JUNIOR ACHIEVEMENT ENTREPRENEURSHIP STUDENT COMPANIES PREDICTIVE MODELS ANALYSIS

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Abstract: *JA-YE Europe Student Company programs give high school and post-secondary students the opportunity to experience the entrepreneurship in practice through learning by doing educational methods. Students get an insight into self-employment, business analysis and creation, risk taking and manage adversity all with advice and support from business consultants.*

The present paper provides the big picture behind the Company program, stakeholder analysis and successful patterns and model recognition. The paper summarizes the preliminary results from 10 years of experience and empiricallyderived research study focusing on the relationship between the degrees of value creation and innovation in a sample of more than 500 high school Student companies and 75 university Student companies, that have been participated in and successfully accomplished JA Company Program. Data was collected for the last 5 years. The results include winning patterns based on a CRISP-DM research methodology using predictive models. The generated models and results can be applied by school and university Student Companies, their tutors and consultants.

Keywords: *Student Company, empirical study, predictive model analysis*

1. INTRODUCTION

Nowadays, gaining business skills and real business experience become as vital as mere theoretical knowledge acquirement, often skills and experience are considered to be even more important. Many of the jobs in 2020 do not exist today and cannot be foreseen yet; this requires the development of broader and better knowledge, skills and competences. [6]

The learning-by-doing methodology applied in business and entrepreneurial education has demonstrated its effectiveness in developing skills and attitudes required

for future professional and personal success. Survey shows that the start-up rate among the Junior Achievement (JA) former student company program participants is 15 %, compared to 5-6% start-up rate in the general population in Europe. And 85% of the student founded companies stay in business. [4]

Student company is a hands-on program that educates participants in the fundamentals of business and management, but moreover it develops a variety of entrepreneurial and intrapreneurial skills, competencies and attitudes that are a must now not only for prospective business founders, but also for organizations management and employees, as well.

That is why we want to find what makes a successful company and to focus more on the patterns for success to deliver high quality entrepreneurial experience that would prepare the young people for the forthcoming economic and business environment.

A successful student company could be a broader definition – it could be measured through skills developed by participants, turnover and profit made, standing in the national student company competition. For the purpose of this study we select the standing in the competition as a key success factor, since the teams there are evaluated by a panel of business professionals, entrepreneurs and venture capitalist based on the overall performance of the company that includes not only the end financial results, but also assessment of the team and team skills and competencies, innovation, feasibility and potential of the business idea etc.

In the paper Junior Achievement (JA) student company program databases are examined and IBM SPSS Predictive Analytics tool is used to describe:

-	profiles and characteristics of students, academic staff and business consultants that are likely to participate in the program;

-	characteristics of the student companies participating in the competition and those who are most likely to win it.

The paper tries to find answers to some challenging questions:

• What are the characteristics of the students, teachers/professors and business consultants that are most likely to participate in the program?

• What are the patterns behind a successful student company that wins the competition?

• What types of companies are more likely to establish a real business?

• How the program could be upgraded to respond even better to the beneficiaries needs?

2. RESEARCH METHODOLOGY AND DESIGN

"Historical data does become critical in decision-making when it is combined with current data and continuously refreshed with new information. This approach is the basis of predictive decision-making; models are based on what has happened and why, and also on what is

Figure 1. Predictive analytics overview
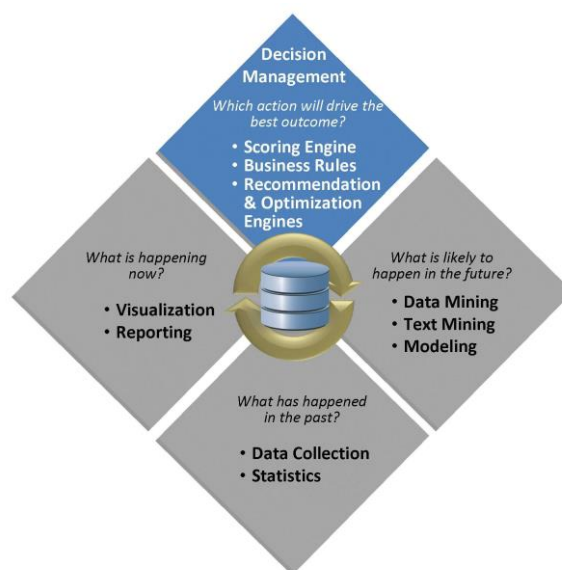
happening now and what will likely happen next." [3]

For the purpose of the study we apply a combination of an explicit data base, sophisticated analytical skills and data mining in order to reveal the winning patterns in the JA Company competition for school and university students. We need a " shift from a sense-and-respond focus to a forward-looking predict-and-act focus". [3]

We based our work on the CRISP – DM model, data mining methodology that makes large data mining projects faster, more efficient and helps in identifying the new and successful patterns. The 6 CRISP-DM methodology major steps **(Business understanding, Data understanding, Data Preparation, Modeling, Evaluation, Deployment)** are presented in Fig.2 , accompanied by generic tasks (bold) together with the tasks corresponding outputs (italic). [1]

Business Understanding	Data Understanding	Data Preparation	Modeling	Evaluation	Deployment
Determine Business Objectives *Background Business Objectives Business Success Criteria*	**Collect Initial Data** *Initial Data Collection Report*	**Select Data** *Rationale for Inclusion/ Exclusion*	**Select Modeling Techniques** *Modeling Technique Modeling Assumptions*	**Evaluate Results** *Assessment of Data Mining Results w.r.t. Business Success Criteria Approved Models*	**Plan Deployment** *Deployment Plan*
Assess Situation *Inventory of Resources Requirements, Assumptions, and Constraints Risks and Contingencies Terminology Costs and Benefits*	**Describe Data** *Data Description Report*	**Clean Data** *Data Cleaning Report*	**Generate Test Design** *Test Design*	**Review Process** *Review of Process*	**Plan Monitoring and Maintenance** *Monitoring and Maintenance Plan*
	Explore Data *Data Exploration Report*	**Construct Data** *Derived Attributes Generated Records*	**Build Model** *Parameter Settings Models Model Descriptions*	**Determine Next Steps** *List of Possible Actions Decision*	**Produce Final Report** *Final Report Final Presentation*
Determine Data Mining Goals *Data Mining Goals Data Mining Success Criteria*	**Verify Data Quality** *Data Quality Report*	**Integrate Data** *Merged Data*	**Assess Model** *Model Assessment Revised Parameter Settings*		**Review Project** *Experience Documentation*
Produce Project Plan *Project Plan Initial Assessment of Tools and Techniques*		**Format Data** *Reformatted Data* *Dataset Dataset Description*			

Figure 2. CRISP-DM reference model

In the study classification tree analysis as a statistical method was used to illustrate and define the problematic areas of the research. When we meet Classification trees in the literature, six goals it could be used for persist [SPSS]:

1. "**Segmentation.** Identify persons who are likely to be members of a particular group." In our case we will use this property for identification of positive target and negative target group. We define positive target groups as groups of students companies with high percentage of winners of the national competitions. The negative target groups are, conversely, the groups with low percentage of winners. The identification of the positive target groups could help us to understand the pattern of success. The identification of the negative target groups will show us where we have to make efforts. Thus we could offer special policies for the special groups.

2. "**Stratification.** Assign cases into one of several categories…" This is an

individual level of the analysis which is not a topic of interest in this paper.

3. "**Prediction.** Create rules and use them to predict future events…" If we succeed to identify stable positive target groups we could prescribe future behaviour which could provide the winning of the national competitions.

4. "**Data reduction and variable screening.** Select a useful subset of predictors from a large set of variables for use in building a formal parametric model." The method will help us to identify only these predictors which really affect the dependent variable. This is very important because the high schools database contains 19 predictors and the universities database contains 48 predictors. In the second place, the method ranges the predictors by their importance.

5. "**Interaction identification.** Identify relationships that pertain only to specific subgroups and specify this in a formal parametric model." Building of formal parametric models is future task for us so that for the moment will not use this property.

6. "**Category merging and discretizing continues variables.** Recode group predictor categories and continues variables with minimal loss of information." If several categories of the predictor have almost the same winning results they are merged. This is part of the describing of the positive and negative target groups. [2]

Data Collection

Student company program curriculum is completely based on the "learning-bydoing" educational method. For a period ranging from one term to one school/academic year, students set up a mini startup under the guidance and supervision of a teacher (university professor in the case with the university student companies) and volunteers from the business community. The aim of the programme is to teach students how to discover business opportunities and to provide them with training in economics and entrepreneurship. The students have to take care of all major aspects related to the creation, functioning and management of an enterprise. [4, 5]

Students participating in the program gain knowledge in the field of economics, business and management, but more importantly they develop entrepreneurial spirit and culture combined with specific functional managerial skills and essential soft skills. Student teams compete in the national contest for student companies, and a panel of entrepreneurs and business professionals evaluate their work. The direct program stakeholders are: Junior Achievement as a program developer and administrator, the

participating schools and universities, teachers, professors, students, business consultants, and the student companies themselves.

[7]

JA Student Company Program has two forms – a basic one targeted at highschool students, and a more advanced one - designed for university students. Each form is consistent with the specifics of the corresponding age groups and educational levels, therefore for more preciseness the data descriptions in the current study are divided into two groups – high schools and universities.

High schools

JA Bulgaria programs for entrepreneurial education based on learning-by-doing methodology have been implemented in the Bulgarian educational system since 1997. Up to now, the students who have participated in the programs are more than 100,000 [8]. JA Student Company Program is the one traditionally attracting most students. The number of high school participants for the last 5 years is indicated in Table 1.

Table 1. High school student companies in Bulgaria (2006-2011)

School Year	2006-2007	2007-2008	2008-2009	2009-2010	2010-2011
Number of schools	28	36	36	49	51
Number of students	932	1120	1080	2106	1726
Number of student companies	75	80	75	144	114

The data collected for the high school students has been gathered for a five year period (2006-2011). The official program application form, translated in Bulgarian and adapted to the national requirements, was used as a key tool for collecting the data. The format of the tool has been constant for the last five years.   Additional information was provided through the data from the annual JA student company competitions. It contains detailed information about: participating companies, special awards and the major category (Company of the Year) top three award-winning places.

Universities

Start Up Programme (JA Student company program for university students) was initially developed in UK in 1998 under the name Graduate Programme. [5] Since that time it has been applied in 15 European countries and more than 20 000 university students have taken part in the program. In Bulgaria the program was introduced as a pilot one in 2005, in 2007 it was introduced publicly. In our study, we processed and analyzed the data collected for the university student companies for the period 20072011. The number of students that have undergone the study and the number of companies established by them in different universities in Bulgaria are shown in Table 2.

Table 2. University student companies in Bulgaria*

Academic Year	2005	2006	2007	2008	2009	2010	2011
Number of Universities	1	1	1	5	9	13	10
Number of students	25	39	45	51	108	305	230
Number of student companies	1	2	2	6	11	28	29

*Data for 2005 and 2006 is indicted as a number of universities, students and companies, however it is not a part of the current research since the tools used for data collection had not been applied for those years.

The tools used for collecting the data are: 1.) the preliminary intention-toparticipate registration form; 2.) the company registration form; 3.) the company liquidation form. The forms were translated, adapted and developed in accordance with the original program materials and the national business and legal environment requirements. [9]

After processing the all collected data, we have identified five major groups of indicators for both high school and university student companies:

Indicators group for high school companies	Indicators group for university companies
1. School profile;	1. University profile;
2. Teachers profile;	2. University tutors profile;
3. Business consultants profile;	3. Business consultants profile;

4. Students profile;	4. Students profile;
5. Student company profile.	5. Student company profile.

The subcategories of each target group include the following indicator variables:

Variables for highs schools companies	Variables for university companies
1. **Schools profile** - Type of school (according to the National classification of the Ministry of Education, Youth and Science), Location – rural area, central or municipality city etc.	1. **University profile** - University name, Location, Field of education according to ISCED etc.
2. **Teachers profile** – Gender	2. **University tutors profile** - Gender, Faculty, Previous program experience etc.
3. **Business consultants profile** – Gender	3. **Business consultants profile** - Gender, Occupation/Job position, Type of organization, Scope of economic activity according to the
	NACE, Previous program experience etc.;
4. **Students profile** - Gender, Class in school etc.	4. **University students profile** - Year of education, Field of education, gender, previous program experience etc.
5. **Student company profile** - Total number of students in the company, specification of the Scope of the company economic activity according to the Statistical Classification of Economic Activities in the European Community (NACE), Participation in the national student company competition, Participation in European competitions, and the company Standing in respect of special category awards and Company of the Year award (first three positions).	5. **Students company profile** - Number of participants, Gender, Scope of economic activity, according to the NACE, company Standing in respect of special category awards and Company of the Year award (first three positions) etc.

The indicators are selected based on empirical experience and the collector intention to have the most comprehensive profile of the program participants, their activities, the factors influencing the decision to join the program and success factors. [2]

3. RESULTS AND DISCUSSIONS

The results and findings discussed in the following section refer to the university student company data examples.

Profile of the students (Universities)

The research shows that the average number of students in a student company is : 9,5 participants. The established program rules require a team to have minimum 2 and maximum 15 participants. [9] Our empirical observations have evidenced that companies with few participants usually suffer from work overload, since there are no enough people to engage efficiently in all functional managerial tasks, while large teams often encounter the "free rider" syndrome and have slower and less effective decision   making process. During the first years of student company program implementation students and their professors were more likely to organize larger teams, however the current research database examination shows that with the development of the program a natural tendency to effectiveness has occurred and the teams are formed by about the average number of participants of the recommended one.

Figure 1 shows that there is less than 10% difference in the number of female and male program participants. Figure 2 shows that bachelor students in their 3rd and 4th l year of study represent more than a half of all program participants.
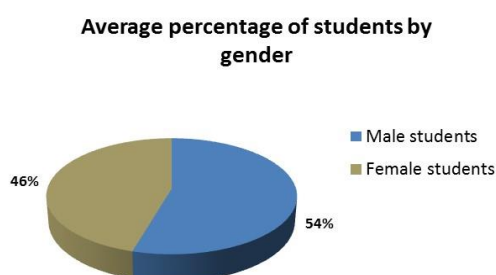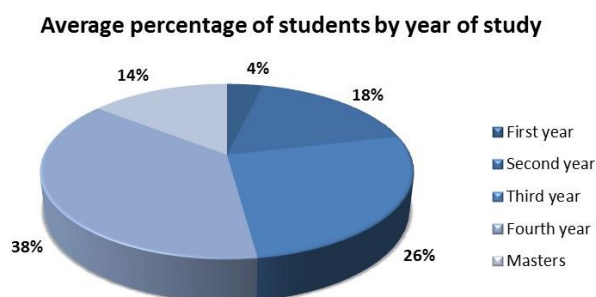
Figure 3. Students by gender

Figure 4. Students by year of study

The average number of the students participating in the program more than once is 0,2.

The question here is why 1st and 2nd year students are less likely to join the program.

Profile of professors and business consultants (Universities)

The average number of professors (male) participating in the program is 0,8 , while their female colleagues are only 0,3. The sum is more than 100% because some of the student companies are guided by several professors. The average number of the professors that have participated in the program before is 0,8.

The average number of business consultants by gender shows that male consultants are more involved with 0,5 average male business volunteers, compared to the female consultants - 0,3. The average number of the business consultants that have participated more than once in the program is 0,2. The sum is less than 100% since there are companies with no business consultants. The results rise several questions: why male business consultants are more likely to support the program? Is there any relation between the gender of the consultant and the company performance?

Competition Standing

The classification trees used (Figures 5 and 6) indicate one most important predictor for all cases, which enables us to identify the most important predictors and the positive and negative major groups as well.
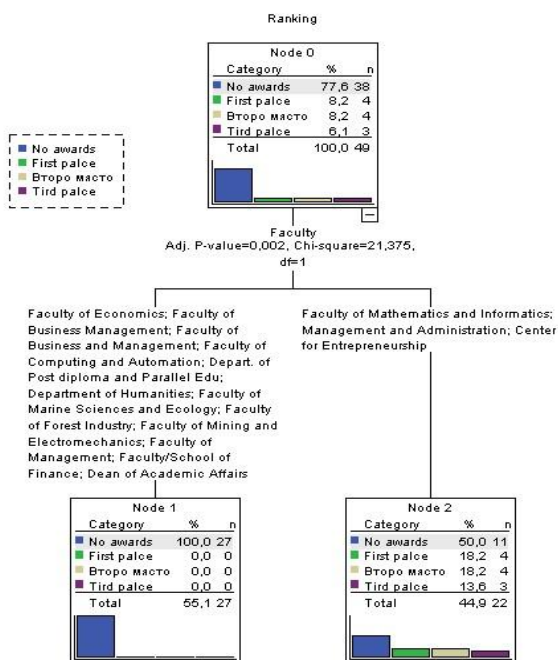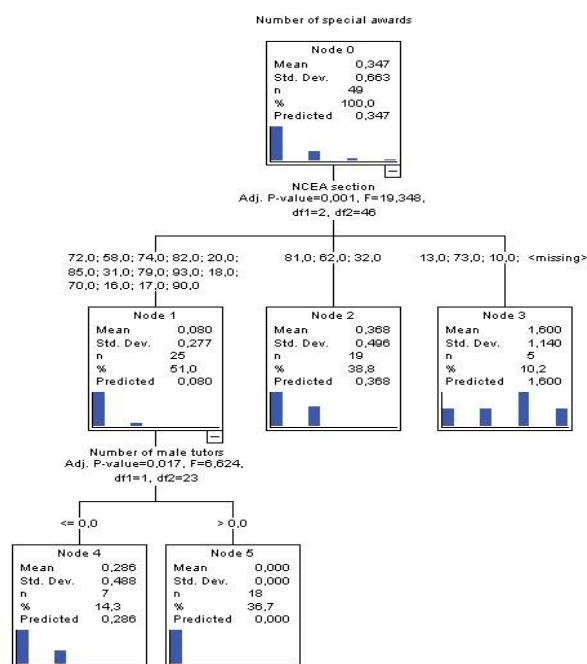
Figure 5. Company of the Year ranking

Figure 6. Special Award categories ranking

When considering the company standing in the Company of the Year award category in the national competitions the important predictor is the professors faculty. The positive target group contains the student companies, guided by professors from the Faculty of Mathematics and Informatics, from Faculty of Management and Administration and from Center for Entrepreneurship. The negative target group contains the student companies with professors belonging to all other faculties. Here we could investigate further to identify if the positive target group is a result of the Faculties that are involved predominantly in technology, management and entrepreneurship.

For the company standing in the special award categories in the national competitions the important predictor is NACE, which could be explained with the very profiled criteria of the award categories.

4. CONCLUSIONS AND FUTURE WORK

The two key conclusions from the paper are:

• The classification trees method used to analyze and visualize the data is very functional and precise to uncover successful patterns in the student company and the student company competition analysis.

•   The tools used so far are quite helpful for localization of the successful patterns, however we need to add more data into the analysis and expand the number of the indicators.

The predictive model analysis helps us to support statistically some intuitive program findings, while rejecting others as irrelevant. The patterns revealed, enlighten the path to the future program development that would provide the program beneficiaries with more quality practices and could enhance the student projects transformation into successful business ventures. It also exposes some blank spots of information (for example – more complete data about the Bulgarian student companies and students that founded real startups after participating in the program is needed) that should be covered by data collected in the future. The next task is to combine the information requirements from the different tools used so far in one integrated tool (in the form of comprehensive questionnaire with additional indicators) that provides more precise information about the student company participants and helps the program developers to adjust the program to meet better the participants needs.

For the current academic year more than 100 high school and 25 university student companies are registered and the students, tutors and consultants will work with the new tool giving more insights for new predictive analysis.

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