Chapter 10
An Interactive Multidimensional Ranking Web Tool

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10.1 Introduction

The quality of a ranking to a large extent depends on the quality and user-friendliness of the presentation of its results. In the past, rankings were mainly published in static print form, but for a number of years many rankings have opted for online publication (replacing or in addition to print publication). In most rankings the tables can now be sorted by individual indicators as a minimum degree of interactivity. A few rankings (e.g. the Taiwanese College Navigator published by HEEACT[1] and CHE Ranking) have implemented tools to produce a personalized ranking, based on user preferences and priorities with regard to the set of indicators. This approach is consistent with the user-driven notion of ranking which is a basic feature of U-Multirank.

The presentation of U-Multirank results outlined in this chapter strictly follows this user-driven approach. But by relating institutional profiles (created in U-Map) with multidimensional rankings, U-Multirank introduces a second level of interactive ranking beyond the user-driven selection of indicators: the selection of a sample of institutions to be compared in focused rankings. Existing international rankings are largely limited to one 'type' of institution only: internationally-oriented research universities. U-Multirank has a much broader scope and intends to include a wider variety of institutional profiles. We argue that it does not make much sense to compare institutions across diverse institutional profiles. Hence U-Multirank offers a tool to identify and select institutions that are truly comparable in terms of their institutional profiles.

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[1] College Navigator: http://cnt.heeact.edu.tw/site1/index2.asp?method=eintro; CHE Ranking: http://ranking.zeit.de/che2011/en/ (both retrieved on 9 May 2011).

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10.2 Mapping Diversity: Combining U-Map and U-Multirank

From the beginning of the U-Multirank project one of the basic aims was that U-Multirank should be – in contrast to existing global rankings which brought about a dysfunctional short-sightedness on 'world-class research universities' – a tool to create transparency regarding the diversity of higher education institutions. The bias of existing rankings towards one specific institutional profile appears to result in the devaluing of other institutional profiles and decreasing diversity in higher education systems (see Chap. 4).

Our pilot sample includes institutions with quite diverse missions, structures and institutional profiles. We applied the U-Map profiling tool to specify these profiles. U-Map offers a multidimensional description of profiles in six dimensions. It is user-driven in the sense that there are no fixed categories or types of institutions. Instead, users can create their own profiles by selecting indicators relevant to them out of the six dimensions.

The combination of U-Map and U-Multirank offers a new approach to user-driven rankings. Users can not only select performance indicators according to their own preferences and priorities; they can also define the institutional profile they are interested in and hence the sample of institutions to be compared in U-Multirank (Fig. 10.1).

We envisage the public face of U-Multirank being a user-driven interactive web tool. This tool has yet to be developed but we have designed a simple prototype to
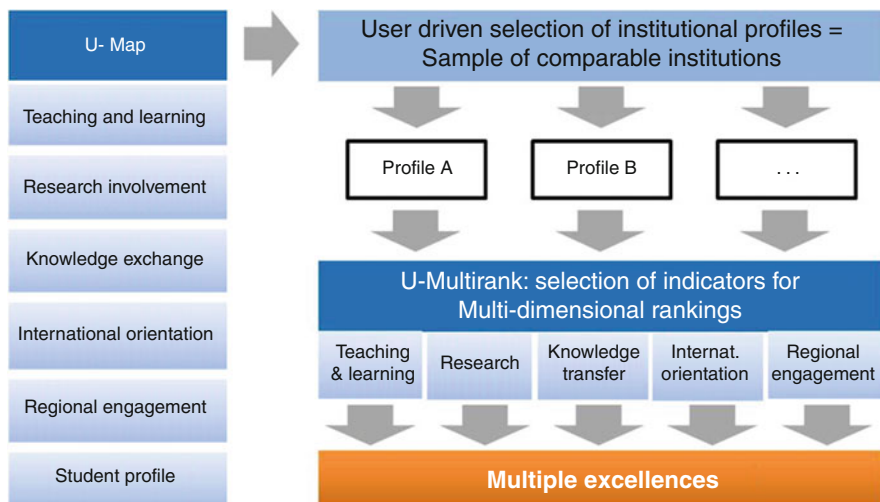
Fig. 10.1 Combining U-Map and U-Multirank

illustrate in broad terms what we think it will look like. The tool will include the two steps outlined above. Users will be offered the option to decide if they want to produce a focused institutional ranking or a field-based ranking, and in the latter case they can select the field(s). The next step will be the selection of the institutional profile the user is interested in. This selection defines the sample of institutions that will be included in the ranking. The user will have the option of selecting criteria from all U-Map dimensions or focusing on a specified set of dimensions. In a third step the user selects the ways the results will be presented. U-Multirank will include different ways of presenting the results.

10.3   The Presentation Modes

Presenting ranking results requires a general model for accessing the results, including provision for guiding users through the data and a visual framework to display the result data. In U-Multirank the presentation of data allows for both:

- a comparative overview on indicators across institutions, and
- a detailed view of institutional profiles.

The ideas presented below are mainly inspired by the existing U-Map visualizations and the way results are presented in the CHE Ranking.

U-Multirank produces indicators and results at different levels of aggregation leading to a hierarchical data model:

- Data at the level of institutions (results of focused institutional rankings)
- Data at the level of departments (results of field-based rankings)
- Data at the level of programs (results of field-based rankings)

The presentation format for ranking results should be consistent across the three levels while still accommodating the particular data structures on those levels. We suggest the following modes of presentation: interactive overview (Sect. 10.3.1), personalized ranking tables (Sect. 10.3.2), institutional results at a glance (Sect. 10.3.3) and a detailed listing of results for single institutions, departments and programs (Sect. 10.3.4).

10.3.1   Interactive Tables

The most common format used in ranking results is a table listing all institutions included in the ranking and all (or a selection of) indicators. In league table rankings tables are usually sorted by rank position. In U-Multirank we present the results alphabetically or by rank groups (see Chap. 6).

Table 10.1 Default table with three indicators per dimension

	Teaching & learning			Research			Knowledge transfer			International orientation			Regional engagement		
	Student/staff ratio	Graduation rate	Qualification of academic staff	Research publication output	External research income	Field-normalized citation rate	% Income third party funding	CPD courses offered	Start-up firms	International academic staff	% International students	Joint international publications	Graduates working in region	Internships in local enterprise	Regional co-publication
Institution 1	🟡	–	–	🟡	🟢	🟢	🟢	🟡	🟢	🟢	🟡	🟢	🟢	🟡	🟢
Institution 2	🔴	🟡	🟡	🟢	🟢	🟢	–	🟢	🟢	🟡	🔴	🟢	🔴	🔴	🟢
Institution 3	🟡	🟢	🟢	🟡	🟢	🟡	🟡	🟢	🟢	🟢	🟡	🟢	🟡	–	🟡
Institution 4	🟢	🟡	🟡	🟢	🔴	🟡	🟢	🟡	🟢	🟡	🔴	🟢	🟢	🔴	🟡
Institution 5	🟡	🟢	🟢	🔴	🟢	🟢	🟡	🟢	🔴	🟢	🔴	🟢	🟡	🟡	–
Institution 6	🔴	🔴	🟡	🔴	–	🟢	🟢	🟡	🟢	🔴	🟢	🟢	🟢	🟡	🟢
Institution 7	🟡	🟡	🔴	🟡	–	🟢	🟢	–	🟢	–	🟡	🟡	🟡	🔴	🟡
Institution 8	🟢	🟡	🟡	🟡	–	🟡	🟡	🔴	🟡	🔴	🟡	–	🟡	🟢	🟢
Institution 9	🟡	🔴	🔴	🟡	🔴	🟢	🟢	🟡	🔴	🟢	🟡	🔴	🔴	🟡	🔴

In the first layer of the table (field-based ranking), an overview is presented comprising three selected indicators per dimension, a total of 15 indicators. The table displays the ranking groups representing the relative scores on the indicators. The current table is a 'default' table. The selection of the indicators in this table will eventually be user-driven. Based on the actual choices made by users in formulating their personalized ranking tables (see Sect. 10.3.2) the indicators chosen most frequently will be presented in the default table (Table 10.1).

Of course, tables can be sorted by a single indicator. Following the grouping approach, institutions are sorted alphabetically within groups – the ranking does not produce a league table, only groups. In the following example the institutions are sorted by the indicator 'research publication output' (Table 10.2).

In Chap. 1 we discussed the necessity of multidimensional and user-driven rankings for epistemological reasons. Empirical evidence from the feasibility study strongly supports this view. The overview table above shows several institutions from the pilot sample and demonstrates that no institution performs in the top group (or bottom group) on all dimensions and indicators. While some institutions demonstrate average performance in many indicators, others show a clear performance profile with marked strengths and weaknesses.

Users may examine one or more dimensions in depth, drilling down to the second layer of the table by clicking on a single dimension, e.g. 'Research', which will then display the complete list of all indicators in that dimension (Table 10.3).

Table 10.2 Default table with three indicators per dimension; sorted by indicator 'research publication output'

Legend: G = green, Y = yellow, R = red, – = not available.

	Teaching & learning			Research			Knowledge transfer			International orientation			Regional engagement		
	Student/staff ratio	Graduation rate	Qualification of academic staff	Research publication output	External research income	Field-normalized citation rate	% Income third party funding	CPD courses offered	Start-up firms	International academic staff	% International students	Joint international publications	Graduates working in region	Internships in local enterprise	Regional co-publication
Institution 2	R	Y	Y	G	G	G	–	R	Y	Y	Y	Y	R	R	R
Institution 4	G	Y	Y	G	R	G	R	Y	Y	Y	G	R	R	G	Y
Institution 1	Y	–	–	Y	G	G	G	Y	G	Y	Y	G	G	G	G
Institution 3	Y	G	G	Y	G	Y	G	G	Y	Y	G	Y	Y	–	Y
Institution 7	Y	Y	R	Y	–	G	–	G	–	Y	Y	Y	R	Y	G
Institution 8	G	Y	Y	Y	–	Y	Y	R	Y	R	Y	–	G	G	G
Institution 9	Y	R	R	Y	G	R	Y	Y	R	G	Y	Y	G	Y	R
Institution 5	Y	G	Y	R	G	G	Y	Y	R	G	R	R	Y	G	–
Institution 6	R	Y	Y	R	–	G	G	G	G	R	G	G	Y	Y	G

Table 10.3 Default table for one dimension

	Research				
	External research income	Research publication output	Doctorate productivity	Field-normalized citation rate	Highly cited research publications
Institution 1	G	Y	–	G	G
Institution 2	G	G	Y	G	R
Institution 3	G	Y	G	Y	G
Institution 5	G	R	G	G	G
Institution 4	R	G	G	Y	Y
Institution 9	R	Y	R	R	R
Institution 7	–	Y	R	R	G
Institution 8	–	Y	Y	Y	G
Institution 6	–	R	Y	R	Y

10.3.2   Personalized Ranking Tables

The development of an interactive user-driven approach is a central feature of U-Multirank. Users have different views on the relevance of indicators included in a ranking and the tool will recognize this by allowing users to select the individual
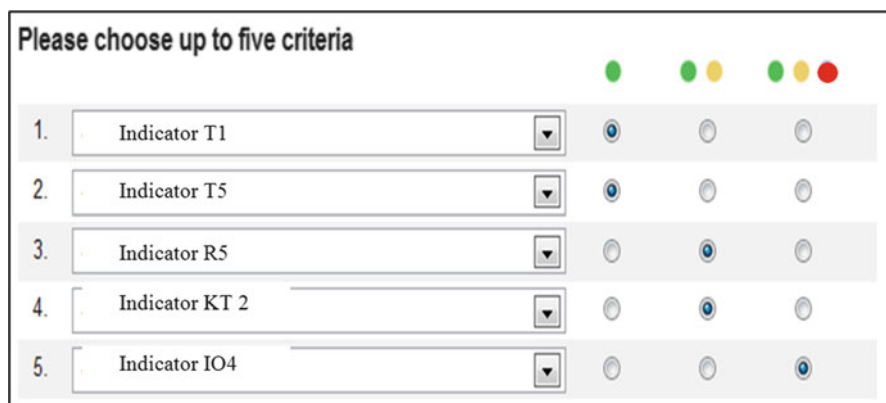
indicators they feel are relevant. This option is available both for the focused institutional rankings and the field-based rankings.

Personalized ranking implies a two-step process:

- First, users select a limited number of indicators, from one or more dimensions
- In a second step, users can specify the result table by choosing rank groups for each indicator selected (e.g. top level only; at least mid-table, all groups etc.).

The following figure shows how users can select indicators (Fig. 10.2).

The 'green' column refers to the top group only; the 'green and yellow' column refers to at least the middle group and the final column to all groups.

Please choose up to five criteria

		●	● ●	● ● ●
1.	Indicator T1	◉	○	○
2.	Indicator T5	◉	○	○
3.	Indicator R5	○	◉	○
4.	Indicator KT 2	○	◉	○
5.	Indicator IO4	○	○	◉

Fig. 10.2 User selection of indicators for personalized ranking tables

The result will be a personalized ranking according to the selection of indicators by the user (Table 10.4).

Table 10.4 Personalized ranking table

	International academic staff	Research publication output	Doctorate productivity	Student internships in local enterprise	CPD courses offered
Institution 4	green	green	green	red	yellow
Institution 9	green	yellow	red	yellow	yellow
Institution 1	yellow	yellow	–	yellow	yellow
Institution 2	yellow	green	yellow	red	red
Institution 3	yellow	yellow	green	–	green
Institution 5	yellow	red	green	green	green
Institution 8	red	yellow	yellow	green	red
Institution 6	red	red	yellow	yellow	yellow
Institution 7	–	yellow	red	red	–

10.3.3 Institutional Results at a Glance: Sunburst Charts

Not all users will want to read a lengthy table when applying U-Multirank. An intuitive, appealing visual presentation of the main results will introduce users to the performance ranking of higher education institutions. Results at a glance presented in this way may encourage users to drill down to more detailed information.

Graphic presentations may help to convey insights into the institutional results 'at a glance' with the performance of the institution as a whole presented without being aggregated into one composite indicator.

The number of presentation modes should be limited, so that there is a recognizable U-Multirank presentation style and users are not confused by multiple visual styles. Four 'at a glance' presentation options were discussed with stakeholders and there was a clear preference for the 'sunburst' chart similar to the one already used in U-Map. The variations in shading symbolize the five U-Multirank dimensions, with the rays representing the individual indicators. In this chart the grouped performance scores of institutions on each indicator are represented by the length of the corresponding rays: the larger the ray, the better the institution performs on that indicator. As shown in Fig. 10.3, different sunburst charts show different institutional performance profiles.
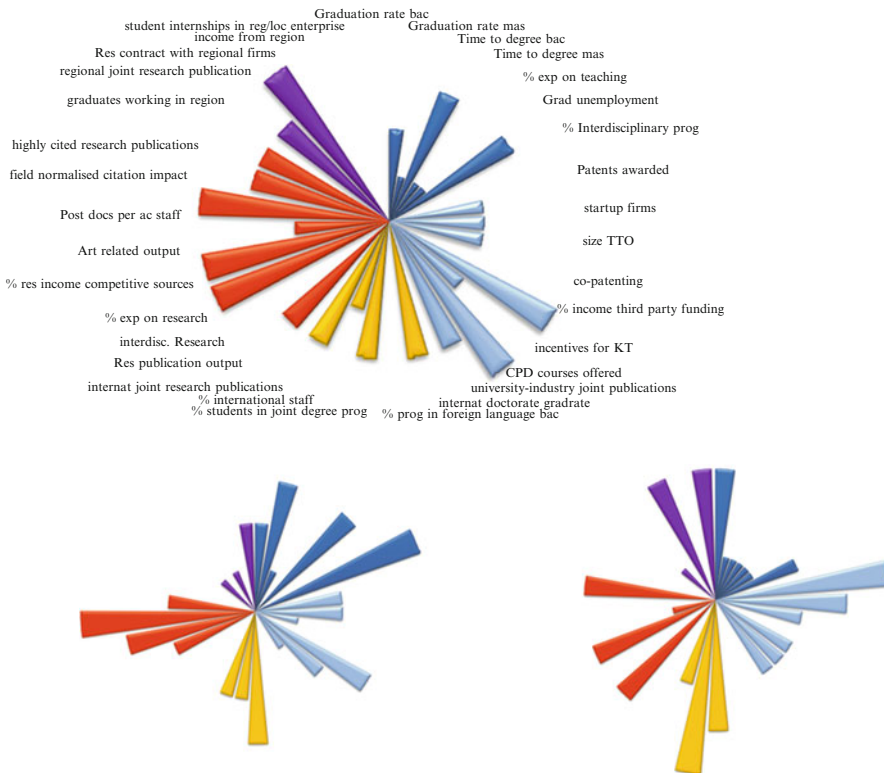
Fig. 10.3 Institutional sunburst chart

10.3.4 Presenting Detailed Results

In addition to the graphic presentation of the results of an institution, detailed infor-
mation may also be presented in text formats.

An example is a detailed view on the results of a department (the following
screenshot shows a sample business administration study program at bachelor level).
Here the user finds all indicators available for the institution – compared to the
complete sample (the groups) – as well as additional descriptive contextual infor-
mation (e.g. on the size of the institution/department). This kind of presentation
can be made available on the institution, faculty/department (field) and program
level (Fig. 10.4).

Fig. 10.4 Text format presentation of detailed results (example)

10.4 Contextuality

Rankings do not and cannot provide causal analyses of their results. They are
comparisons of performance results and offer information without claiming to
be able to explain the differences in performance. Nevertheless, rankings have
to take into account that contextual factors are highly relevant when comparing
results (Yarbrough et al. 2011). In general two types of context factors can be
distinguished:

• Context variables affecting the performance of higher education institutions.
• Context factors that may affect decision-making processes of users of rank-
  ings (e.g. students, researchers) although not linked to the performance of
  institutions.

For individual users rankings reveal that there are differences in reality. For instance: for prospective students intending to choose a university or a study program, low student satisfaction scores regarding the support by teaching staff in a specific university or program is relevant information, although the indicator itself cannot explain the reasons behind this judgment.

Rankings also have to be sensitive to context variables that may lead to methodological biases. An example which has been discussed intensively (cf. Van Raan, 2007) is the use of the publication of journal articles and article-based citations in institutional rankings.

Analytically, relevant context variables can be identified at different levels:

- The institution: context here can refer to the age, size and field structure of the institution.
- The (national) higher education system as a general context for institutions: this includes legal regulations (e.g. concerning access) as well as the existence of legal/official 'classifications' of institutions (e.g. in binary systems, the distinction between universities and other forms of non-university higher education institutions).
- The structure of national higher education and research: the organization of research in different higher education systems is an example. While in most countries research is largely integrated in universities, in some countries like France or Germany non-university research institutions undertake a major part of the national research effort.

A particular issue with regard to the context of higher education refers to the definition of the unit of analysis. The vast majority of rankings in higher education are comparing higher education *institutions*. A few rankings explicitly compare higher education systems, either based on genuine data on higher education systems, e.g. the University Systems Ranking published by the Lisbon Council,[2] or by simply aggregating institutional data to the system level (e.g. the QS National System Strength Ranking). In this latter case global institutional rankings are more or less implicitly used to produce rankings of national higher education systems, thereby creating various contextual problems. Both the Shanghai ranking and the QS rankings for instance are including universities only. The fact that they do not include non-university research institutions, which are particularly important in some countries (e.g. in France, Germany), produces a bias when their results are interpreted as a comparative assessment of the performance or quality of national higher education and research systems.

U-Multirank addresses the issues of contextuality by applying the design principle of comparability (see Chap. 6). In U-Multirank rankings are only created among institutions that have sufficiently similar institutional profiles. Combining U-Map and U-Multirank produces an approach in which comparable institutions are identified before they are compared in one or more rankings.

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[2] See www.lisboncouncil.net

By identifying comparable institutions, the impact of contextual factors may be assumed to be reduced.

In addition, U-Multirank intends to offer relevant contextual information on institutions and fields. Contextual information does not allow for causal analyses but it offers users the opportunity to create informed judgments of the importance of specific contexts while assessing performances. During the further development of U-Multirank the production of contextual information will be an important topic.

10.5   User-Friendliness

U-Multirank is conceived as a user-driven and stakeholder-oriented instrument. The development of the concept, the definition of the indicators, processes of data collection and discussion on modes of presentation have been based on intensive stakeholder consultation. But in the end a user-driven approach largely depends on the ways the results are presented. In U-Multirank a number of features are included to increase the user-friendliness.

In the same way as there is no one-size-fits-all-approach to rankings in terms of indicators, there is no one-size-fits-all approach to the presentation of the results. The presentation modes should allow for addressing different groups of users differently. According to the Berlin Principles, rankings should 'provide consumers with a clear understanding of all of the factors used to develop a ranking, and offer them a choice in how rankings are displayed' (International Ranking Expert Group, 2006, principle 15). U-Multirank, as with any ranking, will have to strike a balance between the need to reduce the complexity of information on the one hand and offering detailed information that meets the requirements of specific users on the other.

U-Multirank seeks to offer a tailor-made approach to presenting results, serving the information needs of different groups of users and taking into account their level of knowledge about higher education and higher education institutions. Basic access is provided by the various modes of presentation described above (overview tables, personalized rankings and institutional profiles). In addition access to and navigation through the web tool will be made highly user-driven by specific 'entrances' for different groups of users (e.g. students, researchers/academic staff, institutional administrators, employers) offering specific information regarding the results. Such a tailor-made approach implies different kinds and degrees of 'guiding' users through the ranking processes.

Another important aspect of user-friendliness is transparency about the methodology used in rankings. For U-Multirank this will include within the web tool a description of the basic methodological elements (institutional and field-based rankings, grouping approach), a description of underlying data sources (e.g. self-reported institutional data, surveys, bibliometric data, patent data) and a clear definition and explanation of indicators (including an explanation of their relevance and what they are measuring). This description of the methodology can be linked to the presentation

of results (e.g. by using hyperlinks) and hence increase users' understanding of the ranking substantially.

In the end the user-friendliness of a ranking tool cannot be assessed *a priori*. Tracking ranking use will be important. How will users choose to navigate through the web tool? What indicators are selected most frequently in personalized rankings? How deeply do users examine the results and where do they stop navigation? Tracking of user behavior will be systematically built into the development of the web tool to allow continuous adaptation to the needs and interests of users.

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