

Developing Agricultural Education in the Republic of Croatia using U.K. examples

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Die Entwicklung der landwirtschaftlichen Ausbildung in Kroatien unter Bezugnahme auf britische Beispiele

1. Introduction

Agriculture in Croatia and the UK operate under different conditions and have different markets to service. The population of Croatia was only 4.494 millions in 1996¹ (DZS, online, 2000) compared to 59.5 millions in the UK in 1999 (GSS, online, 2000). Agricultural practices clearly differ between the two countries due to different environmental conditions, but agricultural education and extension in both countries have long traditions which go back over 100 years. In Croatia agricultural education commenced at High School level in Križevci in 1860 and at university level in 1902. In the U.K., university level agricultural education started towards the end of the 19th century (HARRIS, 1993).

The aim of this paper is to identify problems and possible improvements in Croatian University level agricultural edu-

cation. Data sources include a survey of Croatian agricultural students' perceptions and also, where appropriate a comparison with the UK system. The paper focuses particularly on student motivation and on assessment and examination.

In Croatia, students can enrol for an agricultural degree without any entrance exam (if they have satisfactorily completed courses at an agricultural or related high school). Due to the lack of competition for places on agricultural courses, some students choose agriculture even after failing to enrol on other courses.

With respect to course structures, the majority of each course comprises core modules and few modules are elective. The first four semesters are the same for all agricultural courses. During the remaining five semesters, students may specialise in, for example, animal husbandry or crop production.

Zusammenfassung

Gestützt auf Vergleiche mit Großbritannien und auf eine Befragung kroatischer Landwirtschafts-Universitätsstudenten wurde ein Modell entwickelt, um den Einfluss verschiedener Faktoren auf eine erfolgreiche Absolvierung von Lehrgängen zu untersuchen. Vom Wissen um signifikante Faktoren könnten Studienleiter die Wahrscheinlichkeit, dass neue Studierende erfolgreich sein werden, vorhersagen und sie so dementsprechend führen. In Kroatien, wo mündliche Prüfungsmethoden überwiegen, vermeiden viele Studenten für mehrere Monate diese Prüfungen zu machen.

Es wird vorgeschlagen, dass die drei Schlüsselemente für eine Verbesserung der agrarischen Ausbildung in Kroatien sein sollten: (1) Steigerung des Selbstvertrauens der Studierenden in Verbindung mit (2) einem strengeren, verpflichtenden Prüfungsverfahren und (3) einem unterstützenden Betreuungssystem.

Schlagworte: Humanressourcenentwicklung, landwirtschaftliche Ausbildung, Bildungsverwaltung, Kroatien.

Summary

Based on comparisons with the UK and a survey of University level Croatian agricultural students, a model was developed to explore the influence of various factors on successful completion of courses. From a knowledge of significant factors, tutors could predict the probability that new students would be successful and so guide them accordingly. In Croatia, where oral examination methods predominate, many students avoid taking these examinations for several months. It is suggested that three key elements for improving the quality of agricultural studies in Croatia are (i) improving the confidence of the students in conjunction with (ii) a more rigorous, compulsory examination procedure and (iii) a supportive tutorial system.

Key words: human resource development; agricultural education; Croatia; educational administration.

The Croatian examination system merits explanation. Continuous assessment is rare, so that students are generally graded according to their results in an examination after completion of each module. This examination is usually just an oral, which may take place at any time the student wishes after completion of the module. Agricultural students, like all other students in Croatia, can and do, therefore, tend to postpone taking their examinations for long periods. Reasons why students fail to take examinations are explored in this paper since this examination system may contribute to the drop out rates encountered.

Drop-out rates in Croatia averaged across all subjects are as high as 75 %. By contrast, drop out rates in the U.K. are among the lowest in the world. Recent figures show that 20 % of all University entrants fail to complete their courses in the UK. Only Japan has a better record (10 %) while Germany, the USA and France record 28, 37 and 45 % drop out rates, respectively (HEFCE, 1999). Other indicators likewise show that the UK University level education sector performs well in comparison to that in other countries. According to results of an extensive survey involving 1090 Professors and 7434 students from 102 Universities and covering a wide range of courses, the UK was considered to have the best universities, it was the most popular country in which to study among the students (33 % of students) and it had the shortest average time to complete the course of study (3.5 years) (ANONYMOUS, 1998). It also has the most frequent staff/student contact (46 % of students have personal contact with tutors several times per month) and all this with 33.8 student working hours per month (ranking fourth in the EU).

In this paper, two agricultural education systems at university level are briefly explained. An important element here is the progression from admission to graduation in both countries. Since the purpose of the paper is to identify possible improvements in Croatia, it was believed essential to supplement this overview by surveying perceptions of Croatian agricultural students whereas no equivalent survey was considered necessary in the U.K.

2. Materials and methods

To assess the current situation of agricultural education in Croatia, a survey was carried out with a sample of 192 students from the first and second years of a four-year degree course at the Faculty of Agriculture in Osijek. The survey focused on first two years of study since high drop-out rates

are a particular problem in these two years. The sample comprised 70 female and 122 male students out of a total of 222 students. Research was carried out by a formal questionnaire survey formulated by the research team. Students were asked about their motivation to study agriculture, previous education, results achieved and major obstacles to perform better. The survey and data analysis were conducted according to CZAJA and BLAIR (1996). Additional data was obtained from official statistics and from an independent survey conducted by the Students' Association in Osijek during the academic year 1999/2000. The latter survey consisted of a sample of 94 out of 263 agricultural students (52 females, 41 males and one undisclosed).

Since the students were a very heterogeneous group regarding their motivation, prior education and future plans, they were stratified according to two criteria. First of all, their motivation to enrol for agricultural studies was classified according to their being strongly or weakly oriented students. Strongly oriented students (hereafter designated as those with "strong motivation") were those who enrolled out of personal interest, or who either worked on their own farms or had the prospect of a job in the agricultural sector. Weak orientation described those who enrolled because they either had exemption from the entrance exam or had failed to enrol on a different course elsewhere (hereafter designated as those with "weak motivation"). The second stratification criterion was according to their having prior agricultural or non-agricultural education.

To check the differences in the performance of these subgroups contingency, Kramer's V and f coefficients were calculated (KINNEAR and GRAY, 1999). Finally, canonical discriminant analysis (CDA) was deployed to construct models to predict the future success of the students. An initial model was designed with the help of variables which can be collected at the admission procedure and was applied to first year students only. Applied to the whole sample, the model lost some of its predictive precision. The model to predict the success of second year students was therefore amended with variables collected during the first year of study. The criterion selected for the CDA was Wilk's lambda coefficient.

3. Results

3.1 Agricultural education in the UK

The continuing decline in the agricultural labour force and a trend towards an increase in the size of agricultural hold-

ings has led to a decline in the numbers of students reading agriculture. This tendency has probably been exacerbated in recent years by adverse publicity for agriculture in the UK. Tangible evidence of this trend is shown by the cessation of teaching of agricultural degrees in one Scottish and one English University in 2001. There is still a good choice of Universities and University sector colleges to undertake degrees in the primary land-based subjects of agriculture, horticulture and forestry. This summary masks, however, a major change in UK agricultural education. With increasing concern for environmental issues, ecological and organic farming, conservation and rural resources in general, many new courses have arisen to meet the demand for such courses both by students and employers of graduates. Other new courses have been developed to meet a growing demand for courses in management as applied not only to agriculture but also for rural resources and the countryside in general. Responding to the demand for new courses is clearly a key element in the survival of so many UK colleges and universities teaching agriculture and related subjects.

The graduation rate² in tertiary level education after completing high school in the UK was 37.5 % in 2000 – the highest of the 17 countries for which data is available (OECD, 2003). Entrance standards are based on school leaving exams – which are rated on a points system for most UK students. For example for BSc Agriculture at Reading it is as follows: at least two A levels (240 points) including Chemistry and/or Biology. Irish Highers and International Baccalaureate are also accepted. In 1999, 4120 students were accepted on to higher education courses in agriculture and related subjects (including veterinary studies) comprising only 1.2 % of the total of 334594 accepted entrants to UK universities (UCAS, 2000, online). Gender distribution in UK indicates that both genders show a similar interest for agriculture and related studies, average values are 57.5 % female and 42.5 % male students in 2002 (HESA, 2003, online).

An indicator of success of UK higher education is the completion rate of those who enrol in courses, agricultural students being no exception. Motivation to this end is probably an integration of several elements.

Maintenance of the students' interest in the subject is important and the opportunity to change courses and a wide range of elective modules including foreign languages and specialisation may be offered. A key element in motivating students could be personal contact with members of academic staff. Many UK universities operate a tutorial system by which students have regular meetings with their per-

sonal tutor throughout their course. These tutors offer students personal advice on academic matters, encourage them to develop study skills and to plan for life after university. In agricultural and rural studies where the degree subjects include a vocational element, motivation is sometimes promoted as students may know clearly what they plan to do when their degree course has finished. Levels of graduate unemployment are low (< 6 %, ANONYMOUS, 1999b, online) for agricultural graduates from most universities in the UK.

Maintenance of academic quality is also important as an individual university will want students and sponsors to have confidence in their educational "product". Facilities and teaching quality are clearly important no matter how good the student's initial personal motivation. Publicly funded universities in the UK are therefore subject to external review in teaching quality and academic quality is assured throughout the UK by a system of external examination. In addition, most students are now "customers". Fees have to be paid: higher education is no longer free in the UK and many students leave UK Universities with substantial debts. To minimise debts, there is an incentive to complete courses within the minimum period required.

Certain regulations also tend to encourage students to complete their courses within a fixed period. For example, attendance at university examinations is compulsory and students are generally allowed only two attempts at any examination. Failure to take and pass exams means progression to next stage of course is not permitted. Exceptions are allowed for good cause but they are very rare and involve appeal procedures.

3.2 Agricultural education in Croatia

Professional agricultural education starts in Croatia at high school level. There are five agricultural high schools in Croatia. It is also possible to get an agricultural education in some other high schools, and in total 25 high schools in Croatia offer agricultural programmes lasting three or four years. Further agricultural education at the practical level is possible at the polytechnics in Križevci and Požega.

Undergraduate and postgraduate university level studies in agriculture and related subjects are available in Zagreb and Osijek. All Croatian universities were reorganised according to the Higher Education Act in 1996 such that, instead of a four-year specialisation, basic courses lasting two years were introduced and followed by two years of spe-

cialisation. Entry to all courses depends on passing a written entrance exam administered by the University. Some faculties waive the entry exam for students coming from specialised agricultural schools if they have achieved a certain average grade. (MOST, 2000, online).

Agricultural and related studies, just like all other studies could be attended in two different modes, with support of Croatian Ministry of Science and Technology (without tuition fee) and as a part time or full time student who pays full tuition fee. However, influence of tuition fees was not investigated.

In Croatia, the number of pupils completing secondary school in 1998 was slightly above 51 000. In the same year almost 35 000 students enrolled in the institutions of higher education; 24 280 of them in four year programmes. From the total of 67 514 students registered in four year programmes, 2 148 (3.18 %) were agricultural students and of the total number who graduated (8.697) 2.46 % were agricultural students (ANONYMOUS, 1999a). Gender distribution in Croatia indicates that both genders show a similar interest for agriculture and related studies, average values are 50.6 % female and 49.4 % male students in academic year 2001/2002 (DZS, 2003, online).

Assuming enrolments have remained approximately constant from year to year, the discrepancy between enrolments and graduations implies a high drop-out rate in comparison to the UK and other countries.

A large number of Croatian farmers have no formal agricultural education. University level education (any profile) is still rather rare among farmers, and only 0.64 % of active workers in agriculture have a University level diploma (two or four years programmes, all specialisations included), 8.57 % have high school education, while the rest have eight or less years of elementary school. Illiteracy, therefore, is negligible among Croatian farmers. Farms managed by younger people have on average better education, such that 30.4 % of such farmers have high school education or higher (PETAK, 2000). However, even this latter group generally lacks specialised agricultural education.

3.3 Survey results

The majority of interviewed students decided to go to University very early; more than 20 % during elementary school, almost 60 % during high school and only 20 % after completing high school (mostly male students). The principal basis for that decision in 87 % of cases was the stu-

dent's own wish. Other reasons of comparatively minor importance were parental suggestion (5.7 %), family tradition (2.6 %), postponing the military service (3.1 %) and study as a prerequisite to obtain various types of benefits (1.6 %). Motivation to enrol for agricultural study was less favourable; only 60 % of students were motivated by factors which were hypothesised to give a strong potential for completion of the course (personal inclination, good employment prospects for the future and/or an intention to work on their own farm) (Figure 1).

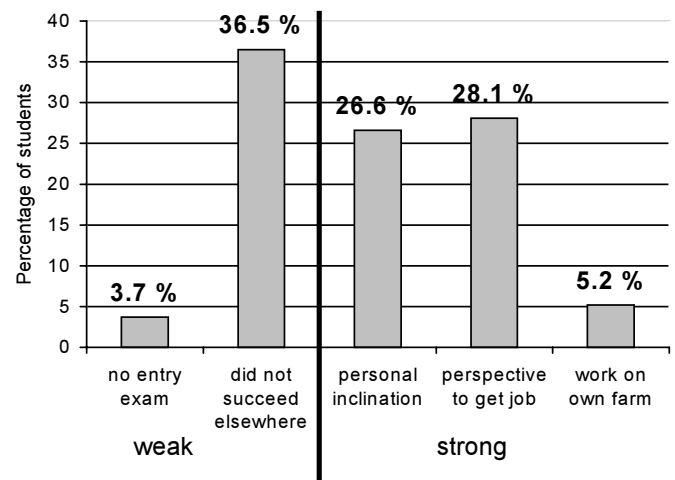


Figure 1: Motivation to enrol for an agricultural degree – Students' motivation is hypothesised to lead to "strong" or "weak" potential for successful completion

Abbildung 1: Motivation zur Immatrikulation für Agrarstudiengänge – Der studentischen Motivation wird ein „starkes“ oder „schwaches“ Potential zugebilligt, zu einem erfolgreichen Studienabschluss zu führen

Very early in the survey, it became evident that only 5.2 % of students took their exams promptly. This might be one of the major reasons for the high drop-out rate rather than failure in examinations. One of the hypotheses tested in this study was therefore to examine whether the "strong" and "weak" sub-groups (Figure 1) varied in performance in their examinations and in their reasons for not taking exams. It is interesting that classification according to both criteria (motivation and prior education) follows the same pattern but differences between groups are significantly different for students stratified by prior education (Table 1).

Although students with different motivations and prior education, differed in the distribution of their reasons for not taking examinations (Table 1), performance measured in terms of passed exams did not differ significantly. Stu-

Table 1: The single most important reason given by students for not sitting examinations (in %). Students were stratified according (i) motivation or (ii) prior education

Tabelle 1: Der von Studierenden angegebene Hauptgrund für die Nichtteilnahme an Prüfungen – Schichtung der Studierenden gemäß (i) Motivation oder (ii) vorheriger Bildung

| | Stratification criterion | Motivation | | | Prior education | | |
|-----------------------------|------------------------------|------------|----------|---|-----------------|------------------|---|
| | | “weak” | “strong” | | Agricultural | Non-agricultural | |
| Do not regularly take exams | Irregular lecture attendance | 4.3 | 5.2 | $\phi = 0.237$ sig. level $P = 0.056$ | 6.7 | 2.3 | $\phi = 0.271$ sig. level $P = 0.015$ |
| | Insufficient literature | 4.3 | 9.1 | | 6.7 | 5.8 | |
| | Insufficient knowledge | 32.2 | 23.4 | | 29.5 | 27.6 | |
| | Insufficient self-confidence | 42.6 | 48.1 | | 41.0 | 49.4 | |
| | Multiple reasons | 10.4 | 10.49 | | 11.4 | 9.2 | |
| Regularly take exams | | 6.1 | 3.9 | | 4.8 | 5.8 | |

dents with a prior agricultural education at high school start in a more favourable position on enrolment and indeed, with a certain average grade they are not obliged to take the entrance exam. Their actual performance in subsequent examinations was not, however, significantly different from those with no prior agricultural education. For example, the average grade in university exams for students from agricultural high schools was 2.10 ± 1.32 (on the scale 1 = insufficient to 5 = excellent) in comparison to students from non-agricultural high schools (2.67 ± 1.02).

3.4 Predictive models

3.4.1 Predictive model for first year students (freshers)

Since the participation rate in tertiary level education after completing high school is 70 % in Croatia and drop out rates during agricultural and other studies are both high, it might be very useful to develop a model to predict the future performance of freshers. However, number of available relevant data is very limited. Canonical discriminant analysis (CDA) was applied on variables that can be collected during the admission procedure to construct a model to predict the future success of 126 freshers (Figure 2). The first two discriminant functions explained 79.3 % of variance (Wilks' lambda coefficient is 0.636 and significance 0.031). Variables important in the construction of the first function are (i) the time when the decision was made about university level education (during elementary school or high school or after high school) and (ii) the student's attitude towards agriculture as a future profession (positive or negative). Variables with the highest correlation in the sec-

ond function are (iii) place of origin (city or village) and (iv) the single most important source of information in deciding to enrol on a university level agricultural course (for example, personal interest, parental suggestion, family tradition, postponing military service or some other reason).

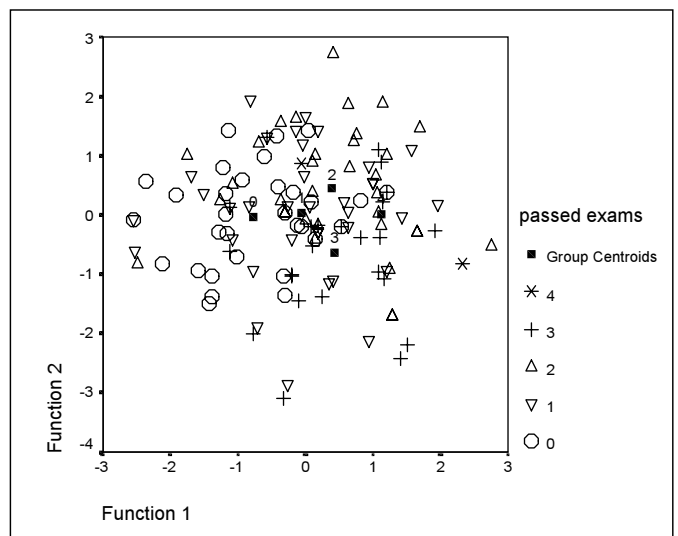


Figure 2: CDA of first year undergraduate students in Croatia showing separation into groups according to the number (0 to 4) of exams passed by the students (n = 126)

Abbildung 2: Kanonische Diskriminanzanalyse bei Studierenden des ersten Studienjahres in Kroatien zur Verdeutlichung der Gruppenbildung gemäß der Anzahl (0 bis 4) bestandener Prüfungen (n = 126)

The model shown in the Figure 2, correctly classified 42 % of those likely to complete their University education successfully. It is interesting that prediction improved with increase in the number of passed exams (irrespective of the subject): 54 % of students who passed three exams were

correctly classified while those who passed all four exams were all classified correctly. When applied to the whole sample (192 students – both years), the model lost some of its predictive precision, and overall, 35 % of cases were classified correctly. Therefore, the model to predict the success of second year students was amended with variables collected during the first year of study (their attitude toward study, reasons for taking or not taking exams and their average grade in their first year).

3.4.2 Predictive model during the second year of study

In this model (Figure 3), the first two discriminant functions explained 73.3 % of variance (Wilks' lambda coefficient is 0.332 and significance 0.081). Variables important for construction of the first function were (i) reasons for enrolling on an agricultural degree (no need to take an entrance exam, failure to enrol on another course, personal inclination, employment prospects and intention of working on their own farm), (ii) student's attitude toward studying agriculture (whether or not exams are taken at the end of semesters, whether or not additional lectures and activities are attended), (iii) student's attitude toward agriculture as their intended future profession (positive or negative), (iv) average grade during the first year and (v) gender. The

variable with the highest correlation with the second function was (vi) the single most important source of information in deciding to enrol on a university level agricultural course. This model is shown in Figure 3 and correctly classified 60.6 % of students who would pass their exams.

With respect to the contribution of gender, gender was important in the predictive model because male students passed more exams and achieved higher grades than female students. Nevertheless when overall means were compared, there were no significant differences between male and female students perhaps due to the high standard deviations (Table 2). Conclusions about gender differences must, therefore, be treated with caution.

Table 2: The gender effect on examinations passed and grades achieved for final year (2000) agricultural students in Osijek, Croatia – Data are means ± standard deviations and medians

Tabelle 2: Gendereffekt bei der Zahl bestandener Prüfungen und erreichter Abschlüsse bei Landwirtschaftsstudierenden im Abschlussjahrgang (2000) in Osijek, Kroatien – Mittelwerte, Standardabweichungen und Mediane

| | Female Mean (± sd) | Median | Male Mean (± sd) | Median |
|---------------|-----------------------|--------|---------------------|--------|
| Exams passed | 1.45 ± 1.11 | 1 | 1.73 ± 1.12 | 2 |
| Average Grade | 2.12 ± 1.36 | 2.5 | 2.99 ± 0.42 | 3 |

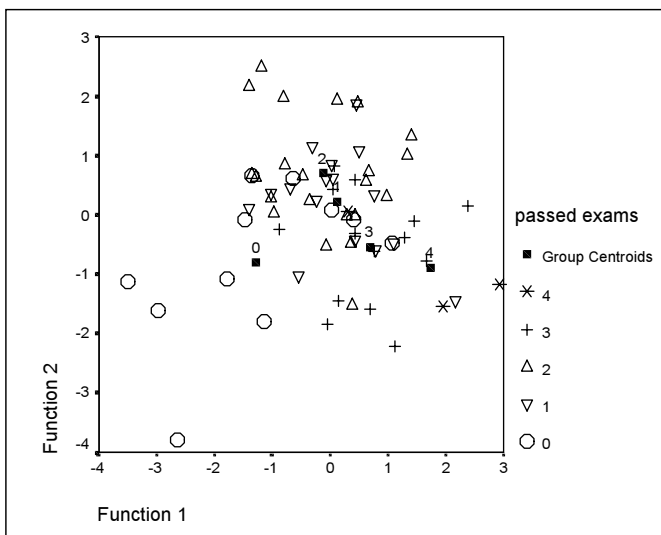


Figure 3: CDA of second year undergraduate students in Croatia showing separation into groups according to the number (0 to 4) of exams passed by the students (n = 66)

Abbildung 3: Kanonische Diskriminanzanalyse bei Studierenden des zweiten Studienjahres in Kroatien zur Verdeutlichung der Gruppenbildung gemäß der Anzahl (0 bis 4) bestandener Prüfungen (n = 66)

4. Discussion

It is evident that the majority of students surveyed decided to study agriculture of their own volition. Surprisingly, 40 % of students surveyed who enrolled for the first semester, did so because they had failed elsewhere or because they were exempted from the entrance exam. Agricultural degree students with a prior agricultural education are often exempted from the entrance exam on the basis of an average grade from the high school. In practice they do not perform significantly differently from students with a non-agricultural education.

The high drop out rate in Croatia compared to the UK is a major cause for concern. It must also be recognised that the much higher participation rate (approximately 70 % of school-leavers) in higher education in Croatia probably means that the 80 % completion rates observed in the UK may be difficult to achieve. A major reason for a high drop out rate in the first three semesters (and an important difference from the UK system) appears to be that students are not required to take their exams for a long period after completing the taught component of the course. As a result, it

is perhaps not surprising, even though it is a remarkable statistic, that as few as 5.2 % of students take exams regularly. Changes in the examination system were highlighted by students themselves as a means of improving their performance (Table 2: points 2, 4 and 6). Continuous assessment is common in the UK and was frequently desired by the Croatian students surveyed. Adoption of continuous assessment in Croatia would probably facilitate many more students taking their examinations regularly. One obvious lesson from the UK example is a need to modify the Croatian examination system so that students drop out if they fail their exams rather than by simply failing to take them. At the same time, the self-confidence of the students could also be helped by a tutorial system as commonly practised in the U.K. (see Table 3: point 1).

Table 3: Proportions of students who consider that specific proposals would help to improve their performance (Continuous assessment means students prefer to be assessed several times during each semester instead of in a final examination only)

Tabelle 3: Anteile von Studierenden mit der Meinung, dass spezifische Vorschläge die Verbesserung ihrer Leistung unterstützen würden (Ständige Beurteilung meint, die Studierenden ziehen es vor, mehrmals während des Semesters, statt nur einmal am Ende geprüft zu werden)

| | | |
|----|--|--------|
| 1. | Introducing a student mentoring system | 82.3 % |
| 2. | Reconciliation of exam timetable for all courses | 80.2 % |
| 3. | Better library and more textbooks | 80.2 % |
| 4. | Continuous assessment | 77.1 % |
| 5. | Better internships | 76.0 % |
| 6. | More examiners | 68.8 % |
| 7. | Better lecture quality | 67.7 % |
| 8. | Regular lecture attendance | 61.5 % |

Source: Students Association Survey, 2000;
sample: 94 agricultural students

The introduction of a compulsory examination could then be combined with a positive effort to maintain the interest and motivation of the students. To increase interest and motivation, it is also suggested that a more flexible degree programme with elective modules as in the UK, could reinforce the students' confidence in the quality and relevance of their education. Elective options could include, for example, foreign language courses with or without foreign exchange programmes for one or more semesters.

Career prospects at the end of a course of study may also help to motivate students. The prospects of new agricultural graduates getting a job are considered quite reasonable in Croatia. Graduates from agricultural faculties wait 9.7 to 12.8 months for employment. This period is similar to many other graduates. For example, in Osijek-Baranja

County (Northeastern Croatia) 37.4 % of all graduates have to wait for more than one year for employment. In the period from 1995 to 2000 approximately 250 graduates were employed per year (BULIĆ, 2000). It is encouraging to note that according to the *Monthly Statistics Bulletin* published by the Croatian Employment Service (ANONYMOUS, 2000) agricultural graduates do not feature among the five worst professions regarding unemployment frequency.

During their university courses, many Croatian students, who were unsure about whether they had chosen the right course at the beginning of their study, accepted agriculture as their future profession by the end of their courses (25 % of all enrolled students). On the other hand 8 % of those students defined as "properly oriented" changed their minds, and did not consider agriculture as their future profession. It is interesting that only 36 % of future professionals in the field of agriculture would obtain eight years of professional education. An additional 42 % would have only 4 years of agricultural education (only University education). In view of these proportions, it may be a cause for concern in terms of motivating students that about 22 % of students who will receive 4 or even 8 years of agricultural education (high school + University) are training for a profession that they will not pursue since they would seek for a job unconnected with agriculture.

Competitiveness of agricultural studies within the higher education sector is based on ability to recognise the current needs of agribusiness and to adjust courses accordingly (COOK, 1992). However, regardless of how flexible agricultural universities might be and how many new courses they might offer, it must be recognised that agriculture is a shrinking sector and that, as in the UK, some universities may eventually have to curtail agricultural courses.

Croatian development in past ten years might and should influence the changes in agricultural education. The transition from a planned to a market economy, extensive privatisation of large state owned agribusinesses among other companies, loss of markets such as the former Yugoslavia and the Soviet Union, combined with globalization (the Republic of Croatia is already member of WTO) are among important reasons for that. The development of new curricula such as Farm Business Management and more flexibility in existing ones might be essential.

As in the UK, there is a false impression that agriculture is relatively unimportant for the national economy. Although the term "Agribusiness" was introduced in 1957 by Davis and Goldberg as the largest part of the US economy, there is no comparable analysis of Croatian agriculture

where the aggregate impact of agribusiness has been included. However, Croatian agriculture contributed 915.64 million pounds sterling (7 %) to the national GDP in 1998. The share of agriculture in foreign trade is 1.84 % of exports and 3.39 % of total imports. All these numbers relate to the direct impact on the national economy. Indirect and induced impacts are not known accurately (ANONYMOUS, 1999). The last available data for the agricultural population in Croatia is from 1991 (DZS, 2000, online). In total 264 895 workers were working in agriculture and 84.25 % of them worked on their own farms.

Agricultural education is arguably an important element in improving food security of developing countries since lack of technical knowledge hinders adoption of sustainable systems. Agriculture is clearly under increasing pressure to be sustainable and competitive at the same time. This is particularly important for the Republic of Croatia which, according to a report in 2001 from the Croatian Ministry of Agriculture and Forestry, is self-sufficient in only five agricultural products and value of food imports exceeds 1 billion US\$. The uncertainty of making a living from agriculture in a globalised economy combined with an unattractive image of farming, has caused a decreasing interest in agricultural studies in Croatia as in many other countries. Clearly those who want to a success of their career in agriculture must receive high quality education and must continue to learn new approaches if they want to stay in business.

5. Conclusion

It is suggested that three key elements for improving the quality of agricultural and related studies in Croatia are (i) improving the confidence of the students in conjunction with (ii) a more rigorous, compulsory examination procedure and (iii) a supportive tutorial system. In the longer term, the admissions procedure may need to be modified, while recognising that structural changes can only be part of the solution.

The models developed in this paper highlight the possibility of predicting the likelihood of success of individual students according to various factors. While such predictions must never be used to discriminate against individuals or groups, mentors could use the knowledge of factors likely to mitigate against the successful completion of a course in the advice they give to students. Results of the investigation lead us to the following important conclusion: it is possible to predict the future performance of freshers with the help

of relatively few variables all of which are available at the time of admission. Monitoring student progress during the first year of study substantially improved the model's predictions.

Acknowledgement

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Annotations

- ¹ According to SALAJ (1957) in the 10th century Croatia had a population of 1.6–2.0 millions. At this time England had population of 1.2 millions. Due to Turkish invasion and shift of economic interest from Mediterranean sea to Atlantic ocean after discovery of America it is obvious that demographic changes went totally different ways.
- ² Ratio of tertiary graduates to the population at the typical age of graduation, multiplied by 100.

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