Is one business and management school better than another? A clustering perspective across UK national HE league tables

Abstract

Higher education (HE) league table rankings have been widely adopted and used by stakeholders such as students and HE institute managers. Nevertheless, criticisms have been raised by researchers. The present study proposes that rather than using league table indicators to make a single, standardised ranking list, indicators of the existing three UK national league tables indicators could be used to form clusters based on the homogeneity of the characteristics of each business and management school. Six groups of business and management schools were extracted and characterised. The approach has removed the notion of saying that one business and management school is better than another (single-ranking). Findings offer stakeholders a clearer view of business and management school by identifying groups that best represent the UK business and management school focus.

Keywords: HE league table, ranking, business and management school, cluster analysis

Introduction

Studies in 'university autonomy' (UA) reveal that higher education institutions (HEI), nowadays, operate in accordance with satisfying the needs of the stakeholders (e.g. students, academics educational managers) who contribute financially, academically and practically to HEIs (Reavill, 1997; Simpson and Marinov, 2016; Souto-Otero and Enders, 2017). Especially in the UK, the change of government policies has altered UA since 1993, when the Higher Education Funding Council was established after which more universities in the UK have developed a greater commercial focus in order to identify alternative income streams and so be less dependent on uncertain public funding (Simpson and Marinov, 2016). This trend of university marketisation (UM) leads UK universities to seek to attract more students (particularly EU and international students) in an attempt to increase their revenue for the continuous development of their universities (Nixon et al., 2016).

The existing research (e.g., Locke, 2013; Hazelkorn, 2014) has shown that an improvement in a university's or school's ranking can significantly lead to dramatic increases in applications in following years. Stakeholders evaluate the quality of an HEI by university rankings, so by climbing up the university league table, universities can attract more quality stakeholders such as students, staff and sponsors, and, consequently enhance the completion rates and employability prospects of their universities, which can further enrich the 'output' factor that most of the university rankings measure. Consequently, universities can further improve their positions in rankings (Hazelkorn, 2014). For instance, when measured at faculty/school level, HE league tables influence the capacity to attract more staff, more students and increased research funds (Wilkins and Huisman, 2012). Therefore, HEIs often set up goals based on what is measured by league tables, and they recruit staff and promote themselves based on the league table positions they achieve (Aguillo et al., 2010; Soh , 2011; Hazelkorn, 2014; Rauhvargers, 2014).

Although the development of university rankings has altered HE and they are likely to continue to affect education both nationally and internationally (Berry, 1999; Hazelkorn, 2009; Kehm, 2013), in the past few decades issues and criticisms of HE league table rankings have been identified (e.g., Williams and Rassenfosse, 2016). For instance, Bowden (2010) argues that current HE league table rankings have methodological problems, such as inconsistent and insufficiently justified weightings on indicators applied in different league tables. Furthermore, studies in ranking theories (e.g., Hazelkorn, 2014; Ursu, 2015) suggest that individuals when viewing a rank list pay significantly more attention to the order and that the initial impression of the ranked list directly affects their choice rather than understanding the underlying drivers for the rank position, such as the methodological issues for various rankings. This is because from the perspective of positional competition theory, higher ranked universities infer status in comparison to the lower ranked ones, which also directly convey higher quality education (Parkin, 1979; Souto-Otero and Enders, 2017). In terms of functionalist theory, ranking can be served as a simple and rational guidance to compare the education quality amongst a massive number of HEIs (Berger, 2001; Usher and Savino, 2006). . Therefore, Marginson and Van Der Wende (2007) and Wilkins and Huisman (2012) indicate that for attracting more support from stakeholders, HEI managers and policy makers, in good faith, could make decisions based on their league table positions, which are driven by their institutes' ranking positions across the different league tables, rather than making decisions in line with the actual strengths and strategic direction of their universities, consequently affecting resource allocation and staff management (e.g., Wilkins and Huisman, 2012).

The present study proposes that instead of using league table indicators to make a single, standardised ranking list, which may bias stakeholders' choices and HEI managers' strategy development, indicators of the existing league tables could be standardised and used to form clusters based on the characteristics and focuses of each HEI. In the past three decades, the number of business and management studies courses in UK HE has increased dramatically, and it

has become one of the most popular subjects amongst UK and international students (Universities UK, 2016). Times Higher Education (2017) reveals that half of international students study abroad for a business and management-related degree. This phenomenon has not only made business and management schools reliable 'cash cows' amongst universities, but also boosts fierce competition between HEI's (Times Higher Education, 2017). Hence, the current study uses the subject of 'business and management' as an empirical case to suggest an alternative approach, cluster analysis, that applies and interprets university league table indicators. The indicators that measure business and management school quality from the three UK national league tables (years 2016 and 2017) are combined and extracted by excluding undefined and inconsistent weightings and two stages of cluster analysis are conducted to form the final clusters. The results not only make practical suggestions to HEI managers for developing strategic plans that enhance institutions' current strengths but also provide methodological improvements on the use of HE league table indicators. For other stakeholders, such as potential undergraduate and postgraduate candidates, the findings could be a point of reference when choosing UK business/management schools.

HE league tables in the UK

In the UK, the need for university ranking was recognised in the 1990s, mainly for audit purposes (Shore and Wright, 1999; Bowden, 2000; Dill and Soo, 2005; Boliver, 2015). Presently, there are three main national league tables for UK HEIs, which are published annually by third parties: The Complete University Guide, The Guardian University Guide, and The Times and Sunday Times Good University Guide. Different league tables adopt different measurement indicators when ranking universities (Aguillo et al., 2010). Each of the university league tables uses different weightings and indicators to determine university and subject rankings. League tables typically rank universities based on a single score that combines various factors and measurements.

The overall Complete University Guide ranking is based on ten indicators, but only four perspectives are displayed for the subject tables, which in turn are determined by five indicators. The indicators used in the subject tables (weightings) are 'Entry Standards' (1.0), 'Student Satisfaction' (1.0), 'Graduate Prospects (1.0), 'Research: Quality' (0.67) and 'Research: Intensity' (0.33). Different weightings have been assigned to the various indicators, with some justification. For instance, "a higher weighting has been given to student satisfaction and lower weighting to research intensity" (The Complete University Guide, 2017). For a university to be included in a subject table, there is a requirement for "at least two indicators", "one of which must be student satisfaction" – the university must also "offer undergraduate courses in the relevant subject". For the subject rankings, z-score transformations are applied to each indicator. These z-scores are weighted and transformed onto a scale, with the highest-scoring university being given a score of 100 and all other universities receiving scores proportional to their weighted z-scores. However, these same indicators when applied to the overall university ranking are given weightings of 1.0, 1.5, 1.0, 1.0 and 0.5, respectively, without clear justification.

The Guardian University Guide league table applies eight indicators for both university ranking and subject areas (weighting), which are 'Satisfied with Course' (0.05), 'Satisfied with Teaching' (0.10), 'Satisfied with Feedback' (0.10), 'Student-to-Staff Ratio' (0.1625), 'Spend per Student' (0.10), 'Average Entry Tariff' (0.1625), 'Value-Added Score' (0.1625) and 'Career after Six Months' (0.1625). However, no clear justification is given for these weightings. The Guardian *does not* include any indicator for *academic research* to determine rank positioning and considers that such factors "are not important to students" (The Guardian, 2017). By contrast, The Complete University Guide uses both research quality and research intensity, with the latter measure capturing the proportion of staff undertaking research. The Times and Sunday Times Good University Guide applies different weightings to different starred levels of research outputs.

The Times and Sunday Times Good University Guide uses nine indicators for university rankings and five indicators for subject rankings (weightings), which are 'Teaching Quality' (0.67), 'Student Satisfaction' (0.33), 'Research Quality' (1.0), 'Entry Points' (1.0) and 'Graduate Prospects' (1.0). Again, no clear justifications and explanations are provided for these weightings. Z-score transformations are applied to these indicators, which are combined, and the highest measured institute is assigned a score of 100. All other universities receive scores proportional to their weighted z-scores.

It is worth noting that student satisfaction is reported by the three league tables in very different ways. All the league tables use the results of the most recent UK National Student Survey (NSS); the survey comprises 22 questions covering seven themes. The Guardian only uses three of the seven question themes to report on three different aspects of student experience, which are 'Satisfied with Course', 'Satisfied with Teaching' and 'Satisfied with Feedback'. The Complete University Guide uses all the question themes except for three questions related to 'Learning Resources'. The Times and Sunday Times Good University Guide uses all the questions covering all the themes but partitions the questions into 'Teaching Quality' and 'Student Experience' (see Table 1).

Insert Table 1 about here

In addition, subtle changes to the weightings of indicators can make year-on-year comparisons of university rankings difficult. For instance, for 2016, The Guardian changed the impact of 'Expenditure per Student' from 0.15 to 0.10. The remaining 5% was shared across the four other measures. The justification given for this change was that "an increasing incidence of one-off high spends was causing volatility" (The Guardian, 2015). On the other hand, for each institution the subject indicator is compared to the average score of the other institutes to produce

a normal distribution of standardised scores. Standardised scores are adjusted for various factors, including extremely high NSS scores, expenditure and Student-to-Staff Ratio values (The Guardian, 2017). The weightings are then applied and summed. The total standardised scores are re-scaled, with the highest-scoring institute assigned a score of 100 and all other institutes receiving lower scores (The Guardian, 2017).

Criticisms and limitations of the existing league table approach

League table rankings have been questioned regarding whether they mislead stakeholders (e.g., Bowden, 2000). From a methodological view, previous literature has debated the validity and reliability of university rankings (e.g. Bergseth et al., 2014; Berbegal-Mirabent and Ribeiro-Soriano, 2015). When exploring the process of creating league tables, Jarocka (2012), Isidro et al. (2010) and Soh (2011) noted that the positions allocated to universities are very much dependent on the factors included in the process to measure performance, the normalisation approach, the weighting values and the combination of the weighted values. League tables employ diverse approaches for normalising the data used. The selection of the normalisation approach can have a large impact on the order in which universities are ranked. The approaches that have been used in creating league tables can be criticised due to their lack of scientific rigour (Lukman et al., 2010; Tang and Wu, 2010). For example, as highlighted previously, The Guardian University Guide does not take into account research-related criteria. The weighting approaches employed in the league tables are subjective and based on no clear empirical evidence (Aguillo et al., 2010; Bergseth et al., 2014; Usher and Medow, 2009).

From a practical and decision-making view, researchers propose that the ranking of universities can easily turn HE into a popularity contest. Bowden (2000) expressed a concern related to the indicators that are used to measure the performance of universities, as they can influence and impact on the decisions made by universities, such as the number of good degrees awarded to students. Furthermore, the league table process usually favours the top research

institutions and supports the belief that one ranking approach fits all universities (Bergseth et al., 2014). Altbach (2006) states that the difficulty associated with ranking universities is the approach used and that the types of questions that should be addressed are whether it is possible to judge how universities are performing as a whole or how do individual universities perform. Targeting at the league table position also removes the freedom for universities to set their own success factors; those universities that focus on under-represented groups and less-employment-focused courses are not supported by the league tables (Altbach, 2006).

The existing alternative ranking approaches to league tables

Given the criticisms of the HE league table ranking approach, alternative approaches have been identified. One approach for grouping that acts as an alternative to league tables is data envelopment analysis (DEA) (Bougnol and Dula, 2006; Turner, 2005; Barr et al., 2000). DEA is a nonparametric frontier estimation methodology originally introduced by Charnes (1978). DEA groups universities into ‘efficient’ and ‘performer’ against ‘inefficient’ and ‘nonperformer’. The DEA grouping of a university depends on solving a linear programming problem. Although the DEA approach adopts another view of looking at league table data and is said to solve the classification problem in a more objective manner than the approaches that are currently used to rank universities, the universities are classified, allocated and ranked by the efficiency of their performance, which still keeps the nature of rankings.

In the approach developed by Jarocka (2012) for the grouping of universities, the author uses k-means clustering. The factors used to represent the universities are the quality of education based on the Nobel Prizes and Fields Medals won by alumni; and the quality of the faculty based on the Nobel Prizes and Fields Medals won by staff. The clustering of universities offers the opportunity to group such institutions and to visualise the different universities and their characteristics. Different clusters have different criteria, which can be explored by stakeholders. Nevertheless, undefined weightings were still applied to the indicators in Jarocka’s (2012) study,

which could lead to a biased result, as highlighted before (e.g., Aguillo et al., 2010). Furthermore, it is arguable that not all/many universities have alumni who have won Nobel Prizes or Fields Medals; these indicators are not directly relevant to most HEI stakeholders.

In order to rank Australian universities, Valadkhani and Worthington (2005) applied hierarchical cluster analysis combined with k-means clustering to group universities by research performance. The factors that were employed were the number of PhD completions and the number of research grants and publications. The research identified only two clusters, with the Group of Eight (Go8) Australian universities being in one cluster and the other universities in the other. This approach reduced the weighting bias and reduced the possible issues associated with rankings. However, the study only focused on the 'research' aspect. Other important indicators, such as teaching quality and graduate prospects, were not evaluated and included in the study, which unsurprisingly led to the only two-cluster finding.

Method

To avoid the discussed criticisms, the analysis approach in this paper does not apply the questionable weighting method and does not use a single ranking that may not appropriately represent performance and may lead to a biased decision. The present study suggests using two-stage cluster analysis without adopting weightings, which emphasises the strengths of different HEIs. The measurement of business schools was applied in this study because of the growing popularity of business-related subjects nationally and internationally. Cluster analysis does not rely on a single approach to measure HEI quality but combines multiple indicators in a system. Furthermore, the present study offers many more features to represent business schools than was offered by the study of Valadkhani and Worthington (2005), whose factors were limited to the research aspect.

Data

The datasets used for this study were from the subject area of 'Business Management and Marketing' across the three leading UK league tables: 'Business Management & Marketing' from The Guardian University Guide; 'Business Studies' from The Times and Sunday Times Good University Guide; and 'Business and Management Studies' from The Complete University Guide. Due to historical changes in the data used and new universities joining the league tables, the most recent data for 2016 and 2017 were used for this analysis. For each league table, the mean score for each respective indicator was calculated across the two years. In instances where only one year's data, either 2016 or 2017, was available within a league table, that value was used for the analysis. In instances where data was unavailable for both years, the indicator was left empty. Next, the seven indicators to be used in the analysis were identified.

Indicators

The *Overall Teaching* indicator was used from The Times and Sunday Times Good University Guide because this is the only league table to use the entire NSS question set. This fully covers all the relevant student satisfaction indicators reported in The Guardian University Guide and The Complete University Guide. The *Student-to-Staff ratio*, *Spend per Student* and *Value-added Score* indicators were adopted from The Guardian University Guide, which is the only league table to use these particular indicators. The *Entry Standards* indicator was the mean of the 'Average Entry Tariff', 'Entry Standards' and 'Entry Points' from the three league tables. The *Graduate Prospects* indicator was the mean score of 'career after six months' and 'graduate prospects' from the three league tables. As highlighted previously, The Guardian University Guide does not use any research indicators for its league table, hence the *Overall Research* indicator was averaged from The Complete University Guide and The Times and Sunday Times Good University Guide league tables (Table 2). It is worth noting that research quality from The Times and Sunday Times Good University Guide incorporates both 'research assessment' and 'research intensity'.

It is worth noting that the aim of this study is not to criticise the validation and meaningfulness of the existing league table indicators. The UK league table indicators are similar across different league tables; these indicators are established enough to be understood by HEIs (the measurements and sources of each indicator are shown in Table 3). It is noted by Bekhradnia (2016) that the league table indicators used in the UK studies and as the basis of our study are much more robust than the indicators found in international league tables. These indicators that are applied to UK HE league tables have also been regularly re-evaluated and revised by relevant organisations such as the NSS. Also, it is arguable that there is a perfect indicator. By combining the criteria across different UK studies, our approach is based on multidimensional indicators that offer diverse measures of universities that do not benefit a single area of higher education at the expense of others (Marope and Wells 2013). However, as indicated previously, this paper tends to address the issue of the existing league table's adoption of unjustified indicator weightings when reporting the indicator scores. The unclear defined weightings to the indicators may also influence stakeholders' decision-making.

Insert Table 2 about here

Insert Table 3 about here

Data analysis procedure

The seven indicators were measured in different scales; therefore, the data across all the variables were standardised with N(0,1). Agglomerative hierarchical clustering was used to identify the appropriate number of clusters for the analysis. In agglomerative hierarchical

clustering, cases that are most similar are combined into a single new cluster. Hierarchical clustering generates a dendrogram, which illustrates the arrangement and sequence of the clusters produced by the clustering algorithm. The dendrogram aided in identifying five clusters as part of the present analysis.

A k-means clustering algorithm was used to organise the business and management schools into five clusters, each with a relatively distinct profile, which was based on the seven identified indicators. Initially, five means were randomly generated, with one mean for each cluster. Euclidean distance, which is an appropriate distance function when all dimensions are properly scaled and standardised (Shahid et al., 2009), was used to calculate the distance of each case (business and management school) from each of the five means. The cases nearest to the five means were allocated to the five clusters. New centroids, which represented the average of all the data points within a cluster, were calculated, and the distances of each case from the five new centroids were also recalculated. Each case was reallocated to each centroid, determined by the closeness of the case to the centroid. This was repeated until convergence of the centroids was achieved, which meant that the centroids did not move and so membership of each cluster was stable. K-means clustering generated statistics for each cluster, as well as for each indicator, which were used to produce charts describing the attributes of each of the five clusters. The flowchart in Figure 1 outlines the methodology used to generate the initial five clusters.

Insert Figure 1 about here

The flowchart in Figure 2 outlines the methodology adopted to allocate the set of university business and management schools that had not been allocated in the initial clustering due to missing indicators. There were 18 universities with no data for ‘Overall Research’. The dendrogram generated from the hierarchical clustering suggested two significant clusters, and K-

means clustering was applied to this set of business and management schools with K = 2. These two new clusters, A and B, were produced and compared to the original five cluster attribute charts. This enabled one of the two clusters to be allocated to one of the original five clusters and a new cluster to be identified. In addition, there was a final set of 14 cases that were not clustered, as they had too many missing indicators.

The clustering method is widely applied across different research areas, such as marketing (e.g. Rohm and Swaminathan, 2004), management studies (e.g. Premkumar et al., 2005), and tourism (e.g. Bigne and Andreu, 2004). It is considered a credible and appropriate approach for our study. Although cluster analysis is not particularly novel, we believe that the clustering technique is an appropriate method to answer our research question, as it identifies homogeneous groups with HEIs sharing similar strengths/characteristics.

Insert Figure 2 about here

Results

Using the methodology outlined, five clusters were identified. These clusters were found to be homogeneous in character; hence, the university business and management schools within each cluster have similar characteristics with respect to: overall teaching; student to staff ratio; spend per student; entry standards; value added score; overall research and graduate prospects. The ANOVA test (Table 3) indicates the five clusters are heterogeneous; the extracted indicators have contributed significantly ($p < .05$; the p-value for overall teaching shows a considerable trend toward significance, $p = .057 < .1$) to the separation of the five clusters, which provides support that universities across clusters have dissimilar characteristics.

Insert Table 4 about here

By reviewing the five cluster attribute charts the researchers identified strengths for each cluster and assigned appropriate labels. The business and management schools in Cluster 1 (Academic Growth cluster) have above-average value-added scores; it is a set of universities offering academic growth from a relatively low entry requirement. The business schools in Cluster 2 (Research-Focused cluster) form a research-focused cluster, which have relative strengths in the attributes of research, teaching, entry standards and student-to-staff ratio. Cluster 3 (Teaching- and Research-Focused with a Strong Graduate Perspective cluster) business and management schools are above average in all aspects but relatively low in the student-to-staff ratio. These business and management schools are focused on teaching and research, with strong graduate prospects. The schools in Cluster 4 (Teaching Intensive cluster) are identified as teaching intensive, which have above-average student-to-staff ratios and a higher quality of overall teaching, although these universities are significantly below average in terms of value-added scores; graduate prospects; overall research; and entry standards. In Cluster 5 (Student Satisfaction cluster), these business and management schools have significantly above-average scores in the measures of student-to-staff ratio and value-added score, as well as average scores for graduate prospects and overall teaching. These schools focus on student satisfaction, given their positive student-to-staff ratios (see Figure 3).

Insert Figure 3 about here

The results show that the business and management schools in Cluster 3 have a cluster centre that is furthest from Clusters 4, 5 and 1, respectively (see Table 4). Clusters that are

distinct but close neighbours are Clusters 1 and 5. All other clusters are relatively equidistant. When looking at Cluster 3, which is further from Clusters 4, 5 and 1, its focus is on all the measures with the exception of the student-to-staff ratio; as described earlier, this would make each school in this cluster a teaching- and research-centred business school with strong graduate prospects. Cluster 1 in comparison to Cluster 3 is distant, as its focus is only on 'Value Added' and hence is described as 'Academic Growth'; Cluster 4 focuses on teaching only, which is not the case for Cluster 3. Cluster 5 focuses only on student satisfaction, as measured by the positive score for student-to-staff ratio and the negative values for other attributes, which is not the case with Cluster 3.

Insert Table 5 about here

Allocating universities that had no data for 'Overall Research'

Eighteen universities had no data for the 'Overall Research' indicator. A similar approach to that previously adopted was applied: the data for these universities was standardised and K-means clustering was used to produce two clusters, A and B, with attributes (Figure 4). By comparing the attributes of these charts to those of the charts produced in the initial clustering analysis, the universities in Cluster A had the most similar profile to Cluster 5, which were universities focusing on student satisfaction. Therefore, universities in Cluster A were assigned to Cluster 5. The profile of the universities in Cluster B was dissimilar to all of the five cluster profiles and hence was preserved as a distinct Cluster 6. The universities in Cluster 6 are all post-2005 universities and are still developing a profile compared to universities with a longer heritage.

Insert Figure 4 about here

Finally, there remained a small set of 14 universities that could not be allocated to any cluster because of either more than one missing indicator value or there being too few cases for further clustering to be effective or appropriate (Kaufman and Rousseeuw, 2009).

Insert Table 6 about here

Discussion and implications

In this study, a clustering approach was used by combining and adopting current league table indicators. This approach has removed the notion of saying that one business and management school is better than another (single-ranking); the findings offer a clearer view of business and management school performance, taking into consideration the closely matched indicators that represent business and management school focus. Some business and management schools have greater emphasis on and strength in research, while some concentrate on providing a valued-added student experience. Hence, students who are looking for such a focus within their education can identify the appropriate cluster that best suits their study expectations (e.g., 'Academic Growth', 'Research Focused', 'Teaching Intensive', etc.). This reduces the search space for students of HE business studies when compared to the current UK league tables. Prospective students can then evaluate their preferred university/school cluster using their personal preferences (e.g., city vs. campus based, location, living costs, etc.).

Business and management school managers could use this approach to get more-meaningful pictures of the strengths and focuses of their schools and the other business and

management schools they are closest to. In addition, for the long-term planning and allocation of resources, the study aids understanding of the changes that school managers would need to implement in order to transfer their school focus and enable migration to another cluster. Cluster attribute information allows planning and spending to be more systematically applied in the long term, rather than focusing on short-term decision-making encouraged by how the HEI can move up the ranked tables. There would also be reduced volatility to sharp rises and falls within current league tables. The clustering approach also reduces the issue of over-focus by some HEI managers on league table ranking position, allowing them to strengthen their foci, such as teaching and learning scholarship, that better reflect the needs of students and their business and management schools as well as aligning with the institution's missions, such as research intensity, teaching excellence, student satisfaction etc. To further explain this, our clustering results highlight the direction on which HEI managers should improve. Take Keele University as an example, the overall mission for the university as well as its management school is to provide excellent teaching quality, student satisfaction and internationally recognised research output (Keele University, 2018). Based on the outlined missions, Keele Management School should aim for the third cluster in our results, i.e. "Teaching & research with strong graduate prospects" rather than staying in the research focussed cluster. In this case, HEI managers from Keele Management School should put more efforts on improving graduate prospects, teaching quality and student satisfaction. n addition, such decision-making is likely to be proactive rather than reactive to sudden changes in ranking positioning when little may have changed within the business and management schools themselves.

Methodologically, this study incorporates indicators from across all UK HE league tables, giving a fuller perspective of university performance. Furthermore, a criticism of academic league tables is that they incorporate subjective weighting into the indicators, which could change and consequently alter the HEIs' rank positioning within the league tables. In our approach, there is no weighting included, with clustering being used to determine the measures that are the most

important for cluster membership and so offering objectivity in the approach used in this clustering methodology.

In the existing approach, where a business and management school does not have data for ‘research outputs’, it will be lower in the league table ranking. Our method offers an additional approach to placing HEIs in clusters if there is one missing indicator value. Managers of such business and management schools could identify a cluster that maps to their organisational profiles based on the indicators. HEIs may identify clusters that they may wish to join and could develop overarching strategies that impact on all the indicators to move from one cluster to another.

Limitations, suggestions for future studies and conclusions

Even though the approach in the present study applies new elements to offer better representation of the business and management schools being considered, some limitations should be acknowledged. Firstly, the clustering approach is designed to overcome the challenges associated with single-ranking league tables. However, the results could possibly lead to a similar over-focus on the measurement devices found with league tables, although, compared to league table rankings, this may be less likely to happen because HEIs will need to affect more than just one indicator to move across clusters.

Further, this study systematically examines and evaluates the approaches and indicators used across UK HE league tables and identifies the most-fitting attributes; the identified clusters are dependent on the attributes selected to represent only business and management studies. Future studies are suggested to explore this topic across different subject areas using similarly identified attributes and may consider including attributes that students may be interested in, such as city vs. campus, living costs and facilities.

Methodologically, cluster analysis requires expert human interpretation of clustering outputs to identify the salient features; future studies are encouraged to involve educational experts and stakeholders as to their attitudes to the clustering approach when identifying cluster features. In addition, in the second clustering stage, our approach only overcomes instances of single missing indicators. For clustering business and management schools that have more than one missing indicator, future research is suggested to collect qualitative data, which may provide additional insights and may yield more-comprehensive results. On the other hand, although the focus of this study is not to criticise or discuss the validation or meaningfulness of the existing league table indicators, it is acknowledged that there is no perfect indicator and that the indicators need to be re-evaluated and revised regularly and communicated effectively with HEIs. Future studies are encouraged to evaluate the existing HEI league table indicators and propose new ones that take different perspectives that may better reflect HEI performance.

In this paper, we have put forward an alternative perspective to apply league table indicators, which aids appropriate decision-making by key stakeholders in the HE sector. Although this study focuses on the UK, the approach could also be adopted by other countries and applied to global HE league tables. It is hoped that this study will attract more studies that continue to extend and improve the proposed clustering approach and so offer educational stakeholders a tool to engage in more-effective decision-making in the future.

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HE League Table	Reported Indicator	NSS - Question Theme	NSS - Questions
The Guardian University Guide	Satisfied with Course	Overall satisfaction	22
	Satisfied with Teaching	The teaching on my course	1, 2 ,3, 4
	Satisfied with Feedback	Assessment and feedback	5, 6, 7, 8, 9
Complete University Guide	Student Satisfaction	All themes except questions about learning resources	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 19, 20, 21, 22
The Times and Sunday Times	Teaching Quality	The teaching on my course, Assessment and feedback & Academic feedback	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
	Student Experience	Organisation and management, Learning resources, Personal development & Overall satisfaction	13, 14, 15, 16, 17, 18, 19, 20, 21, 22

Table 1. NSS questions and question themes used by league tables

The Guardian University Guide		**The Complete University Guide**		**The Times and Sunday Times Good University Guide**		**Indicators Selected for Analysis**	
Indicators	*Weighting*	*Indicators*	*Weighting*	*Indicators*	*Weighting*	*Indicators*	*Weighting*
Satisfied with Course	0.05	Student Satisfaction	1.00	Teaching Quality	0.67	Overall Teaching	1.00
Satisfied with Teaching	0.10			Student Satisfaction	0.33		
Satisfied with Feedback	0.10						
Student to Staff Ratio	0.1625					Student to Staff Ratio	1.00
Spend per Student	0.10					Spend per Student	1.00
Average Entry Tariff	0.1625	Entry Standards	1.00	Entry Points	1.00	Entry Standards	1.00
Value Added Score	0.1625					Value-added Score	1.00
		Research Assessment*	0.67	Research Quality	1.00	Overall Research	1.00
		Research Intensity*	0.33				
Career after 6 Months	0.1625	Graduate Prospects	1.00	Graduate Prospects	1.00	Graduate Prospects	1.00

* - Combined to give ‘Research Quality’

Table 2. Indicators and weightings used by the three UK HE league tables

Table 3. Measures and data sources of indicators

Complete University Guide

Indicator	Definition	Data Source
Entry Standards	The average UCAS tariff score of new undergraduate students.	HESA
Student Satisfaction	A measure of student views of the teaching quality at the university.	NSS
Graduate Prospects	A measure of the employability of a university's first-degree graduates.	HESA
Research Quality	A measure of the quality of the research undertaken in the university.	REF
Research Intensity	A measure of the proportion of staff involved in research.	HESA

Guardian University Guide

Indicator	Definition	Data Source
Satisfied with Course	The students' satisfaction regarding the overall quality of the course.	NSS
Satisfied with Teaching	The extent to which final-year students have a positive experience of teaching delivered by their departments.	NSS
Satisfied with Feedback	How students think their efforts were assessed and the usefulness of the feedback.	NSS
Student-Staff Ratio	A comparison between the number of staff teaching a subject and the number of students studying it.	Self-reported by universities
Spend per Student	A comparison between the amount of money spent by the university to deliver a subject and the number of students who are studying it.	Self-reported by universities
Average Entry Tariff	The UCAS average tariffs scores by students who are aged under 21, full-time and first-degree entrants.	UCAS
Value-Added Score	The score which compares between students' quality at the time of enrolment and their degree honours. HEIs score a higher value-added score when a student with a lower than entry qualification at the time of enrolment gains a first or second-upper class honours at the end of their studies.	Self-reported by universities
Career after Six Months	The proportion of students who can find a graduate-level employment, and/or study at an HEI or professional level within 6 months of graduation.	HESA

The Times/The Sunday Times Good University Guide

Indicator	Definition	Data Source
Teaching Quality	A measure considers the teaching quality, assessment and feedback and academic support.	NSS
Student Satisfaction	A measure regarding the organisation and management, learning resources, personal development and overall satisfaction to the HEI.	NSS
Research Quality	According to the REF, this measure shows the overall quality of research outputs by the HEI which are above 3* internationally recognised.	REF
Entry Points	The average UCAS tariff points of first-year, first-degree entrants who are under 21 years old. This measure takes into account the A- and AS-levels and Highers and Advanced Highers, and other equivalent qualifications (for example, international baccalaureate).	UCAS
Graduate Prospects	A measure of students who can find a graduate-level employment, and/or study at an HEI or professional level within 6 months of graduation.	HESA

Sources: The Complete University Guide (2017), Hiely-Rayner (2016), The Times (2016)

ANOVA						
	Cluster		Error			
	MS	df	MS	df	F	Sig.
Entry Standards	13.758	4	0.256	81	53.673	0.000
Overall Teaching	1.750	4	0.730	81	2.396	0.057
Overall Research	14.556	4	0.195	81	74.598	0.000
Graduate Prospects	11.906	4	0.425	81	28.038	0.000
Student to Staff Ratio	4.801	4	0.630	81	7.620	0.000
Spent per Student	10.401	4	0.480	81	21.689	0.000
Value-added Score	9.502	4	0.420	81	22.618	0.000

Table 4. ANOVA table of cluster attributes

Distances between Final Cluster Centres

Cluster	1	2	3	4	5
1		2.329	3.398	1.941	1.697
2	2.329		2.561	2.108	2.088
3	3.398	2.561		4.071	3.324
4	1.941	2.108	4.071		2.145
5	1.697	2.088	3.324	2.145	

Table 5. Distance between the first five cluster centres

Academic Growth	Research Focussed	Teaching & Research with Strong Graduate Prospects	Teaching Intensive	Student Satisfaction	Post-2005
Bournemouth	Bangor	Aberdeen	Aberystwyth	Abertay **	Bolton *
Bradford	Brunel	Aston	Anglia Ruskin	Bath Spa **	Cardiff Metropolitan *
Brighton	Essex	Bath	Bedfordshire	Birmingham City	Chichester *
Central Lancashire	Keele	Birmingham	Buckinghamshire New	Canterbury Christ Church **	Royal Agricultural University *
Chester	Liverpool	Cardiff	Hertfordshire	Coventry	University of the Arts London *
Cumbria	Queen Mary	City	Huddersfield	De Montfort	West London *
Derby	Queen's, Belfast	Durham	Salford	Edge Hill **	
East London	Royal Holloway	Edinburgh	Sunderland	Edinburgh Napier	
Greenwich	Stirling	Exeter	Teesside	Glasgow Caledonian	
Hull	UEA	Glasgow	York St John	Gloucestershire **	
Kingston	Ulster	Heriot-Watt		Leeds Beckett	
London Metropolitan	York	Kent		Leeds Trinity **	
London South Bank		King's College London		Lincoln	
Middlesex		Lancaster		Liverpool Hope **	
Northampton		Leeds		Liverpool John Moores **	
Plymouth		Leicester		Manchester Metropolitan	
Portsmouth		Loughborough		Northumbria	
Roehampton		Manchester		Nottingham Trent	
Sheffield Hallam		Newcastle		Oxford Brookes	
Staffordshire		Nottingham		Queen Margaret **	
Westminster		Sheffield		Robert Gordon	
		Southampton		South Wales	
		Strathclyde		Southampton Solent **	
		Surrey		St Mary’s, Twickenham **	
		Sussex		Swansea	
		Warwick		West of England	
				West of Scotland	

* - From Cluster A	Winchester **
** - From Cluster B	Worcester

Table 6. Final clusters with associated business and management schools

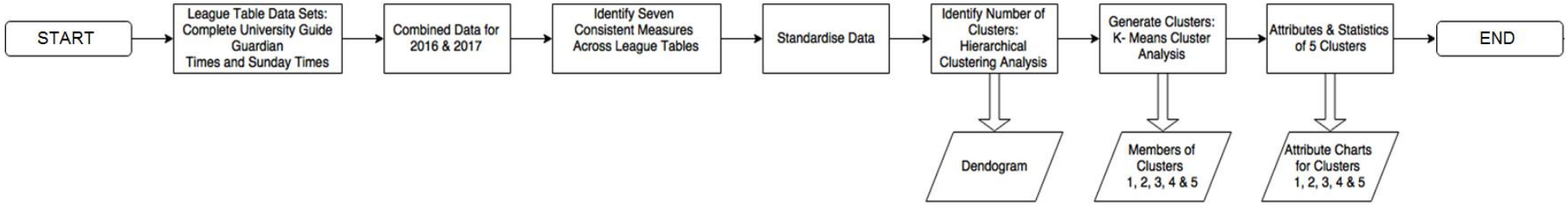

Figure 1. Flowchart outlining the methodology to generate the initial clusters

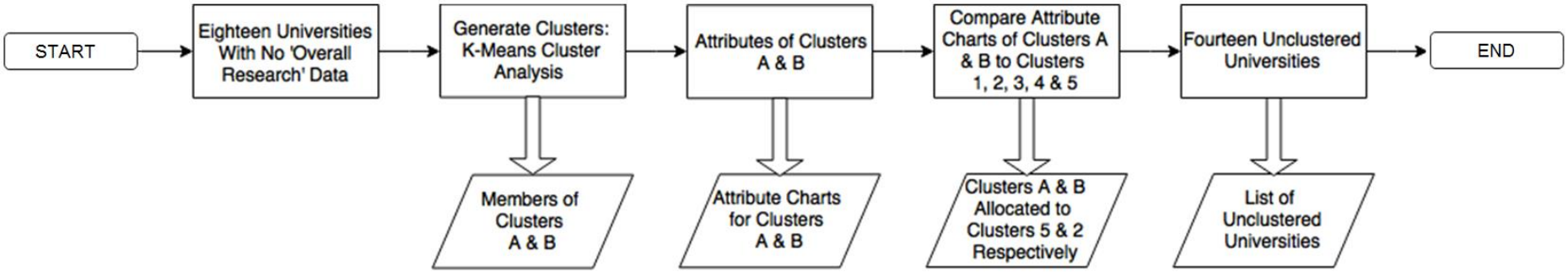

Figure 2. Flowchart outlining the methodology for unallocated universities

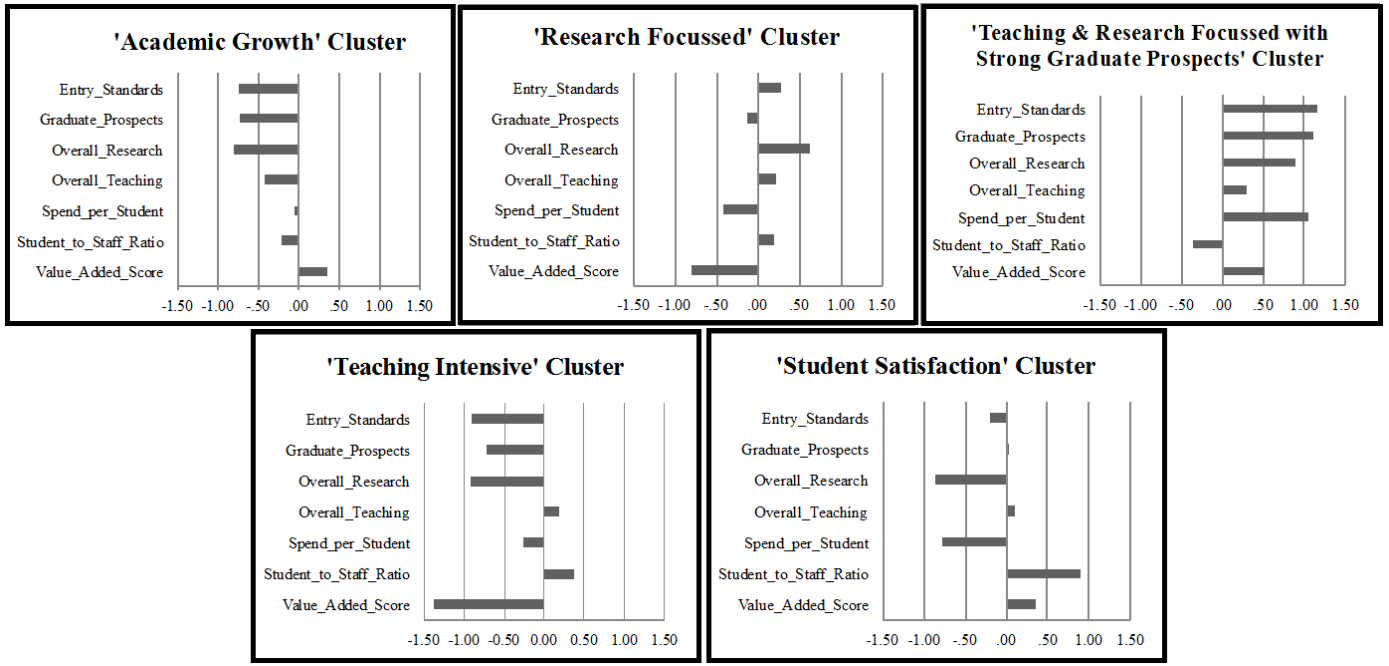

Figure 3. Relative strengths and attributes of the initial five clusters

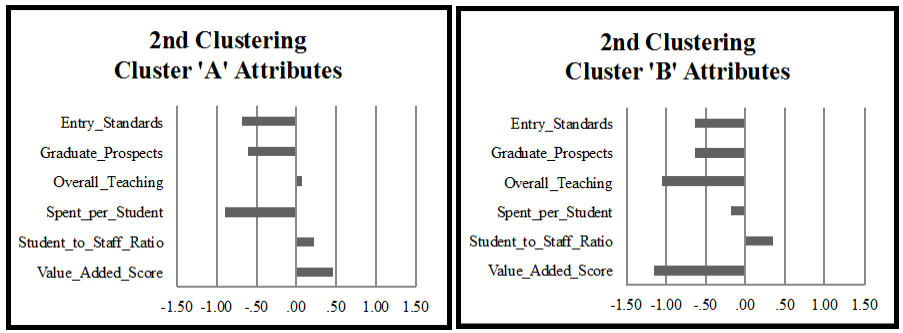

Figure 4. Attribute charts for clusters with no data for research indicator