

How to rank universities from sustainability perspective?

Research, educational and environmental indicators

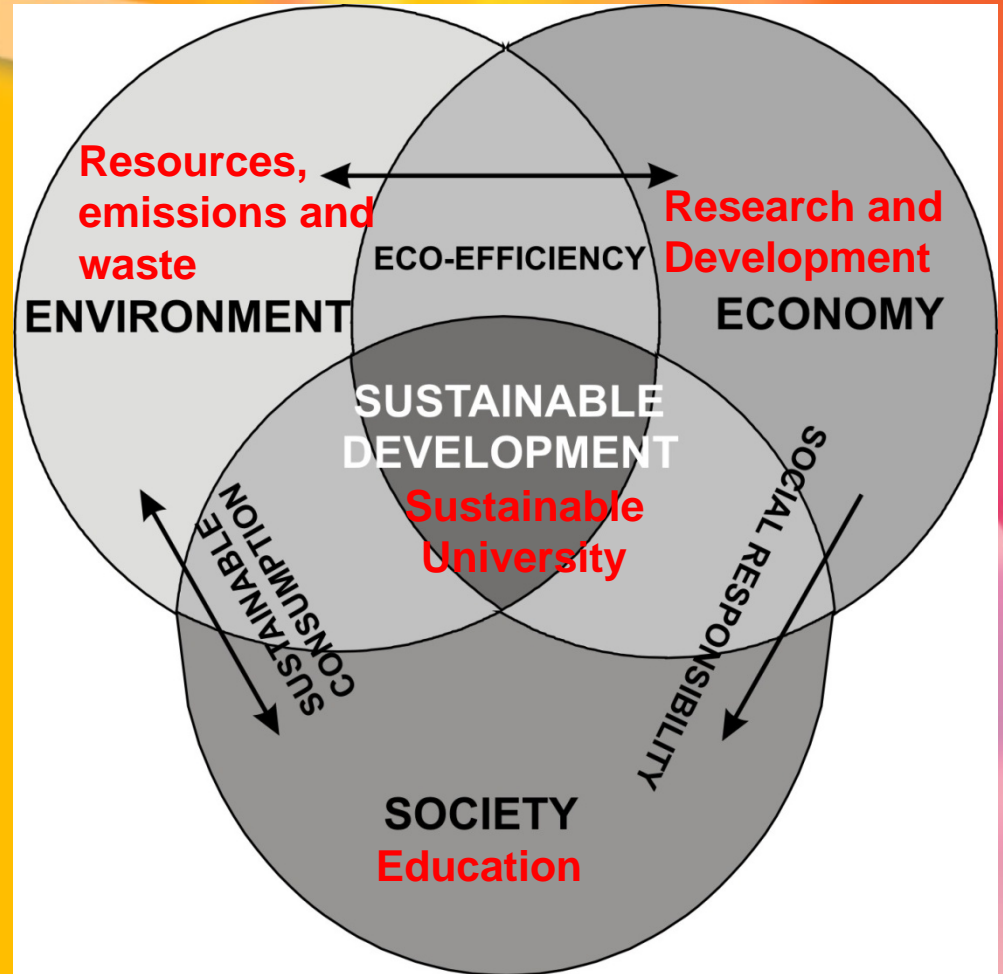
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Introduction

- Ranking is **global phenomenon**, starting in **1983**
- **Purposes** of ranking tables (Jesenšek, 2006):
 - evaluating **global entrance** to HE programmes,
 - evaluating **international higher education market**,
 - introducing market **direction of universities** at national level and
 - enhancing **positive competition**.

Introduction

- Environmental preservation
- Economic prosperity
- Societal development needs



Ranking tables

Indicators	Ranking tables							
	Asia's best universities	Meclean's best universities	ARWU ranking	CHE ranking	THES ranking	Webometrics ranking	US News Best colleges	College Sus Report Card
<i>Research and academic reputation</i>								
• Publications	✓		✓	✓	✓	✓		
• Research expenses	✓	✓		✓			✓	
• Library and equipment	✓	✓		✓				
<i>Education</i>								
• Student/staff ratio				✓	✓		✓	
• Graduation rate		✓		✓			✓	
• International students		✓		✓	✓			
• Presence on the web						✓		
• Employment rate	✓			✓				
<i>Environmental performance</i>								✓

Criticism about ranking tables

Critics:

- RT conceal **methodological problems** (Marginson, 2007)
- Why particular indicator was chosen, how well it was funded, by whom it was decided, how open and reflective the decision process was (RFSU, 2008)
- **Subjective evaluations** (peer review)
- **Research oriented** indicators
- **Subjective data** received from universities themselves (Enserink, 2007)
- Social sciences and humanities suffer under Shanghai system (20 % *Nature and Science*)

? **Credibility of ranking tables**

Our research

Objective: - to rank universities from three perspectives
- to develop a quality index

Quality index:

- Comprehensive university ranking
- Evaluation of development trends
- Identification of “hot spots” and improvement options
- Communication with stakeholders

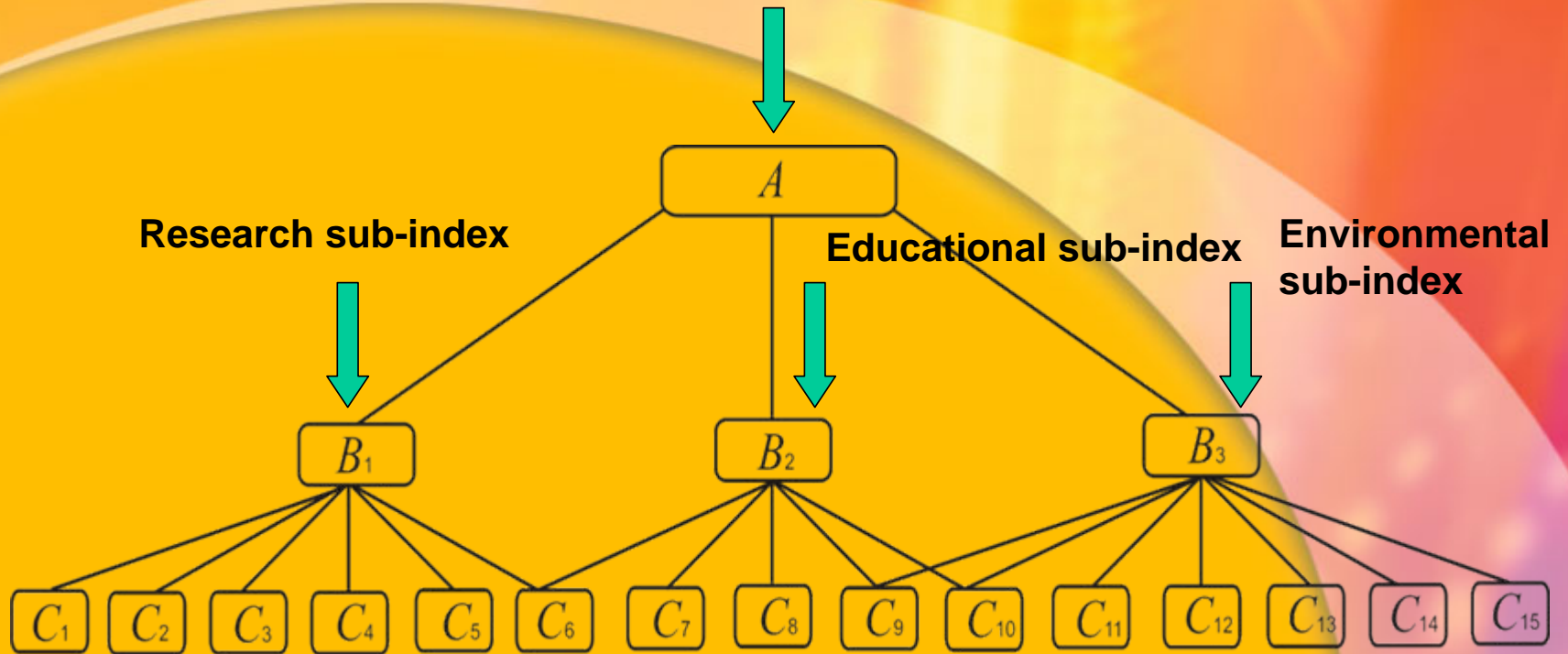
Index, permitting an evaluation from

- Research
- Educational
- Environmental perspective

has **not been developed** yet.

Indicators

Index



Weighting

To **determine the weight** of each indicator

- Analytical hierarchical process (AHP) has been used to calculate the **contributions** of each indicator to the various sub-indices and index.

AHP: was developed by Saaty (1980). It is an **intuitive method** for formulating and **analyzing decisions**.

Saaty (1980, 2000) suggests the use of **9-point scale** to transform the verbal judgements into numerical quantities.

Numerical values	Verbal scale
1	Equal importance of both elements
3	Moderate importance of one element over another
5	Strong importance of one element over another
7	Very strong importance of one element over another
9	Extreme importance of one element over another

Judgment matrix

	C_1	C_2	C_3	C_4	C_5	C_6	Weights (w)
C_1	1,0000	1,6583	3,4581	3,5831	3,1664	3,4164	0,3096
C_2	0,6030	1,0000	2,2220	2,4673	2,8444	4,5630	0,2605
C_3	0,2892	0,4500	1,0000	1,4578	1,9162	2,8741	0,1519
C_4	0,2790	0,4053	0,6860	1,0000	1,7156	2,5185	0,1101
C_5	0,3158	0,3516	0,5219	0,5829	1,0000	3,5111	0,1195
C_6	0,2927	0,2192	0,3479	0,3971	0,2848	1,0000	0,0484

$$\lambda_{\max} = 6,2367$$

$$I_C = 0,04734$$

$$R_C = 0,0378 < 0,1$$

$$R_C = \frac{I_C}{R_1}$$

$$I_C = \frac{\lambda_{\max} - N}{N - 1}$$

Normalization

$$C_{N,ij}^+ = \frac{C_{ij}^+ - C_{\min,j}^+}{C_{\max,j}^+ - C_{\min,j}^+}$$

$$C_{N,ij}^- = 1 - \frac{C_{ij}^- - C_{\min,j}^-}{C_{\max,j}^- - C_{\min,j}^-}$$

Indicators group	Indicators with positive impact	Indicators with negative impact
Research	$C_1, C_2, C_3, C_4, C_5, C_6$	
Educational	C_8, C_{10}	C_7, C_9^*
Environmental	$C_{11}, C_{12}, C_{13}, C_{14}, C_{15}$	



“more is better”



“less is better”

Aggregation and ranking

Aggregation

$$B_j = \sum_{ij}^N w(C_{i,j})_{B_j} C_{N,ij}^+ + \sum_{ij}^N w(C_{i,j})_{B_j} C_{N,ij}^-$$

Ranking

$$A = \sum_j^N w(B_j)_A B_j = \sum_{ij}^N w(C_{ij})_A C_{ij}$$

Final Rank	University	B_1	Rank	B_2	Rank	B_3	Rank
1	Harvard	0,429	2	0,861	2	0,603	7
2	Stanford	0,418	3	0,825	3	0,588	10
3	MIT	0,397	5	0,713	5	0,600	9
5	UC San Franc	0,533	1	0,558	14	0,336	25
6	Princeton Univ	0,279	9	0,893	1	0,387	22
8	Duke	0,265	11	0,562	13	0,692	1

Correlations

Correlations between ranking tables

Ranking tables	Correlation coefficient
ARWU and NEW RT	0,6711
THES and NEW RT	0,3418

Correlations between indicators

Indicators	Correlation coefficient
HiCi and <i>h</i> -index	0,7131
<i>h</i> -index and research expenses	0,6020
Student/staff ratio and graduate rate	0,0650

Discussion

A new ranking method is to provide simplified information about the qualities of universities in respect to the three various perspectives

- research,
- educational and
- environmental

The proposed method is **flexible** and enables also inclusion of more indicators. Then AHP process has to **be repeated** with a new pair wise comparison.

Limitations:

- **indicators (objective, accessible)**
- determination of **weights** of the indicators

Conclusions and Outlook

Conclusions:

- provides information about universities' characteristics, but also allows understanding of its development
- provides an opportunity for determining “hot spots” and their improvement options.

Proposed university ranking is an attempt to evaluate universities from a more perspectives.

Outlook:

The **CHEPRA** Network (Consortium for Higher Education and Research Performance Assessment) wins a European tender to develop a multi-dimensional global ranking of universities – they have a responsibility to include sustainability indicators

- **indicators:** a need for **standardization exists** (reporting, data base)
European Commission directive or UN (UNESCO)
- determination of **weights** of the indicators, which are mostly based on the personal opinion of the expert



Thank you for your attention

Calculating the local priority

$$w(C_{i,j})_A = \sum_{ij}^N \left[w(C_i)_{B_j} w(B_j)_A \right]$$

C_i	Indicator	$w(C_i)_{B_1}$	$w(C_i)_{B_2}$	$w(C_i)_{B_3}$	$w(C_{i,j})_A$
C_1	Patents	0,3096	-	-	0,1684
C_2	Research expenditure	0,2605	-	-	0,1416
C_3	Highly cited researchers	0,1519			0,0826
C_4	Hirsch indices	0,1195	-	-	0,0649
C_5	SCI	0,1101	-	-	0,0599
C_6	Expenses for ICT and/or library	0,0484	0,3212	-	0,1282
C_7	Student/staff ratio	-	0,2769	-	0,0878
C_8	Graduation rate	-	0,2360	-	0,0749
C_9	Presence on the web	-	0,1007	0,0658	0,0412
C_{10}	Mobility	-	0,0652	0,0655	0,0298
C_{11}	Voluntary environmental agreements, commitments,	-	-	0,2032	0,0282
C_{12}	Sustainability oriented courses	-	-	0,2020	0,0225
C_{13}	Sustainability oriented programmes	-	-	0,1616	0,0281
C_{14}	Office, council or manager for sustainable development	-	-	0,1542	0,0214
C_{15}	Sustainability vision, mission	-	-	0,1477	0,0205
	SUM	1,0000	1,0000	1,0000	1,0000