

Analysis of the popularity of technical engineering courses

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ABSTRACT: Statistical analysis of the popularity of engineering courses, using the example of enrolments in the AGH University of Science and Technology, is presented in this paper. The paper also shows the results of statistical analysis of the past few years of enrolment in the University of Science and Technology-AGH (UST-AGH) and the preferences of the candidates in choosing courses. The collected data are related to averaged demographic and other data. Indicated trends in enrolment and possibilities of increasing the attractiveness of courses is also outlined, as are ways of increasing future enrolment in engineering courses.

INTRODUCTION

Over the past few years in Poland a gradual decline of interest has been observed in the engineering and technical field of study [1]. Young people see technical studies as being difficult to undertake because of the required high level of mathematics and physics. In addition, it is said that engineers' salaries are much lower than that of graduates in economics or management. Therefore, various social activities to encourage young people to study within the University's technical faculty are being staged.

Further, for many years in Poland, a decline in population has been noted. Both of the factors mentioned can reduce the number of candidates studying at technical universities. This paper presents the results reached from analysis of the admission process for the AGH University of Science and Technology.

DEMOGRAPHIC DATA

Since the beginning of the 1990s, a demographic decline in Poland was observed [2]. The decrease in the birth rate, from 1988 to 2003, was up to 40% (Figure 1). As a result, a decline in the number of high school students already has been noticed.

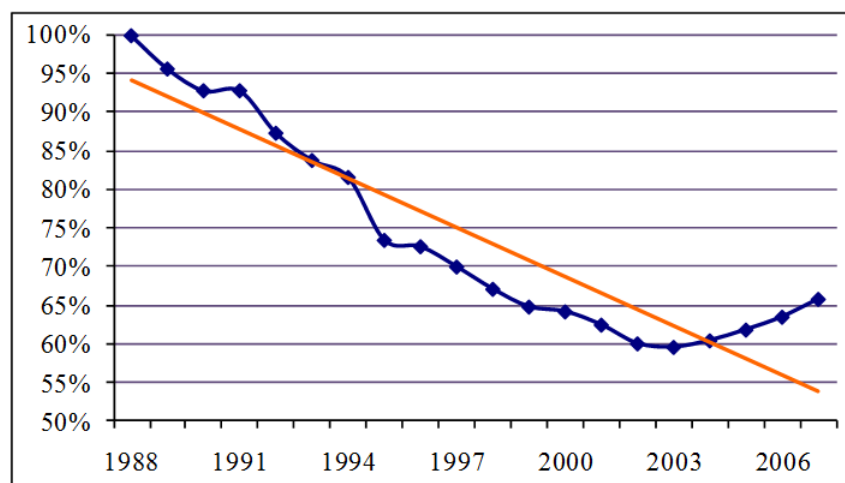


Figure 1: The dynamics of birth decline in Poland [2].

In the coming years it is expected that the impact, in terms of a fewer number of candidates, will be felt by universities. Analysis of the population age group 19 to 24, of potential candidates for study, shows the minimum number of candidates that can be expected in the year 2025 (Figure 2).

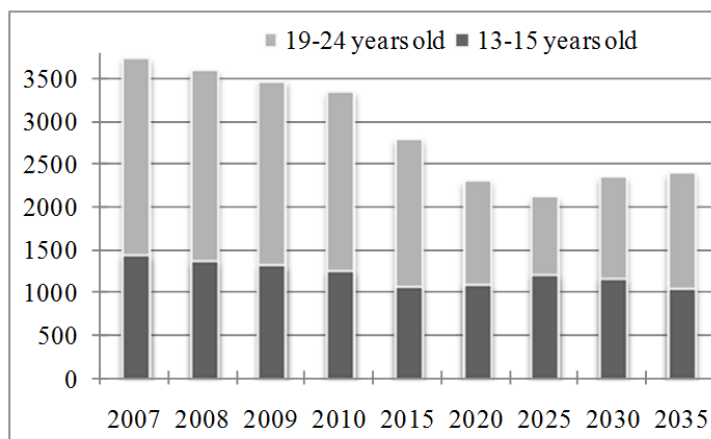


Figure 2: Forecast population by age groups 19 to 24 and 13 to 15 (in thousands) [3].

ADMISSION PROCEDURES

The new Law on Higher Education introduced the principle of admission to higher education, consisting of a dependence on results from the matriculation examination [4]. The AGH-University of Science and Technology's rating of candidates is based on the index of recruitment (W), which itself is based on the results of the matriculation examination, according to the formula below (1). The maximum total value of the recruitment index is 1000 points.

$$W = J + 4G \quad (1)$$

J - results from the matriculation examination in a foreign language. The maximum value of the index is 200 points.
 G - results from the written part of the matriculation examination of one of the following subjects: mathematics or physics, or computer science, or geography, or chemistry, or biology. The maximum value of the index is 200 points.

Unfortunately, each year, the Ministry of Education changes the rules for the matriculation exam; for example, in 2007 matriculation at two levels was abandoned - basic and advanced. The results were converted from advanced level to basic level by the MEN rate. In 2008, the Ministry of Education waived the conversion of results and also organised a correctional exam in August. In 2010 an obligatory matriculation exam in mathematics was introduced, at basic level. As an additional subject, mathematics could only be taken at advanced level.

Table 1: Statistics of candidates on full-time and extramural Bachelor studies at UST-AGH in the years 2006 to 2010 [5].

	2006	2007	2008	2009	2010*
Total number of applications and candidates = A	12,949	14,802	16,667	19,365	-
Number of candidates on full-time courses A_S A_S / A	9,838 76.0%	11,628 78.6%	12,923 77.5%	15,181 78.4%	15,591 -
Number of candidates on extramural courses A_N A_N / A	3,111 24.0%	3,174 21.4%	3,744 22.5%	4,184 21.6%	-
Total number of admitted Q Q / A	8,469 65.4%	9,341 63.1%	9,778 58.7%	9,713 50.2%	-
Admitted on full-time courses Q_S Q_S / Q	5,614 66.3%	6,348 68.0%	6,881 70.4%	6,909 71.1%	-
Admitted on extramural courses Q_N Q_N / Q	2,855 33.7%	2,993 32.0%	2,897 29.6%	2,804 28.9%	-

*admission in progress

Candidates for Bachelor studies at UST-AGH can enrol on one main course and up to four alternative courses. A candidate may submit only one application for full-time and extramural Bachelor studies. In 2006 enrolment was still for long-cycle programmes. But since 2007, enrolment has been taken for three-cycle programme study under the

Bologna Process (which objectives are the introduction of undergraduate and postgraduate levels in all countries, with first degrees no shorter than 3 years; a European Credit Transfer System; and the elimination of remaining obstacles to the mobility of students and teachers [6]).

Then the candidates are pre-qualified onto declared courses based on the recruitment index. If ineligible for the main course, the candidate is qualified for an alternative course if there are free places on the course. The criterion for candidates' qualification is their recruitment index. The minimum value of the recruitment index is set separately for every course by the Faculty Admissions Committee. There are more pre-qualified candidates (ca 130%) than there are a number of available places, because not all qualified candidates decided to start study or were admitted.

Thanks to this system, the Faculty is able to fill the entire number of places on courses with good candidates, and candidates have a better chance of admission to the University. More than 75% of candidates applied for full-time studies. However, a proportionately greater percentage of candidates are admitted for extramural study due to the ratio of candidates to one place.

In analysing statistical data on enrolment for the UST-AGH in the years 2006 to 2009, a number of interesting trends have emerged (Table 1). Despite the declining birth rate, this year is another year in which the number of candidates has increased, noting:

- The proportions of candidates for full-time and extramural study have been changing.
- The number of pre-qualified candidates for full-time studies, who were finally admitted, has strongly decreased (averaging over 70%).
- Despite the growing number of candidates for extramural studies, the number of candidates admitted decreased.
- Completing extramural studies are considered an alternative for candidates who are not qualified for full-time studies.

THE MOST POPULAR COURSES

Candidates may choose between 32 fields and disciplines, as well as more than 170 specialisations the wide variety of which is worth mentioning: besides traditional faculties closely related to mining and metallurgy, the UST-AGH offers faculties where candidates can study not only computer science, telecommunications, automatics (informatics), robotics, new materials, technical physics and applied mathematics, but also management and sociology. The following new disciplines are being introduced: Mechatronics (the combination of electronics, mechanics and robotics), Biomedical Engineering, Computer Science and Econometrics, as well as Technical and Computer Science Education.

Table 2: Number of candidates for one place on the courses for Bachelor full-time studies (data only for the first stage of enrolment and just for the main declared courses) [5].

No		2006		2007		2008		2009		2010
1	S_H	10.2	S_H	10.4	S_H	9.7	TiR_GGiOŚ	10.7	B_GiG	9.82
2	I_EAiE	5.00	B_GiG	6.14	B_GiG	6.5	S_H	9.56	GiK_GGiŚ	7.77
3	GiK_GGiŚ	4.31	IB_MSIB	5.71	GiK_GGiŚ	5.9	K_H	8.25	K_H	6.35
4	Z_Z	3.27	GiK_GGiŚ	5.01	K_H	5.9	GiK_GGiŚ	8.17	S_H	6.01
5	M_MS	2.84	I_EAiE	3.40	IB_MSIB	5.1	B_GiG	7.77	IA_E/M	5.20
6	EiT_EAiE	2.76	AiR_EAiE	3.01	I_EAiE	3.1	IB_MSIB	5.86	IB_MSIB	4.79
7	IS_EAiE	2.61	IS_EAiE	2.34	AiR_EAiE	3.0	AiR_EAiE	3.98	Z_Z	4.45
8	AiR_EAiE	2.53	AiR_IMiR	2.24	ZiIP_GiG	2.2	IA_E/M	3.77	TiR_GGiOŚ	3.93
9	B_GiG	2.23	Z_Z	2.19	IŚ_GGiOŚ	2.2	IS_EAiE	3.07	AiR_EAiE	3.30
10	IB_MSIB	2.00	IŚ_GGiOŚ	2.05	IA_E/M	2.1	OŚ_GGiOŚ	3.06	ZiIP_Z	3.16

Abbreviations and Acronyms:

AiR_EAiE	- Automatics and Robotics in Faculty of Electrical Engineering, Automatics, Computer Science and Electronics
AiR_IMiR	- Automatics and Robotics in Faculty of Mechanical Engineering and Robotics
B_GiG	- Building Engineering in Faculty of Mining and Geoengineering
EiT_EAiE	- Electronics and Telecommunications in Faculty of Electrical Engineering, Automatics, Computer Science and Electronics
GiK_GGiŚ	- Geodesy and Cartography in Faculty of Mining Surveying and Environmental Engineering
I_EAiE	- Computer Science in Faculty of Electrical Engineering, Automatics, Computer Science and Electronics
IA_E/M	- Acoustic Engineering; Inter-Faculty course EAiE / IMiR
IB_MSIB	- Biomedical Engineering at Multidisciplinary School of Engineering in Biomedicine
IS_EAiE	- Applied Computer Science in Faculty of Electrical Engineering, Automatics, Computer Science and Electronics
IS_FiIS	- Applied Computer Science in Faculty of Physics and Applied Computer Science

IŚ_GGiOŚ	- Environmental Engineering in Faculty of Geology, Geophysics and Environment Protection
K_H	- Culture Studies in Faculty of Humanities
M_MS	- Mathematics in Faculty of Applied Mathematics
S_H	- Sociology in Faculty of Humanities
TiR_GGiOŚ	- Tourism and Recreation in Faculty of Geology, Geophysics and Environment Protection
Z_WZ	- Management in Faculty of Management
ZiP_GiG	- Management and Production Engineering in Faculty of Mining and Geoengineering
ZiP_Z	- Management and Production Engineering in Faculty of Management

Table 2 shows the new courses that are considered very popular, especially in the first year (in 2006 Biomedical Engineering; in 2008 Acoustic Engineering, Culture Studies; in 2009 Tourism and Recreation). Nevertheless, the most popular courses were traditional, such as Sociology, Building Engineering, Geodesy and Cartography, as well as Computer Science.

In 2009 and 2010 high interest was registered in the so-called *ordered courses* because additional student scholarships could be obtained. *Ordered courses* were financed by projects implemented under the EU Human Capital Operational Programme, Priority IV, *higher education and science*, Action 4.1: *Strengthening and developing the potential of university teaching and increasing the number of graduates of courses critical for a knowledge-based economy*.

The UST-AGH received from the Ministry of Science and Higher Education previously requested funds for education on *ordered courses* such as Environmental Engineering and Environmental Protection. The project's target group were students of full-time first-cycle and second-cycle studies at the Faculty of Geology, Geophysics and Environment Protection (WGGiOŚ); Faculty of Mining Surveying and Environmental Engineering (WGGiŚ); and Faculty of Mining and Geoengineering (WGIG). In 2010 the *ordered courses* are Medical Physics and Technical Physics in the Faculty of Physics and Applied Computer Science (FiIS), and Building Engineering in the Faculty of Mining and Geoengineering (GIG).

An important decrease in popularity can be observed in courses at the Faculty of Electrical Engineering, Automatics, Computer Science and Electronics (especially Electronics and Telecommunications, and Electrical Engineering). Also, explicit regress is shown in Applied Computer Science and Management. Traditionally, the smallest popularity has always been noticed in Metallurgy and Materials Engineering courses - 0.2 to 0.35 candidates for one place.

COURSE RANKINGS

The ranking of the first three courses, based upon the recruiting index, was unchanged for the past five years. The courses are Computer Science, Applied Computer Science, Automatics and Robotics – all of them in the Faculty of Electrical Engineering, Automatics, Computer Science and Electronics. In the years 2007 to 2009, the next two positions in terms of recruiting popularity were: Engineering, in the Multidisciplinary School of Engineering in Biomedicine; and Geodesy and Cartography, in the Faculty of Mining Surveying and Environmental Engineering.

The values of the recruitment index for the best courses are subject to minimum fluctuations. Among the 10 courses with the highest recruitment index for the past year was Electronics and Telecommunications (this year at the rate of 708 pts), and new courses such as Acoustic Engineering, Tourism and Recreation.

Table 3: Ranking of courses due to recruitment index W (*data for main course*).

Pos.	2006		2007		2008		2009		2010	
1	I_EAiE	908	I_EAiE	857	I_EAiE	900	AiR_EAiE	931	AiR_EAiE	909
2	IS_EAiE	874	IS_EAiE	820	AiR_EAiE	885	I_EAiE	910	I_EAiE	865
3	AiR_EAiE	829	AiR_EAiE	811	IS_EAiE	862	IS_EAiE	890	IS_EAiE	865
4	EiT_EAiE	821	IB_MSIB	800	GiK_GGiŚ	828	IB_MSIB	854	IA_E/M	851
5	M_MS	800	GiK_GGiŚ	757	IB_MSIB	823	GiK_GGiŚ	853	B_GiG	846
6	GiK_GGiŚ	792	EiT_EAiE	747	B_GiG	802	B_GiG	840	GiK_GGiŚ	830
7	IB_MSIB	759	S_H	730	S_H	681	IA_E/M	820	IB_MSIB	830
8	Z_WZ	737	B_GiG	722	EiT_EAiE	674	EiT_EAiE	800	M_IMiR	777
9	S_H	717	AiR_IMiR	630	TiR_GGiOŚ	731	TiR_GGiOŚ	731	G_GGiOŚ	757
10	IS_FiIS	680	IA_E/M	606	AiR_IMiR	718	AiR_IMiR	718	IS_FiIS	750

CONCLUSIONS

As the statistics show, the UST-AGH, despite a demographic decline for several years, has noted an increase in the number of candidates. The education level of candidates assessed by the recruitment index did not change.

The most common reason for choosing education at UST-AGH, as indicated by the candidates, was the University's reputation and the possibility of graduates finding a job. Therefore, it is concluded that a high quality of education and, again, a university's reputation, are deciding factors when it comes to candidates' choice of university. The University's actions to mitigate the demographic crisis, inter alia undoubtedly should be the development of new fields of study, the promotion of the university and/or a friendly and simple enrolment process.

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