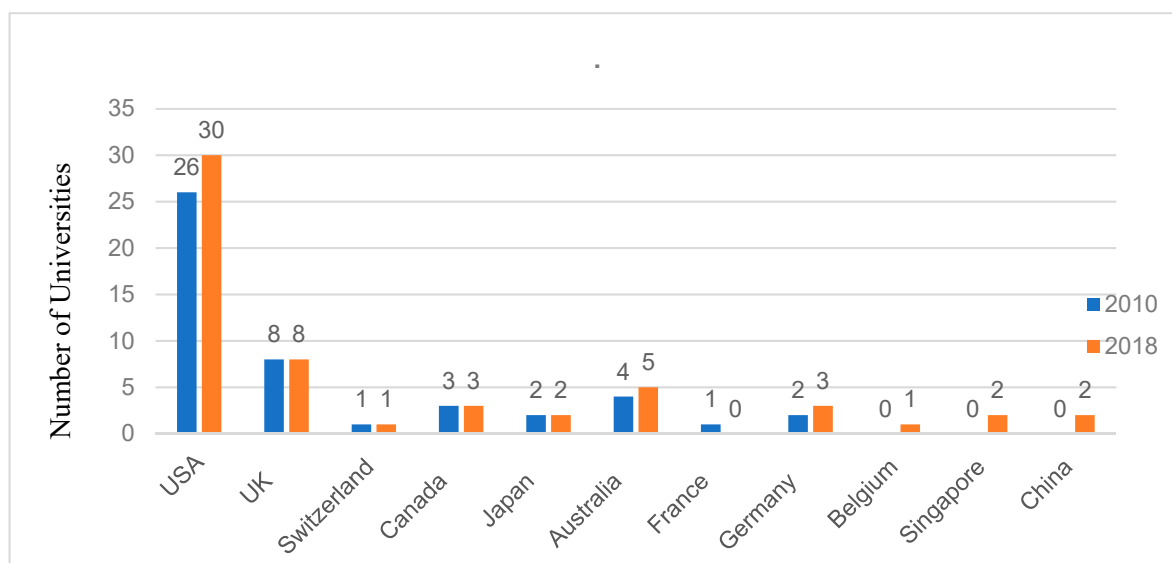
Figure 4. The variation and total number of Newly Formed World Class Universities (NFWCUs) from 2010 to 2018.

Compared with US and UK publications, most of the research published in languages other than English are not counted in the ranking system. Indeed, the French university system differs from the German education system. France has a well-developed research and technology base in their grandes ecoles. French universities are mostly teaching-focused and therefore different from German universities, which combine research and teaching. The majority of its students are recruited directly from French preparatory schools. There is a strong division of labor between universities and grandes ecoles and between research institutes and the higher education sector. Germany adheres to the philosophy and historical idea that all universities and research universities are equal, which mostly emphasizes global competition. Hence, with excellence initiatives, the government abolished a similar university philosophy.

Currently, the Ecole Normale Supérieure is doing better in ranking because France has a long-established system and the government has attempted to merge teaching-focused universities with research institutes. This has shown strong achievement and high status of French universities in global ranking systems.

Japanese university practices and initiatives for NFWCUs and the capacity of their universities feature a wide range of positive outcomes. Although Asian universities are latecomers in the quest for WCU, global ranking demonstrates how fast they are catching up. According to THE, nine of the top 10 universities in Asia ranked among the top 100 universities in the world. THE has a slightly wider range of countries, showing that four of them were among the top 50 in the world. Based on rapid changes, Japan established its WCU status during the 1990s with Research University 11 (RU11). In August 2011, RU11 launched its mission of getting Japan's research universities ready to face fierce global competition. The government and universities in Japan have made efforts such as the Global 30 Project, a new grand design of the higher education system in which universities collaborate with each other as the official policy of fostering WCU in the first decade of the 21st century. To pursue the goal of being comprehensive and maintaining the breadth of capabilities, universities have engaged in dynamic resources and revitalizing partnerships.

5.2.4. Change in System in All Rankings

Table 6 indicates the variations and disparities of countries and university rankings from 2010 and 2018. The results show changes in a system wherein several universities replaced elite universities in ranking. The successful universities are in countries such as China, Singapore and Belgium. Over the

past eight years, these countries have stimulated their domestic universities to achieve world-class status. The findings show that to date, most universities in Asia are increasingly experiencing immense pressure to compete internationally. The growing interest in the sustainability of universities in the global league has become the norm. Tables 4 and 9 also shows further details of the system change in 2010 and 2018. As revealed by the three international ranking systems, the US and the UK showed falling rankings by ARWU (7) and THE (10) and ARWU (2), QS (3) and THE (2), respectively. Similarly, France fell in both rankings and Germany showed a relatively advantageous position in THE (7). China, Singapore and Belgium had leading status and demonstrated a fast increase in the emergence in a change of system and global ranking exercises. This also serves as evidence that there have been several improvements in global ranking and many NFWCUs are likely to improve further. In Singapore, two universities scored slightly better. This reveals that they are yet to be among the top 100 world-class universities. The NTU and NUS presents a model and marked the beginning of new chapter as Singapore's global universities.

6. Discussion of the Findings

Considering the determinants of success and achievements for NFWCUs in the last eight years, the following are scientifically based frameworks for sustainability and potential complementary critical indicators leading to universities being among the top 100 global rankings by the three selected systems, ARWU, QS and THE.

Comprehensive and high concentration of talent. In an attempt to propose manageable lessons learned from the results of top NFWCUs from 2010 to 2018, it is found that the dominant feature of all leading universities ranked at the top is the essential attribute of faculty and students (Tables 6–8). The superior results of NFWCUs and changes in a number of countries are highly sought by graduates, leading-edge research and technology transfer. It is widely acknowledged that NFWCUs are distinguished by the presence of outstanding faculty, a critical mass of academically qualified students and the most researchers and qualified professors. The concentration of talent is the key outlook and sustainability indicator for NFWCUs.

It is clear that the foremost determinant of excellence in top-ranked universities is the presence of a critical mass of top students and outstanding faculty Table 8. Top-ranked universities can select and attract the most qualified students, professors and researchers not only from their own country but also internationally. Indeed, it must be pointed out that the concentration of talent is the essential factor that represents the ability and privilege of NFWCUs to select the best students and staff. Principally, this can be observed at elite universities such as Harvard University and the Massachusetts Institute of Technology (MIT), which are among the most selective universities in the US and Tsinghua University, China's top institution, which admits the 50 best students from each province every year. Faculty quality is considered as one of the most important components in defining academic excellence and has an enormous impact on the quality of the program offered. Ascertaining this important condition is extremely important and a good example can be seen in the champions of NFWCUs such as the National University of Singapore (NUS) and Tsinghua University. According to Salmi Jamil, the proportion of international students at Stanford University is 21% and at Harvard University is 19%, hence the proportion of international faculty and sizable foreign academic staff. The proportion of international academic staff at Cambridge University is approximately 36%.

Indeed, this factor has always been seen in both early formed and NFWCUs such as Oxford University in the UK, Tsinghua University in China and the National University of Singapore. For instance, in the United States, the most selective universities, such as Yale University, measure SAT scores in their recruitment of undergraduate students. As shown in (Table 8), enrollment at Stanford University (US) was 17,354; University of Cambridge (UK), 18,977; KU Leuven (Belgium), 56,351; University of Tokyo (Japan), 28,253; and Tsinghua University (China) 47,762. The huge enrollment size is undoubtedly a major factor in the growth rate gap in the top global ranking. At Stanford and Cambridge Universities, overall enrollment is fewer than 30,000 students. In line with global rankings

and their desire for a good reputation, NFWCUs are also favored by the strong international dimension of foreign academic staff and students.

Sound financial return base and resources. The lesson learned from the National University of Singapore (NUS) is the university's success in the top ranking of NFWCUs for 2018 in response to substantial endowment funding. Comparing to elite universities such as Oxford and Cambridge, NUS has a steady source of financing through substantial fundraising. Also, the NFWCUs of Singapore managed to use about 775 million to build up an effective, sizeable portfolio. Comparatively, the US has always managed to cover the top 100 world-class universities in all rankings due to large endowments of about $40,000 every year.

Research-based rankings. Rankings of NFWCUs are also based on government research funding. Therefore, the level of expenditure in one way affects the rankings and respective catch-up countries. Universities in the UK and Switzerland are the best competitors with the highest variations due to abundant resources and good funding.

As illustrated in (Table 5), despite being ranked by all three systems in 2010, the Ecole Normale Supérieure dropped from the ranking despite France's status of having the strongest economy in the world. This is in line with German universities, few of which are placed in the top 100, despite its strong economy in the world.

The discussion and the lesson learned regarding Figure 4 is that China and Singapore have shown the most improvement in the ranking system in the last eight years (2010–2018). Considering the NFWCUs of 2018, Tsinghua, National University of Singapore, Monash University and Rice University showed relative progress toward being among the family of world-class universities for a short time compared to previous rankings. When evaluating against changes in scores in both top 100 university rankings, the following discussion offers a perspective for the variation among countries.

Inducing excellence-initiatives: Following the same ideology in constructing world-class universities and enhancing global sustainability and competitiveness, China has been undertaking programs such as the 211 Project and 985 Scheme, which were carried out earlier, compared to other countries such as India. The objectives were measurable and the construction results were obvious. As far as the advantages of cooperation and innovation are concerned, China still has an opportunity to catch up with the UK and the US. The following sustainable strategies for globalization should be used to retain its leading position in the world: modernize the higher education system, attract active research faculty, encourage dissemination of research output, nurture competitive graduate departments and research groups by inviting capable research scholars to join them and integrate resources with full advantages for efficient implementation [39,40]. Thus, Peking University and Tsinghua University are demonstrating better global rankings because they started internationalization earlier than other Asian universities [39]. World-Class 2.0 was released in 2015 with a target goal of developing a number of world-class universities and first-class disciplines by 2020, as well as having higher education and disciplines among the best in the world by 2030 and leading in the number and capacity of WCU and disciplines among the world's best, hence becoming a higher-education powerhouse by 2050. Tsinghua University aims to be a WCU by 2020 and one of the world's best universities by 2050, with greater precision as part of the Chinese dream.

Developing global students: Meanwhile, in China since the 1990s, the mass movement of overseas students from many developed countries has increased, driven by both financial and marketing efforts in countries such as US, UK, Canada and Australia [59]. Internationalization of higher education enables students to exchange and flow in all directions, not only from west to east but from less developed to more developed countries. China is now hosting 7% of the 3.3 million international students worldwide, just behind the US, the UK and France [4,60]. In previous years, the data show that China was the leading nation for sending students to study abroad in those developed countries and the top ranked universities. According to 2017 statistics, China has become the nation that is attracting and receiving more international students from different countries of the world [61–63]. As of the end of 2017, China was the most popular destination for international students in Asia.

Ultimately, nearly two-thirds of all foreign students in the country (65%) come from markets targeted by China's One Belt, One Road initiative. The literature shows that the top 10 source countries were South Korea, Thailand, Pakistan, US, India, Russia, Japan, Indonesia, Kazakhstan and Laos.

China currently has a significant number of international students seeking a degree, increasing from 184,799 to 209,966 in 2016, while those seeking PhDs increased from 14,367 to 18,051 (www.csis.org). *Programming, curriculum and environment:* The Singaporean government has strategically identified the leading global universities and invited them to set up branch campuses in the city-state, actively promoting collaborations between world-renowned academics and local scholars [64]. According to the policy target, the ministry was well placed to gain an estimated $2.2 trillion of the world education market. Indeed, the Singaporean government has been successful in convincing world-renowned institutions to establish overseas campuses or offer programs in collaboration with local institutions, thus helping Singapore's universities become globally competitive [61,65,66]. At the same time, the sustainability of the highly ranked top university in Asian countries was based primarily on broader goals, including:

- *Governance and organizational structure*
- *Curriculum and teaching*
- *Learning resources and environment*
- *Learner support services*
- *Professional staff development*
- *Capacity and human resources management*
- *Organizational culture and values*

Identifying these critical factors is associated with the sustainability of higher education institutions. According to Shin [67], in their effort to develop NFWCUs, policy makers and institutional leaders pay attention to research productivity, research funding and international faculty and students but other factors such as international alliance, language, geographic location, international climate on campus and economic development are also important for building WCUs.

Experience from Singapore's Newly Formed World-Class Universities

Building NFWCUs is a national strategy implemented and guided by top policy makers. As early as the 1990s, the Singaporean government was proposing the idea of building a world-class university from its elite universities. In its overall development of higher education, Singapore has had a remarkable achievement in the goal of being among the top research universities. This is particularly true when analyzing the milestone at two of the country's oldest universities, the National University of Singapore (NUS; 1905) and Nanyang Technological University (NTU; 1981). In term of rankings, Table 4 demonstrates that NUS moved up from 101 to 150 on the ARWU, 31st on the QS and 34th on THE in 2009–2010 and to 85th on the ARWU, 15th on the QS and 22nd on THE in 2017–2018, very impressive gains among the top 100 in all three ranking systems. The NUS is free to bring top researchers, including foreign faculty. This involves professors from all over the world, who are paid based on the global market and provided with performance incentives to stimulate competition.

Comprehensive internationalization: The NTU and NUS successes are reflective of Singapore's broader agenda of building Singapore as and education and knowledge hub "global war of talent". Thus, being primarily rely on core institution missions, programs, curriculum, and the large number of international faculty and students. NUS is around 60% foreign faculty, while NTU is around 70%.The overall QS data reveal that NTU and NUS have high faculty/student scores at 95% and 91.8%, respectively and are more advanced in international faculty (www.topuniversities.com).

According to studies by many researchers [66], global ranking is arbitrary depending upon which criteria are applied. However, [67] showed how much ranking could change by applying different measures such as the collaboration index, the total or per capita measure of publications and citations. As many academics have said, a world-class university is recognized by global ranking. The best

conceptual approach to define WCU is to identify the characteristics of the newly formed WCU. Global university ranking systems are currently a measure of world-class universities and there are many theoretical and methodological issues involved in the ranking process [66].

In this context [11,68,69], there are four models for NFWCUs: (1) Upgrade the institution's existing strategic alternative. Several studies found that China has followed this since the early 1980s. Upgrading existing strategies is less expensive but it is a challenge to reform and transform. (2) Merge institutions' existing strategic alternatives. Several studies found that advanced mergers among institutions could be applied to transform a university into a world-class one. These studies found that France, Denmark and China adopted this strategic alternative recently [70,71].

In France, at institutions such as grandes ecoles, the government is investigating the possibility of merging as a regional foundation. It was found in Reference [72] that the Danish government has encouraged setting up world-class universities through grants and innovation funds. In China, some mergers have taken place; for example, Beijing Medical University was combined with Beijing University in 2000 and Zhejiang University was the outcome of merging five different universities. (3) Create new institution strategic alternatives. In Reference [73], it was found that it is most costly to create WCU from scratch. This strategy can be done faster and more successfully than upgrading [42]. (4) Use collaborative strategic alternatives. In Reference [27], a mixed option of upgrading and merging existing universities was noted. This can be done at both the national and international level at the same time. This measurable strategy has recently been implemented in India and Japan.

Given the increased importance of science-based innovation in new technologies, university–private sector partnerships are expected to assume a prominent economic role in national development, as they did in Singapore. Centering on NUS, Singapore established the national science and technology system, made up of diverse public–private research networks, which has contributed to a shift toward a knowledge-based economy. Currently, NUS accounts for about 52% of scientific publications in Singapore and contributes 50% to 70% of the total research and development output.

Going beyond ranking systems, there are many opportunities and connections for the future. Considering the increased interest in global rankings, young learners gain an opportunity to think deeply and work collaboratively across cultural boundaries and differences. With the distinctive roles and missions of world-class universities, young learners are encouraged to take advantage and reassess the value of education. Hence, it is important to find pathways to become globally competitive and adopt local challenges to address employability, social mobility and a high-quality graduate environment. Apart from ranking, looking at the status of any university demonstrates the importance of adding learning opportunities, providing new insights to deepen the collective understanding of the dynamic world of global higher education and research.

7. Conclusions and Sustainable Policy Implications

This study employed an understanding of sustainability indicators of NFWCUs from 2010 to 2018. This section offers our conclusion of the findings.

Given the recent literature, sustainability for NFWCUs has recently dominated public discourse, mainly regarding their catching up and development. This study investigated the variations and contributions of NFWCUs among countries. It should be noted that NFWCUs represent a concept that manifests in university strength, performance and standards. Global ranking systems are necessary indicators for measuring strengths, sustainability and standards. The study considers the universities included in the top 100 from 2010 to 2018 in three rankings of different methodologies and characteristics. To understand the status and variation among countries, integrating the three rankings helps to minimize the impact of the methodology used, sustainable changes and position gain over time. On the basis of top-ranked world-class universities, it should be recognized that in the last eight years since the THE and QS split into two independent programs, the commonly ranked top 100 universities in 2018 by ARWU, QS and THE were denoted by the top 57, compared with 2010, which was 47 universities. The paper synthesizes the difference between 2010 and 2018, showing that

44 universities maintained their position in all ranking systems among the top 100 without deviation and weight discrepancies and decline of ranking.

Three lower-ranked NFWCUs in the hybrid list of 2010 did not appear in the top 100 universities in 2018, which are covered by some catch-up universities. The Ecole Normale Supérieure, Brown University and the University of Minnesota dropped out of the NFWCU list in 2018, as their rankings fell from the top 100 in THE and ARWU.On the basis of the result of analysis, even though all the three ranking systems have different hypothesized factors, all the variables affecting rankings variations is more observed for 2018 study period.

Likewise, due to outstanding progress made by Tsinghua University, Nanyang Technological University and Peking University, the rankings of these NFWCUs have shown a tremendous sharp increase and homogeneity. These three universities indicate that variations in NFWCUs still have a long way to go to catch up with other world-class universities. A direct implication of the regression analysis also serves as a reminder that to achieve a standard of academic excellence, a university has a chance to become world-class if it continues to increase the quality and significance of research and is highly internationalized with a wide range of subject coverage. Further analysis suggested that in the future, elite universities can lose their ranking if they have no high-level, creative, talent turning out high-quality original research results and making scientific and technological progress.

This study brings the following variable results and conclusions. By systematic comparison, the US and UK dominated the variation of NFWCUs in 2010 and 2018 consecutively.

Climbing up the hierarchy of NFWCUs and since the start of global ranking more than a half-decade ago, elite universities have consistently ranked in the top 100 in all three ranking systems. Monash University represents a particular case and Tsinghua University, National University of Singapore and Peking University have shown overall improvement in their global reputation. Indeed, elements for success at those universities include a regulatory framework governing public universities, structural policies and flexible pathways that enable fluidity of student movements and structural decisions and exceptional innovations such as ongoing government excellence initiatives in Asia and Europe.

Moreover, a more analytical perspective in NFWCUs is that Harvard, Oxford and Cambridge Universities continue to battle year by year for their positions in the ranking systems and these are highly internationalized, comprehensive universities with a wide range of subject coverage. Although most NFWCUs are large in size, academic research quality is a very important element of success. Also, except for private universities, most NFWCUs are relatively large, with an average number of students ranging from 22,000 to 35,000 and correlated faculty ranging from 2400 to 3500. Likewise, most NFWCUs have sufficient technical and administrative personnel to support teaching and research as a critical path to bring the institution to international prominence. Despite the strong constraints of NFWCUs, what distinguishes the top 100 universities in the last eight years from the rest is the enormous amount of available funding. Although some of the top 100 universities are hundreds of years old, they have a concentration of talented academics and students, significant budgets and strategic visions, which are effective approaches to achieve high ranking.

The results are relevant for the strategic planning of universities to improve their reputation. Following empirical data and literature reviews, this paper theorizes that there is a need for this type of study to be undertaken in order to inform society on the gaps in ranking and for NFWCUs to catch up across wide global variation. This involves excellence initiatives, WCU projects, government funding, reforms, policies and strategies to find the correct measurable approaches and key factors to upgrade and transform HEIs into WCU. This study could serve to stimulate new plans and actions toward striving for adequate provision of WCU development. The data could potentially bring forward evidence on institutional practices and sustainable approaches that work well in transforming to WCU status.

Ultimately, for many years, universities in the United States and Europe have been the dominant and best of the WCU, particularly NFWCUs in 2010 and 2018. Despite the remarkable rankings

of US and UK, China and Singapore appear to have demonstrated their advantageous positions in the NFWCUs rankings. In the academic year 2017–2018, two universities in China and Singapore were ranked in the ARWU, QS and THEs. The study brings to light the increasing emphasis on the effectiveness and efficiency of government-supported research for more approaches to internationalized initiatives. Hence university expansion is one of the excellent approaches to improve performance in the global ranking systems.

In terms of future implications, our study has endeavored to identify some general patterns in performance among the arguably more research-oriented universities based on the criteria used by ARWU, QS and THE. To improve NFWCUs interpretation factors, it might be better to judge global competitive order and shared indicators of global top best universities by integration of dominant rankings methodology. However, it is debatable whether US and UK universities dominate all global ranking systems. A closer analysis shows that US universities vary and, in some instances, have lost status in the middle and lower end of the ranking systems over recent years and have been replaced by universities from catching-up countries. Our analysis draws attention to how university rankings have generated global variation and sustainability of institutional reputation and the relationship between status and the emerging proliferation of ranking systems. Our paper offers critical contributions to the current literature on success strategies for NFWCUs and their implications for future universities and their quality, not only to create a landscape of new possibilities for reputation but also to reshape sustainability and institutional behavior in the pursuit of enhanced performance. Therefore, considering the sustainability indicators of NFWCUs, many universities benefit from these rankings as an indication of superior output, thus educational and research progress. Universities need to increase their knowledge generation and knowledge transfer and enlarge their focus on research. Providing a more international learning environment, exchange students and researchers with other leading universities in the world and internationalization of NFWCUs policy ant national and university level. In many instances, rankings help to maintain and build institutional position and reputation; rankings are used by students to shortlist their university choices and by universities, stakeholders and policy makers for direct decision-making in higher education, supporting the predominant and leading disciplines and increasing and improving the number and level of foreign teachers, students and international cooperation.

Finally, although the quest for sustainability of NFWCUs remains a challenge around the world, Singaporean and Chinese universities should be applauded for their efforts. Along with various reforms and improvements, in mainland China and Singapore the governments have concentrated their resources on helping their universities become global competitors. Moreover, the Chinese government has focused its grants on a limited number of universities to transform the country's elite universities into world-class universities. In particular, according to policy targets, the Singaporean government has set up campuses for leading universities and has actively promoted active collaboration between world-renowned and local scholars to establish overseas campuses. The empirical results confirm that elite universities are continually leading competitors due to their distinguishing factors: a comprehensive internationalization strategies and activities which driven by; a stable concentration of talented academics and students, a significant budget, research productivity, global and national partnerships and outstanding educational programs. We therefore suggest that it is necessary to take effective major action for NFWCUs in higher education such as maintaining the stability of investments and research productivity, clear mechanism for adjusting the allocation of funds among universities and implementing related strategic initiatives to enhance their international reputation to cope with leading global universities in the future.

ARWU, QS and THE, formal analysis, and discussed the final results, and all the authors have read, discussed and approved the final version of the manuscript.

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References

1. Forster, N. Why are there so few world-class universities in the Middle East and North Africa? *J. Furth. Higher Educ.* **2018**, *42*, 1025–1039. [CrossRef]

2. Altbach, P.G.; Balan, G. *Transforming Research Universities in Asia and Latin America World Class Worldwide*; Johns Hopkins University Press: Baltimore, MD, USA, 2007; Available online: http://muse.jhu.edu/journals/tam/summary/v065/65.3.covert.html (accessed on 15 January 2019).

3. Bing-Lin, G.U. Focus issues in building the world-class university. *Tsinghuajeduc* **2007**, *1*. Available online: http://en.cnki.com.cn/Article_en/CJFDTOTAL-QHDJ200701002.htm (accessed on 17 December 2018).

4. Altbach, P.G. The past, present and future of the research university. *Econ. Polit.* **2011**, *46*, 65–73.

5. Altbach, P.G.; Salmi, J. (Eds.) *The Road to Academic Excellence: The Making of World Class Research Universities*; The World Bank: Washington, DC, USA, 2011; pp. 11–32.

6. Salmi, J. *Global Rankings and the Geopolitics of Higher Education: Understanding the Influence and Impact of Rankings on Higher Education, Policy and Society*; Taylor & Francis: Abingdon, UK, 2016; pp. 216–243.

7. Pizarro Milian, R.; Rizk, J. Do university rankings matter? A qualitative exploration of institutional selection at three southern Ontario universities. *J. Furth. High. Educ.* **2018**, *42*, 1143–1155. [CrossRef]

8. Li, J.; Li, J. *Quest for World-Class Teacher Education?* Springer: Berlin, Germany, 2016. [CrossRef]

9. Kim, D.; Song, Q.; Liu, J.; Liu, Q.; Grimm, A. Building world class universities in China: Exploring faculty's perceptions, interpretations of and struggles with global forces in higher education. *Comp. J. Comp. Int. Educ.* **2018**, *48*, 92–109. [CrossRef]

10. Liu, N.C.; Wang, Q.; Cheng, Y. *Paths to a World-Class University*; Sense Publishers: Leiden, The Netherlands, 2011; pp. 10–14.

11. Salmi, J. Excellence strategies and the creation of world-class universities. In *Matching Visibility and Performance*; Springer: Berlin, Germany, 2016; pp. 15–48. Available online: https://doi.org/10.1007/978-94-6300-773-3_2 (accessed on 17 September 2018).

12. Soh, K. Nearing world-class: Singapore's two universities in QSWUR 2015/16. *J. High. Educ. Policy Manag.* **2016**, *38*, 78–87. [CrossRef]

13. Luque-Martínez, T.; Faraoni, N. Meta-ranking to position world universities. *Stud. High. Educ.* **2019**, 1–15. [CrossRef]

14. Cheng, Y.; Wang, Q.; Liu, N.C. How world-class universities affect global higher education. In *How World-Class Universities Affect Global Higher Education*; SensePublishers: Rotterdam, The Netherlands, 2014; pp. 1–10. Available online: https://link.springer.com/chapter/10.1007/978-94-6209-821-3_1 (accessed on 17 September 2018).

15. Jang, D.H.; Ryu, K.; Yi, P.; Craig, D.A. The hurdles to being world class: Narrative analysis of the world-class university project in korea. *High. Educ. Policy* **2016**, *29*, 234–253. Available online: https://link.springer.com/article/10.1057/hep.2015.23 (accessed on 20 August 2018). [CrossRef]

16. Hazelkorn, E. *Rankings and the Reshaping of Higher Education: The Battle for World-Class Excellence*; Springer: Berlin, Germany, 2015; Available online: https://books.google.com/books?hl=en&lr=&id=rMW_BwAAQBAJ&oi=fnd&pg=PP1&dq=Rankings+and+the+Reshaping+of+Higher+Education:+The+Battle+for+World-Class+Excellence%3B+S&ots=6nPS9S4YMj&sig=cbmViT6L_pAkpSKxBV_OWP8a_o4#v=onepage&q=Rankings%20and%20the%20Reshaping%20of%20Higher%20Education%3A%20The%20Battle%20for%20World-Class%20Excellence%3B%20S&f=false (accessed on 2 January 2019). [CrossRef]

17. Tilak, J.B. Global rankings, world-class universities and dilemma in higher education policy in India. *High. Educ. Future* **2016**, *3*, 126–143. [CrossRef]

18. Zhang, Y.; Zhang, Q.; Qizhen, D.U. World university rankings index system comparison and its enlightenments for building the world-class universities and the world-class disciplines of China. *J. China Univ. Pet.* **2017**. Available online: http://www.en.cnki.com.cn/Article_en/CJFDTOTAL-SYSK201702016.htm (accessed on 17 December 2018).

19. Hazelkorn, E. Reshaping the world order of higher education: The role and impact of rankings on national and global systems. *Policy Rev. High. Educ.* **2018**, *2*, 4–31. Available online: https://doi.org/10.1080/23322969.2018.1424562 (accessed on 20 January 2019). [CrossRef]

20. Yuan, B.T.; Pan, Y.L. Internationalization and the construction of world class universities:A case study of Tsinghua University. *J. High. Educ.* **2009**. Available online: http://en.cnki.com.cn/Article_en/CJFDTOTAL-HIGH200909006.htm (accessed on 10 November 2018).

21. Liu, L.L. Optimization of university teaching faculty and relevant measures—Based on an analysis of world-class universities' experience. *J. Southeast Univ.* **2010**, *6*, 15–24. Available online: http://www.en.cnki.com.cn/Article_en/CJFDTOTAL-DNDS201006028.htm (accessed on 20 April 2019).

22. Douglass, J.A. *The New Flagship University Changing the Paradigm from Global Ranking to National Relevancy*; Springer: Berlin, Germany, 2016.

23. Danson, M.; Halkier, H.; Cameron, G. *Governance, Institutional Change and Regional Development*; Routledge: London, UK, 2018.

24. Salmi, J. Directions in Development—Human Development. In *The Challenge of Establishing World Class Universities*; The World Bank: Washington, DC, USA, 2009; p. 115.

25. Ahmed, H.O.K. Strategic approach for developing world-class universities in Egypt. *J. Educ. Pract.* **2015**, *6*, 125–145.

26. Salmi, J. Excellence initiatives to create world-class universities: Do they work? *High. Educ. Eval. Dev.* **2016**, *10*, 1–29. Available online: http://www.heeact.edu.tw/public/Attachment/73218241446.pdf (accessed on 17 October 2018).

27. Salmi, J. *The Challenge of Establishing World Class Universities*; The World Bank: Washington, DC, USA, 2009.

28. Cui, Y. Times higher education "World university rankings 2010–2011": A new world-class Universities evaluation system. *High. Educ. Eval. Dev.* **2011**. Available online: http://en.cnki.com.cn/Article_en/CJFDTotal-JTGY201103004.htm (accessed on 17 October 2018).

29. Liu, L.; Liu, Z. The variation of universally acknowledged world-class universities (UAWCUs) between 2010 and 2015: An empirical study by the ranks of THEs, QS and ARWU. *High. Educ. Stud.* **2016**, *6*, 54–69. [CrossRef]

30. Liu, X. How government policy is implemented in the private university: A case study from china. *Front. Educ. China* **2018**, *13*, 426–447. Available online: https://doi.org/10.1007/s11516-018-0020-2 (accessed on 2 January 2019). [CrossRef]

31. Sheil, T. Moving beyond university rankings: Developing a world class university system in Australia. *Aust. Univ. Rev.* **2010**, *52*, 69.

32. Liu, Y. On the path choice of building double world-class university in China. *Mod. Educ. Sci.* **2016**. Available online: http://www.en.cnki.com.cn/Article_en/CJFDTOTAL-JLJK201610001.htm (accessed on 2 January 2019).

33. Taylor, P.; Braddock, R. International university ranking systems and the idea of university excellence. *J. High. Educ. Policy Manag.* **2007**, *29*, 245–260. [CrossRef]

34. Wang, Q.; Cheng, Y.; Liu, N.C. *Building World-Class Universities*; Springer: Berlin, Germany, 2013; pp. 1–10.

35. Yang, X.; You, Y. How the world-class university project affects scientific productivity? Evidence from a survey of faculty members in China. *High. Educ.Policy* **2017**, *4*, 1–23. [CrossRef]

36. Kauppi, N. The global ranking game: narrowing academic excellence through numerical objectification. *Stud. Higher Educ.* **2018**, *43*, 1750–1762. [CrossRef]

37. Li, M.; Shankar, S.; Tang, K.K. Catching up with Harvard: Results from regression analysis of world universities league tables. *Camb. J. Educ.* **2011**, *41*, 121–137. [CrossRef]

38. Soh, K. The seven deadly sins of world university ranking: A summary from several papers. *J. High. Educ. Policy Manag.* **2017**, *39*, 104–115. [CrossRef]

39. Hazelkorn, E. World-class universities or world class systems: Rankings and higher education policy choices. In *Rankings and Accountability in Higher Education: Uses and Misuses*; UNESCO: Paris, France, 2013.

40. Liu, C.B. *Speeding up the Pace of Constructing World-class University from the National Strategic View. Research on Education*; Tsinghua University: Beijing, China, 2005.

41. Shin, J.C. *The World-Class University: Concept and Policy Initiatives*; Springer: Berlin/Heidelberg, Germany, 2013; Available online: https://doi.org/10.1007/978-94-007-4975-7_2 (accessed on 10 September 2018).

42. Wang, Y. Comprehensive internationalization and world-class university. *Int. Comp. Educ.* **2018**, *7*. Available online: http://en.cnki.com.cn/Article_en/CJFDTotal-BJJY201807001.htm (accessed on 2 January 2019).

43. Xavier, C.A.; Alsagoff, L. Constructing "world-class" as "global": a case study of the National University of Singapore. *Educ. Res. Policy Pract.* **2013**, *12*, 225–238. [CrossRef]

44. Rhoads, R.A.; Li, S.; Ilano, L. The Global Quest to Build World-Class Universities: Toward a Social Justice Agenda. *New Dir. High. Educ.* **2014**, *2014*, 27–39. [CrossRef]

45. Mok, K.H.; Hallinger, P. The quest for world class status and university responses in Asia's World Cities: An introduction by the guest EDITORS. *J. High. Educ. Policy Manag.* **2013**, *35*, 230–237. [CrossRef]

46. Tayeb, O. *Roadmap to Become a World-Class University*; Springer: Berlin/Heidelberg, Germany, 2016.

47. Ngok, K.; Guo, W. The quest for world class universities in China: Critical reflections. *Policy Futures Educ.* **2008**, *6*, 545–557. [CrossRef]

48. Bejinaru, R.; Prelipcean, G. Successful strategies to be learnt from world-class universities. In Proceedings of the International Conference on Business Excellence, Bucharest, Romania, 30–31 March 2017; Volume 11, pp. 350–358.

49. Bratianu, C.; Pinzaru, F. Challenges for the university intellectual capital in the knowledge economy. *Manag. Dyn. Knowl. Econ.* **2015**, *3*, 609.

50. Weerts, D.J.; Freed, G.H.; Morphew, C.C. Organizational identity in higher education: Conceptual and empirical perspectives. In *Higher Education: Handbook of Theory and Research*; Springer: Berlin/Heidelberg, Germany, 2014; pp. 229–278.

51. Yukl, G.A. *Leadership in Organizations*; Pearson Education: Chennai, India, 2013.

52. Wang, Y.J. Shared governance: UC Berkeley's road of becoming a world-class university. *Comp. Educ. Rev.* **2011**. Available online: http://en.cnki.com.cn/Article_en/CJFDTotal-BJJY201101002.htm (accessed on 2 June 2018).

53. Liu, N.C.; Cheng, Y. The academic ranking of world universities. *High. Educ. Eur.* **2005**, *30*, 127–136. [CrossRef]

54. Li, M.; Shankar, S.; Tang, K.K. Why does the usa dominate university league tables? *Stud. High.Educ.* **2011**, *36*, 923–937. [CrossRef]

55. Sowter, B. The times higher education supplement and quacquarelli symonds (THES–QS) World university rankings: New developments in ranking methodology. *High. Educ. Eur.* **2008**, *33*, 345–347. [CrossRef]

56. Çakır, M.P.; Acartürk, C.; Alaşehir, O.; Çilingir, C. A comparative analysis of global and national university ranking systems. *Scientometrics* **2015**, *103*, 813–848. [CrossRef]

57. Hazelkorn, E. Reflections on a decade of global rankings: What we've learned and outstanding issues. *Eur. J. Educ.* **2014**, *49*, 12–28. [CrossRef]

58. Bo, Y.U.; Yang, X. University positioning issue during the construction process of world-class university and world-class discipline. *Heilongjiang Res. High. Educ.* **2017**. Available online: http://en.cnki.com.cn/Article_en/CJFDTotal-HLJG201702005.htm (accessed on 4 December 2018).

59. Huang, C.; Yang, Y.J.; Jiang, H. Strategy organization to create a world-class university. *J. High. Educ.* **2011**, *32*. Available online: http://en.cnki.com.cn/Article_en/CJFDTOTAL-HIGH201108007.htm (accessed on 4 September 2018).

60. Chen, J.; Tian, Z.Z. Internationalization strategy and practice of world class universities in Japan—Taking the university of Tokyo as an example. *High. Educ. Sci.* **2017**. Available online: http://www.en.cnki.com.cn/Article_en/CJFDTotal-GDLK201704010.htm (accessed on 17 December 2018).

61. Mok, K.H.; Chan, D.K.K. Challenges of Transnational Higher Education in China. 2012, pp. 113–133. Available online: https://works.bepress.com/mokkh/104/ (accessed on 10 June 2018).

62. Ma, J.; Zhao, K. International student education in China: Characteristics, challenges and future trends. *High. Educ.* **2018**, 1–17. [CrossRef]

63. Ma, W.; Yue, Y. Internationalization for quality in Chinese research universities: Student perspectives. *High. Educ.* **2015**, *70*, 217–234. [CrossRef]

64. Chen, K. *International Student Mobility in Higher Education in China: Tensions between Policies and Practices*; The University of Western Ontario: London, ON, Canada, 2016.

65. Rhoads, R.A.; Shi, X.; Chang, Y. *China's Rising Research Universities: A New Era of Global Ambition*; Johns Hopkins University Press: Baltimore, MD, USA, 2014.

66. Sabzalieva, E. The policy challenges of creating a world-class university outside the global 'core'. *Eur. J. High. Educ.* **2017**, *7*, 424–439. [CrossRef]

67. Shin, J.C.; Kehm, B.M. *The World-Class University in Different Systems and Contexts*; Springer: Berlin/Heidelberg, Germany, 2013; pp. 1–13.

68. Salmi, J.; Liu, N.C. *Paths to A World-Class University: Lessons from Practices and Experiences*; Sense Publishers: Leiden, The Netherlands, 2011.

69. Salmi, J. Daring to Soar: A Strategy for developing world-class universities in Chile. *Pensam. Educ.* **2013**, *50*, 130–146.

70. Morphew, C.C.; Fumasoli, T.; Stensaker, B. Changing missions? How the strategic plans of research-intensive universities in Northern Europe and North America balance competing identities. *Stud. High. Educ.* **2018**, *43*, 1074–1088. [CrossRef]

71. Aula, H.M.; Tienari, J. Becoming "world-class"? Reputation-building in a university merger. *Crit. Perspect. Int. Bus.* **2011**, *7*, 7–29. [CrossRef]

72. Shattock, M. The 'world class' university and international ranking systems: what are the policy implications for governments and institutions? *Policy Rev. High. Educ.* **2017**, *1*, 4–21. [CrossRef]

73. Deem, R.; Mok, K.H.; Lucas, L. Transforming higher education in whose image? Exploring the concept of the 'world-class' university in Europe and Asia. *High. Educ. Policy* **2008**, *21*, 83–97. Available online: https://link.springer.com/article/10.1057/palgrave.hep.8300179 (accessed on 10 June 2018). [CrossRef]