Using Data Sources, Tools and Applications During Data Mining in Marketing Management of Higher Education

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Introduction

Higher education is a sector that significantly contributes to the development of society and economics and forms an essential base for sustainable growth. Since 1989, when the political revolution took place in the Czech Republic, the number of students at higher education institutions has grown almost fourfold and higher education institutions have practically become accessible to all those who have successfully completed secondary school leaving examination and are interested in pursuing further studies. The character of higher education institutions has significantly changed and got adapted to unusually high numbers of students with much more varied previous education, profile and background than was usual 10 years ago. However, the transformation has not been completed so far—the necessary profiling and diversification of degree courses have not been carried out; neither the required infrastructure has been created nor the required staff has been recruited. In 2014, Czech higher education arrived at the end of an era of a massive expansion in terms of quantity. Undoubtedly, one of the current biggest challenges is the rapid decline in student numbers as regards the usual applicants caused by the demographic decline and the issue of how to effectively ensure and continually enhance the quality of activities carried out at higher education institutions and reinforce the value and relevance of education for each student.

In the first decade of the twenty-first century, the extension of accessibility to higher education continued in the sphere of Czech higher education. The number of students reached its peak in 2010 and 2011, namely 396 and 392,000 students,

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respectively. Since then, the student numbers have repeatedly decreased; as of 20 January 2016, 326,909 students studied at higher education institutions in the CR. (Výkonné ukazatele MŠMT 2015, © 2016) One of the major reasons for the current decrease in the number of students is the demographic development. Students born in the second half of 1990s, i.e. in years with low birth rates, progress to the final year of study at a secondary school and, thus, the number of usual applicants for higher education—those who have successfully completed secondary school leaving examination—rapidly decreases. The data provided by the Czech Statistical Office demonstrate that the trend is going to continue. It is estimated that by the end of 2016, the total number of 19-year old in the population will drop from 131,000 (data as of 2011) to 92,000, i.e. by a total of 30%. A reverse tendency, i.e. an increase in the number of applicants who have successfully completed secondary school leaving examination, can be expected only after 2023; in 2028 the high values are supposed to be reattained (approx. 115,000–120,000), even though, apparently, only for a limited period of time. This fact is also the reason why higher education institutions begin to concentrate, besides the quality of education, also on attracting "high-quality" applicants and students, just as in the case of companies that seek efficient and qualified employees.

Data Mining

The Gartner Group defines data mining as "the process of discovering meaningful new correlations, patterns and trends by sifting through large amounts of data stored in repositories and by using pattern recognition technologies as well as statistical and mathematical techniques." The author has refined the notion of data mining for higher education to be a process of uncovering hidden trends and patterns that lend them to predicative modelling using a combination of explicit knowledge base, sophisticated analytical skills and academic domain knowledge. It is producing new observations from existing observations. Or, as explained by Rubenking (2001), "data mining is the process of automatically extracting useful information and relationships from immense quantities of data. In its purest form, data mining doesn't involve looking for specific information. Rather than starting from a question or a hypothesis, data mining simply finds patterns that are already present in the data" (Luan 2002).

Academic analytics is a new field that has emerged in higher education in the aftermath of the widespread use of data mining practices and "business intelligence tools" in business and marketing (Beapler and Murdoch 2010).

This paper is focused on the marketing use of data collected about prospective and actual applicants, not on the enhancement of educational process; that is why it is based more on the questions from the first "business" column applied to the higher education sphere particularly in the Czech Republic.

Methodology

Within this paper, a model will be presented which was prepared using results of research comprising several stages and conducted at the Faculty of Multimedia Communications of Tomas Bata University in Zlín (the Czech Republic) during 3 years. The research involved the following stages:

1. Analysis of the data available (resources, quantity, quality of hard and soft data related to applicants).
2. Qualitative research aimed to identify the decision process used by applicants.
3. Quantitative testing using a sample of 496 applicants for studies at the given faculty.
4. Setting of available software applications intended for the analysis and interpretation of important data.
5. Marketing decisions aimed to reach the target group.
6. Assessment of the first year of application.

Taking into consideration the extent of the study, this paper will briefly deal with the implementation of the first three items—i.e. with results of the analytical stage which may be an inspiration and, to a certain extent, in general applicable for these types of educational institutions in post-communist countries.

Findings

Within the first phase of the research, qualitative interviews were carried out with 12 students in the last year of secondary schools (Please note: In the Czech Republic, a three-level educational system has been introduced: Primary, i.e. 9 years: from 6 to 15 years, secondary—15–19 years, higher—19–24 years) of various specializations as well as of general grammar schools. The aim was, among other facts, to find out about the factors decisive for the selection of a higher education institution, when and from which sources applicants obtain the required information about the educational institution. "Based on interview responses, we may speak about two groups of potential university students. Those who have made their decision and have profiled know what study subject and school they will aspire after, and those who have made their decision to go to university, but have not profiled yet. Both the groups undergo the following information process which at first is passive from their side when they attend presentations and the cooperation with the university, they record achievements and successes of university students and graduates in PR reports etc. Then the 'active' phase follows when they are already interested in communication activities of the particular university." (Jurášková et al. 2015).

It was necessary to quantitatively verify the results of the qualitative interviews; therefore, a questionnaire survey was carried out with 496 FMC applicants.

Respondents were interviewed during their visit to the FMC, namely during the Open Day, or during the admission procedure. They heard about the **FMC for the first time from a friend**, **who is a FMC student**. This version of a response was given by 185 respondents, which corresponds to **37%** of the total sample (Kocourek 2015). Among other mostly preferred responses the following can be named: The website of the University, attendance at a fair or information received via social networks. The importance of personal recommendation is also evidenced by the fact that the respondents could also mention *another form of the first contact with the FMC* than those listed in the survey. The most frequently given responses included for example: **Positive reference given by a teacher**, **university recommended by an employer or rumours**.

The positive effect of presentation of the University at fairs is evidenced by data obtained from the research surveys, which means that it can be considered one of very important channels. The importance for the FMC is obvious and the opinions of visitors to the fairs can serve to back this statement. The research, conducted every year by the organizers of the Gaudeamus Brno fair, proves that over 50% of attendees to the fairs are grammar school students (Honzík and Mikula 2014 © 2015).

With regard to the relevance of PR activities for applicants, the dependence of the level of prestige of a higher education institution was tested as to whether it is perceived as an institution providing general/specific education. The testing thereof enables us to verify whether it is more appropriate to focus PR activities on more specialized events or to concentrate on building of a general positive reputation. In addition, mainly because of the localization of Tomas Bata University in Zlín, in a relatively small town with a short tradition of higher education in comparison to other towns, the dependence of the perception of prestige of a higher education institution tested as to whether it is perceived as a local (i.e. Czech) or an international university. The testing was carried out using scales from 1 to 5, where 1 = the lowest value, general setting, local orientation of an educational institution, and 5 = the highest level of prestige, specificity of the orientation of an educational institution and its international character (Table 1).

The results indicate dispersion in the responses to the question whether the respondents perceive the FMC as Czech/international. The value of 1.346 was the highest among others. As regards the level of prestige and the variable

Table 1 Statistical tests

	Prestige of HEI	General/specific	Czech/international
Mode (most frequent)	4	4	3
OR (ordinal median—middle value)	3.682	3.434	2.811
Dorvar (discrete ordinal variable = dispersion)	1.265	1.276	**1.346**

"general/specific", the middle value was shifted in the direction of "neither—nor" when compared to the most frequent values 4—a rather high prestige/rather international.

$$X - squared = 16.8534, df = NA, p - value = 0.4001$$

The H_0 on the independence cannot be rejected, i.e. the perception of specialization/specificity of education institution is not dependent on the perception of the level of prestige of the given higher education institutions. Since the FMC offers a humanities-oriented degree course in marketing communications (the preferences of the applicants for this degree course were investigated), it is not a higher education institution with narrow specialization (compared to, e.g. medical studies), therefore, it is sufficient to monitor more general coefficients of prestige of the given higher education institution, such as career prospects, etc., with regard to the applicants.

$$X - squared = 26.1445, df = NA, p - value = 0.05519$$

Upon testing the influence of internationality on the level of prestige of the higher education institution, it is possible to state that with the level of importance being 5% the H_0 on the independence of the variables cannot be rejected—the variables are independent in fact. However, with the risk of error being 10%, the independence would be rejected. The result thus reveals that the perception of these values is inconsistent.

Discussion

A model of the collection, analysis and interpretation of data, that would serve to effectively direct marketing activities towards applicants, was made in accordance with surveys conducted within the data mining system setup.

It is possible to acquire hard data—quantitatively processable data from: statistics provided by the Ministry of Education, also from the application for studies (name, surname, email). Google analytics tracking set up for websites and the microsite of the Faculty reveals information related to visit rate, interactivity, newsletter open rate and click rate, database of contacts for the registration for newsletter subscription, etc. It is also important to monitor the interconnection of activities (newsletter—application for a preparation course—application for studies), analysis of Facebook activities (commentaries, involvement of "opinion leaders" from among students, applicants as well as teachers, etc. and their influence on interactivity), portals focused on higher education. Soft data about applicants: their interests, preferences, user-friendliness, web ergonomics, social interaction and social status are no less important for marketing specialists. These

can be monitored either on the above-mentioned websites, or they can be interviewed during road shows, fairs and open days.

Testing of hypotheses demonstrated independence between perception of the level of prestige of a higher education institution and perception of its orientation (generally vs. specifically oriented higher education institution), which can be interpreted as the fact that the degree course in Marketing Communications is often selected by students who do not want to study a degree course with narrow specialization. The dependence between internationality of the education institution and its level of prestige is of no importance to them. This means for the marketing specialists that they should focus on an interactive debate with applicants on topics that are attractive to them, to stimulate interest in the degree course among them by means of, e.g. stories about successful graduates, or get them acquainted with the professions that the graduates practise, and avoid providing them with a mere list of specializations, that would not reveal anything about the possible future career of the applicants.

Data mining is a long-term process and the FMC is still at the beginning of the process. Nevertheless, it is important to realize when, what type of data a from where to acquire them, and by means of what kind of tools, which information is primary and which is complementary; how often we will process and evaluate the data, how to plan marketing activities according to the conclusions, etc. which opens up new opportunities for the application of data mining in the sphere of higher education.

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