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Grouping the mega university countries according to their similarities

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Abstract

The mega Universities are higher education institutions with more than one hundred thousand students. There are 57 mega universities in 25 countries. Anadolu University in Turkey is a mega university. We examined 23 mega university countries as of year 2011, by addressing the variables of Information Society, Population and Information and Communication Technologies. By using Multidimensional Scaling analysis we grouped these countries according to their similarities and we concluded that America is in the best condition and followed by UK and South Korea. Argentina is the country of greatest similarity with Turkey. The most distant countries are Nepal and UK.

Keywords: Mega University, Information Society, Population, Information and Communication Technologies, Multi Dimensional Scaling

1. Introduction

John S. Daniel in his book named *Mega-Universities and Knowledge Media* says; “In the last seven days, somewhere in the world, a new university campus should have opened its gates to students. Next week, in a different location, another new university ought to begin operations.” At the end of the last millennium in which the idea of the university has developed and changed, population growth is forcing governments to open new education institutions almost in all countries around the world. But none of these countries can create enough capacity in campuses to give people access to universities. A sizeable new university would now be needed every week merely to sustain current participation rates in higher education. New institutions are not being created at this frequency. A crisis of access lies ahead (Coomb, 1985; Daniel, 1998).

Increased demand for education and learning along with population growth has created a suitable environment for the formation of mega-universities in the world. Undoubtedly, such universities should need to use new information and communication technologies to deliver education and training to a wide mass of students and audience. This reality creates another important issue.

From this point of view, in our study first we identified mega universities in the world, then the home countries of the mega universities, and at last we clarified the number of mega universities in these countries. Then, we tried to evaluate countries by taking into account their population growth rates, their situation in creating information society, and the use of information and communication technologies in the country. We used one of multivariate statistical techniques as multidimensional scaling analysis (MDS) to reveal the similarities and differences of these countries. In our study we used data of year 2011, which can be reached from the website of the World Bank.

2. Mega Universities, Information Society and Communication Technology

There are a similar problems at all other levels of learning. Demand for all education and training has grown steadily in most parts of the world in recent decades and is likely to remain as an important issue in the future (Coombs, 1985). The earth's population will probably grow in the 21st century. Individuals and governments are increasing their ambitions for educational attainment and the acquisition of skills. In the industrialized world there is increasing demand for post-secondary education and training. In the developing world, where the great majority of children are being born, countries are still struggling to achieve universal primary schooling and wider access to secondary education (Coombs, 1985; Daniel, 1998).

Higher education system and institutions are started to change in response to these challenges. A new type of university which is called mega university emerged in last three decades and these institutions are spreading every year, and they deliver pathways

and lessons for the renewal of all other universities. This university type is open and distance teaching universities. Some of these new mega universities are, generally young but very large institutions.

The definition of a mega university combines three criteria: distance teaching, higher education, and size. Each is intentionally restrictive and important.

First, although many universities now offer both distance and classroom teaching, we defined mega universities as the institutions carrying open and distance education as the primary activity. In this way the special organizational arrangements established by such institutions to use technology for teaching at a distance stand out more clearly.

Second, although tertiary and secondary open and distance education institutions in the same country may share common features, the student profile, the nature of degree-level study and the research missions of universities make them special and distinctive.

Finally, setting a threshold of 100,000 active students for mega universities is an arbitrary way of selecting institutions that should be able to take advantage and gain from economies of scale and competent logistic opportunities.

These mega universities are generally powerful enough to challenge with crises in the numbers of access and educational costs. Each of these mega universities can mas a substantial proportion of the university students in its country and gives education to the students with a very small cost when compared with other universities. The success of mega universities is closely related with delivering their courses not only nationally but often internationally to students in their homes. By this way, these institutions allow students to choose place and time for their education. However, the cost structures and technological facilities of these universities, sometimes limit the available choices for students.

Generally these mega universities have led the renewal of educational forms, correspondence tuition and off-campus lecturing, but almost all of them had low status when ompared with campus aducation only a few decades ago. The reputation of the mega universities varies between countries and none of them can yet take the credibility of their distance education methods for granted in the near future. This makes the mega universities a subject, especially in two very important discussion topics. These two important topics are of course: First quality of the education, second the use and potential of technology in education.

Ready access to media and networks all over the country is clearly an advantage for mega universities. There is, of course, a danger that these institutions might use these facilities only because of their availability not for their effectiveness and do not need to construct sub-structures for new technologies.

Most universities are non-profit bodies belonging to the public sector. But just like the firms in the private sector, mega universities must take care of competitive advantage and increasing performance as important goals. Because, many of them in many countries started to depend more on student fees and other incomes than on the funds from the state.

Although the general concern is the competitive advantage of mega universities as total organizations, we need to focus especially on the use of technology for open and distance education. Interest in these types of learning, unites most of higher education, and all over the world the concerns of campus institutions and the mega universities are converging rapidly. In examining the role of technology in competitive advantage of the mega universities is especially interesting, because of their prior experience of the strengths and weaknesses of technology in open and distance education (Daniel, 1998).

The main educational advantage of online learning is that, this system enables students to learn in some different ways from traditional classroom teaching (or print-based distance education).

In a knowledge-based society there is a need for several skills such as; analysing and applying every kind of information and knowledge, seeking, independent and lifelong learning, problem-solving ability , creative thinking, and teamwork. The education of knowledge-based workers requires a different approach which enables them to learn both inside and outside the schools or any other conventional higher education institutions. Such learners must be encouraged to analyse and criticize, they must be able to offer alternative solutions and approaches and be ready to take risks. This type of learning cannot be effectively carried in large lecture classes or in distance education through mass communications such as broadcasting (Bates, 2000).

It is argued that there is always an important relationship between the beliefs about the nature of knowledge and knowing, the skills needed in a knowledge-based society, and the choice of technology. For example, Postman (1993) argues that there is a strong link between technology and the modes of thinking. On the other hand, scientific thinking is mainly dependent on the 'objectivity' and linearity of printed material and allowing communication between scientists through printed journals.

If we start to move from linear to lateral thinking, we may have some gains in creativity but we may lose some certainty and predictability. Thus there may be strong advantages in combining print with Web-based learning. In this context, mega-universities with open and distance learning institutions have these strong advantages in terms of learning. More importantly; skills needed in the information society in recent years has been moved towards more constructive approaches in developing the skills needed in a knowledge-based society. This change placed more emphasis on information management and analysis and knowledge construction, rather than on comprehension and memory. Thus the creation of knowledge has become more important and technologies such as the Internet made it easier (Bates, 2005).

We examined 54 mega universities and saw that the expression of open or distance education exists in the names of 9 universities. Some of them have open or distance education faculties. However, all of these universities are benefiting from information and communication technologies. Therefore, distance education technology has an important place in the mega universities.

Table 1: Mega Universities and Countries

Countries	Numbers	Mega Universities
Argentina (AR)	2	University of Buenos Aires National University of Cordoba
Brazil (BR)	2	Estacio de Sa University Norte do Parana University
China (CN)	1	Shanghai Open University
Dominican Republic (DO)	1	Autonomous University of Santa Domingo
Egypt (EG)	2	Ain Shams University Cairo University
France (FR)	1	National Centre for Distance Education
India (IN)	9	Indira Gandhi National Open University University of Pune Andhra Pradesh Open University University of Delhi Sikkim Manipal University Osmania University Rajiv Gandhi Technical University Uttar Pradesh Technical University Madhya Pradesh Bhoj Open University
Indonesia (ID)	1	Universitas Terbuka
Iran (IR)	2	Islamic Azad University Payame Noor University
Italy (IT)	2	Sapienza University of Rome University of Bologna
Korea Republic (KP)	1	Korea National Open University
Malaysia (MY)	1	MARA University of Technology
Mexico (MX)	3	National Autonomous University of Mexico University of Guadalajara National Polytechnic Institute
Nepal (NP)	1	Tribhuvan University
Pakistan (PK)	3	Allama Iqbal Open University University of the Punjab University of Karachi
Romania (RO)	1	Spiru Haret University
Russian Fed. (RU)	1	Modern University for the Humanities
South Africa (ZA)	1	University of South Africa
Spain (ES)	1	National University of Distance Education
Thailand (TH)	1	Ramkhamhaeng University
Turkey (TR)	1	Anadolu University
United Kingdom (UK)	1	Open University
United States (US)	15	University System of Ohio State University of New York California State University University System of Georgia State System of Florida University of California Technical College System of Georgia University of Texas System Utah System of Higher Education University of North Carolina University of Wisconsin System University System of Maryland Texas A&M University System Pennsylvania State System of Higher Education Oregon University System

Reference: http://en.wikipedia.org/wiki/List_of_largest_universities_by_enrollment

On the other hand, political, economic and technological developments started a strong movement towards internationalization. Increasing integration and interdependence of national economies are followed by the attempts towards economic integration at regional levels (Europe, South East Asia, North and South America, and East and Southern Africa). International and regional co-operation in education and training is often included in any kind of integration between different countries. Internationalization is encouraged by the development of information and communication technologies. By the help of such developments, international and regional markets for education and training emerged in many places in the world (UNESCO, 2002).

So far, basing on our argument we can say that a mega university in a country, the concept of information society and information and communication technologies are feeding and supporting each other, and they are very important concept which are closely associated with each other. So, we carried our study on these three main concepts, and identified the variables of our analysis in this framework.

3. Methodology

In our study, we used the multidimensional scaling analysis (MDS), which is one of the multivariate statistical analysis techniques named as perceptual mapping model. The general purpose of the MDS analysis is, with lesser number of dimensions, to represent the structure of objects (using the distance values) as close to their original form. Thus, when relations between objects are unknown by using distances between objects can identify these relationships (Berberoğlu, 2010). Complex relationships between objects or individuals in multi-dimensional data matrix is easily understandable with this analysis technique and is reduced further explainable size. The map composed at the results of the analysis, shows that objects which are close to each other are similar, while far objects are not similar (Lilien & Rangaswamy, 2003; Yenidoğan, 2008).

Similar to clustering and discriminant analysis, the MDS is among the Q analysis techniques; moreover, it is also among R analysis techniques due to its characteristic of dimension reduction. MDS operates directly on dissimilarities and no statistical distribution assumptions are necessary in it. According to the type of the variable, the calculated distances between objects can be represented with the least error in MDS by any form of regression method (linear, polynomial, monotonic) (Kalaycı, 2008).

To conduct MDS, a collection of similarity estimates between each pair of items in the stimulus set. For a set composed of k items, $(k(k+1))/2$ proximities must be acquired, such that each item is compared to every other at least once. One of the main objectives of the MDS analysis is finding the best-fitting least-dimensional spatial map of the object, so in the analysis, determining the number of dimensions is also important (Akküçük, 2009; Berberoğlu, 2010).

The reliability and validity of the results in MDS must be tested. There exits two stages in testing the reliability and validity of the analysis. The first of these, known as the coefficient of determination R^2 is to be interpreted. R^2 is the square of the correlation coefficient which indicates how well the model represents the objects in a multi-dimensional scaling analysis. The desired value of R^2 is %60 or over. The second stage which is needed to test the reliability and validity of the findings is the interpretation of the stress values. Stress coefficient which is a measure of goodness of fit, indicates the quality of the MDS analysis and has been widely used (Dura, Atik, & Türker, 2004).

Shepard diagram shows the relationship between inter-object distance and dissimilarity for all pairs of objects in MDS. Shepard diagram is simply a scatterplot with dissimilarity on the horizontal axis and inter-object distance on the vertical axis. Now consider a linear or nonlinear regression model relating inter-object Euclidean distance as the response variable to dissimilarity as the predictor variable. The differences between the observed inter-object distances those predicted by the regression model (disparities) are the residuals from the regression model. These residuals can be used to measure the match between the calculated dissimilarities and the inter-object distances in the configuration (Kalaycı, 2008).

SPSS program gives two stress values as Young and Kruskal. These stress values can be calculated according to the distances between objects (Özdamar, 2004). The stress coefficients obtained as a result of the analysis is evaluated in Table 2:

Table 2: Stress and Goodness of Fit

Stress Value	Goodness of Fit
$\geq 0,20$	Poor
0,10-$<$0,20	Fair
0,05-$<$0,10	Good
0,025-$<$0,05	Excellent
0,00-$<$0,025	Perfect

3.1. Variables Used in the Analysis

The variables below, from the 2nd to 12th were obtained from the data of World Bank. We carried MDS analysis by using these variables:

- Mega University Numbers of Countries
- Electric power transmission and distribution losses (% of output)
- Residential fixed line telephone tariff (US\$ per month)
- Mobile cellular prepaid tariff (US\$ per month)
- Fixed broadband Internet access tariff (US\$ per month)
- ICT goods exports (% of total goods exports)
- ICT goods imports (% total goods imports)
- Secure Internet servers (per 1 million people)
- Internet users (per 100 people)
- Fixed broadband Internet subscribers (per 100 people)
- Age dependency ratio, young (% of working-age population)
- Population ages 15-64 (% of total)

3.2. The Countries Involved in the Analysis

As we have already mentioned, 23 home countries of the mega universities are examined in our analysis. These countries are Argentina (AR), Brazil (BR), China (CN), Dominican Republic (DO), Egypt (EG), France (FR), India (IN), Indonesia (ID), Iran

(IR), Italy (IT), Korea Republic (KP), Malaysia (MY), Mexico (MX), Nepal (NP), Pakistan (PK), Romania (RO), Russian Fed. (RU), South Africa (ZA), Spain (ES), Thailand (TH), Turkey (TR), United Kingdom (UK) and United States (US). In reaching the variables used in the analysis we used especially the data set of World Bank. However, even though mega-universities exist in Bangladesh and Guatemala, these countries were not included in the analysis, because of the lack of statistical data related to other variables which we considered.

4. The Findings of the Analysis

In MDS analysis solutions are desired in three or lesser dimensions. Because in such cases the graphical representation of the objects or the units can be monitored and analyzed easily. When the number of dimensions increases the ground will be difficult to detect. So, we determined the number of dimensions, first as 2 and then as 3. When evaluating the obtained stress value from the result of MDS model constructed with 2-dimensions, we see that the value of Young's stress value is being 0.11286 after the 4. iteration. Then, with a high R^2 value such as 0.96019, Kruskal's stress values is found to be as 0.12377. According to Table 2, our model has a fair fit. Because of the fair fit we obtained in 2-dimensional model, we continue our analysis with 3-dimensions. The generated stress values which specifies the goodness of fitting in 3-dimensional model must be examined. First, we see that Young's stress value is 0.07091 after the 4. iteration. Then we see that, Kruskal's stress value is 0.07559, with a high R^2 value such as 0.97664. These results, according to Table 2 shows us that our model has a good fit. When we look at the disparities, two closest states are Pakistan and India. The Indian sub-continent during the British rule included the present Pakistan and Bangladesh, and any educational developments during and subsequent to the rule are excluded today in describing the educational status of independent India. Today, while evaluating the level education in India and Pakistan we must consider the period passed under British rule (Panda, Venkaiah, Garg, & Puranik, 2006). It must be mentioned that Bangladesh is beyond our sample.

Argentina is the closest country to Turkey. Closest other countries to Turkey respectively, Romania, South Africa, Brazil, Dominican Republic, Mexico, Italy, Egypt and Russia. Berberoğlu (2010), with the title of 'Turkey And European Union On The Path Of Establishing Knowledge Society And Economy' cited that the closest country to Turkey is Romania. However, according to the variables considered in this study, Turkey has a remarkable similarity with countries in South America.

United States of America (USA), is the best country in its group, and varies widely from many states in the same group. However, UK is the nearest country to USA with 1.254 value. South Korea is following the United States with 1.300 value and also following UK 1.698 value. When we look at Disparities Matrix we see that the farthest countries are UK and Nepal and the second farthest countries are France and Nepal.

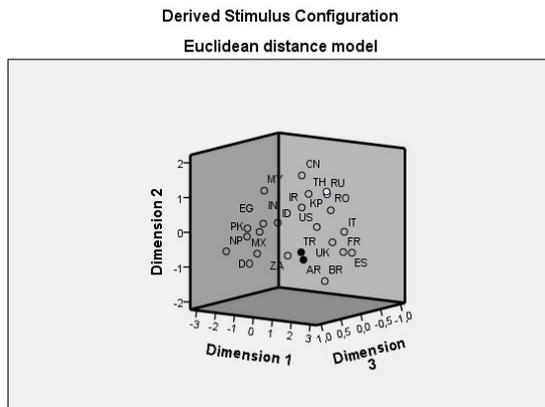


Figure 1: Euclidean Distance Model

With the help of Figure 1, the locations of Turkey and other countries are shown in 3-dimensional space. Turkey is highlighted with a dark point. However, as can be seen from the Figure 1, the closest country to Turkey is Argentina.

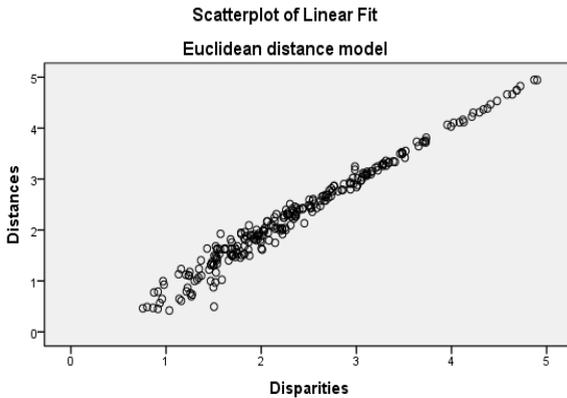


Figure 2: Shepard Diagram

According to the Shepard diagram, disparities between the objects and distances are fitting linearly with each other can be seen in Figure 2. One of the basic objectives in MDS is, the measurement of the similarity between the data directly obtained from the distance matrix and the estimated distances from the distance matrix generated. The linear relationship seen in Figure 2. shows that estimated distances fit the real values.

5. Results and Evaluations

In MDS analysis solutions are desired to be in three or lesser dimensions. Because when the number of dimensions grow in the analysis the detection gets difficult. So, we carried our analysis first by using only 2-dimensions, but we obtained fair fit. Then, we decided to use 3-dimensions and we entered 253 data related to 11 variables. After this choice, our analysis showed good fit with a high R^2 value.

Table 3: Optimally scaled data (disparities) and Countries

Sorting	Distance Value (Optimally scaled data (disparities))	Countries
1.	0.755	Pakistan (PK) and India (IN)
2.	0.801	Romania (RO) and Russian Fed. (RU)
3.	0.862	Turkey (TR) and Argentina (AR)
4.	0.873	Pakistan (PK) and Indonesia (ID)
5.	0.913	France (FR) and United Kingdom (UK)
6.	0.915	France (FR) and Spain (ES)
7.	0.934	Nepal (NP) and Pakistan (PK)
8.	0.968	China (CN) and Thailand (TH)
9.	0.978	Spain (ES) and Italy (IT)
.	.	.
.	.	.
.	.	.
252.	4.869	Nepal (NP) and France (FR)
253.	4.901	Nepal (NP) and United Kingdom (UK)

When we look at the disparities, we can say that values below 1 and over 4 are especially noteworthy when their closeness to each other is emphasized. We tried to summarize these results in Table 3.

With the help of created perceptual map in 3-dimensional space, we saw that Argentina is the closest country to Turkey. After that, countries such as Romania, South Africa, Brazil, Dominican Republic, Mexico, Italy, Egypt and Russia was found to be close to Turkey. These results can be seen in Table 4.

Table 4: Close Countries to Turkey (according to their distances)

Sorting	Distance Value (Optimally scaled data (disparities))	Countries
1.	0.862	Argentina (AR)
2.	1.158	Romania (RO)
3.	1.159	South Africa (ZA)
4.	1.207	Brazil (BR)
5.	1.243	Dominican Rep. (DO)
6.	1.346	Mexico (MX)
7.	1.501	Italy (IT)
8.	1.538	Egypt (EG)
9.	1.568	Russian Fed. (RU)

As mentioned earlier, efforts in international and regional cooperation often contain joint projects and organizations related to education and training. Wherein, if geographical closeness is playing an important role for Turkey, closeness with Romania and then Russia is so striking. Therefore, to create alliances and cooperation with these countries in the fields of education and training may have important consequences for the future.

References

- Akküçük, U. (2004). Çok Boyutlu Ölçekleme Tekniği Olarak Torgersen Ölçekleme Yöntemi ve Temel Bileşenler Analizi ile Karşılaştırması, ISSN–1302–1842, *Dumlupınar Üniversitesi, Sosyal Bilimler Dergisi*, Aralık, 25, s.312
- Bates A. W. (Tony), (2005). *Technology, E-learning and Distance Education*, Second Edition, ISBN: 0-415-28436-8 (hbk), ISBN: 0-415-28437-6 (pbk), Routledge, Taylor & Francis Group, London and New York, s. 139, 215
- Bates A. W., (2000). *Managing Technological Change: Strategies for College and University Leaders*, San Francisco: Jossey-Bass.
- Berberoğlu, B., (2010). Bilgi Toplumu ve Bilgi Ekonomisi Oluşturma Yolunda Türkiye ve Avrupa Birliği, *Marmara Üniversitesi, İktisadi ve İdari Bilimler Fakültesi Dergisi*, Cilt: XXIX, Sayı:2, s.111-131
- Coombs, P. (1985). *The World Crisis in Education: The view from the eighties*, OUP, Oxford
- Daniel, J. S., (1998). *Mega Universities and Knowledge Media Technology Strategies for Higher Education*, ISBN: 0 7494 2634 9, Kogan Page Limited, London, s. 4, 8, 29, 35, 68
- Panda, S., Venkaiah, V., Garg, S. & Puranik, C., (2006). *Tracing the Historical Developments in Open and Distance Education*, In S. Garg et al (Eds.) (2006) *Four Decades of Distance Education in India: Reflection on Policy and Practice*. New Delhi: Viva Books.
- Postman, N. (1993). *Technopoly: The Surrender of Culture to Technology*, New York, Vintage Books/ Random House.
- Dura, C., Atik, H., Türker, O., (2004). *Beşeri Sermaye Açısından Türkiye'nin Avrupa Birliği Karşısındaki Kalkınma Seviyesi*, 3. Ulusal Bilgi, Ekonomi ve Yönetim Kongresi, 2004, Bildiriler Kitabı, Eskişehir, s.15
- Kalaycı, Ş., (2008). *SPSS Uygulamalı Çok Değişkenli İstatistik Teknikleri*, Asil Yayın Dağıtım LTD. ŞTİ., 3. Baskı, ISBN 975-9091-14-3, s.379-399
- Lilien, G. L., Rangaswamy, A. (2003). *Marketing Engineering Computer Assited Marketing Analysis and Planning*, Prentice Hall, New Jersey, s.128
- Özdamar, K. (2004). *Paket Programlar ile İstatistiksel Veri Analizi (Çok Değişkenli Analizler) 2*, Yenilenmiş 5. Baskı, ISBN: 975-6787-11-2, Kaan Kitabevi, s.501-518
- Yenidoğan, T. G., (2008). Pazarlama Araştırmalarında Çok Boyutlu Ölçekleme Analizi: Üniversite Öğrencilerinin Marka Algısı Üzerine Bir Araştırma, *Akdeniz İktisadi ve İdari Bilimler Fakültesi Dergisi*, (15), s.140.

Internet References

- http://en.wikipedia.org/wiki/List_of_largest_universities_by_enrollment (Access Date:04.02.2014)
- <http://unesdoc.unesco.org/images/0012/001284/128463e.pdf> (Access Date: 06.06.2013)
- <http://data.worldbank.org/indicator> (Access Date: 05.03.2014)