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MODELS FOR THE DECISION SUPPORT SYSTEM IN THE ALUMNI MANAGEMENT

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Abstract. The article examines some aspects of model development for the decision support system in the alumni management. The interpretation of the obtained results is also discussed by using proposed hybrid alumni loyalty model.

Key words: structural equation modelling; decision support system, alumni management; hybrid model of intention to alumni loyalty; key factors.

Cuts in government funding, unstable and complex graduate employment, competitive marketplace and intensive international and regional competition were caused to improve the quality of education, university reputation and reform the whole higher education system. In order to solve the problems described above many universities around the world start to focus on the special task group – alumni [1, 2]. Moreover, American scientists [3] revealed that the great percentage of US and UK university budgets comes not from state funding or tuitions but from fundraising (philanthropic sector) especially from alumni. In addition, alumni could provide invaluable assistance to their alma-mater in various areas and therefore they can be used as an additional largest source of different kind of support for a university.

The reviewed literature shows that among foreign scientists the following researches comprehensively analyse alumni-university relationship: D. Heller, T. Mortenson, AF Kabrela, J. Wirths, R. Glowe, L. Leslie T. Kaboni, Y. Cunberg, S. Hofmann, S. Muller, C. Noble, F. Mael, V. Tinto, Tom G., etc. Among domestic scholars whose works are also related to this subject area, we can highlight scientific work of E. B. Lutsenko, V. N. Zaryanka, M. K. Borisova and others.

Furthermore, the reviewed literature demonstrates a large set of econometrical models which allow scholars to investigate different aspects of the alumni-university relationship. However, these models have different restriction of their direct application. Since alumni research is not nearly as well examined in Russia as in the USA, interpretation of these models for Russian reality requires consideration of both national peculiarities and regional characteristics.

The article also describes a software development of the decision support system for alumni management.

FACTORS INFLUENCING ON INTENTION TO ALUMNI LOYALTY

Several researchers, such as Hueston (1992), Pendel (1985), Connolly and Blanchette (1986), identified the following key socio-demographic indicators, which describe the ability to implement financial and volunteer assistance to high school: age, family income, career and the history of education, membership in both commercial and nonprofit organizations, creative activities, free time and hobbies (hobby), wife (husband) career, his (or her) history of education and age, education of children and grandchildren, etc. Having analysed these indicators we could select those of them that have the most impact on alumni loyalty (the ability to charity) to a alma-mater. During this analysis we could identify some regular occurrences. In spite of it, we can see a view conflict concerning obtained factors and corresponding to them indicators (some factors were proved by some scholars but rejected by others).

Most studies indicate no statistically significant difference in average contributions by gender (Clotfelter 2003b; Marr et al. 2005; Monks 2003; Okun-

ade 1996; Wunnava and Lauze 2001). However, a study about alumni from a private institution found that men are more likely donors than women (Lindahl & Winship 1994). Although other researchers found that women volunteer at a higher rate than men across age groups, education levels, and other major characteristics (Bureau of Labor Statistics, 2004; Weerts & Ronca, 2008; Holmes, 2009).

Whites are more likely to make a contribution to their alma mater than Blacks and Asians. (Okunade, 1996; Monks, 2003; Bureau of Labor Statistics, 2004)

According to some researches, life cycles play a significant role in changing leisure time use and are based on four factors (Zuzanek & Smale, 1999): age, marital status, presence of children, employment status.

Some researches (Bureau of Labor Statistics, 2004) argued that among the different age groups, persons age 35–44 are most likely to volunteer. On the other hand, volunteer rates were lowest among persons in their early twenties (20.0 %) and those age 65 and over (24.6 %) (e. g. Bureau of Labor Statistics, 2004); Other researches assert, that the most of the money are got from alumni of 60 years and elder (e. g. Karpova, 2006), or even suggest that age does not play significant role at all (Weerts & Ronca, 2008). Generally, some studies confirmed that older alumni are more likely to give than younger alumni (Beeler 1982; Bruggink and Siddiqui 1995; Haddad 1986; Keller 1982; Yankelovich 1987; Okunade and Berl 1997; Olsen et al. 1989; Wunnava and Lauze, 2001; Holmes, 2009).

Some studies reported that married alumni are more likely to donate than nonmarried alumni (Okunade and Berl, 1997; Bureau of Labor Statistics, 2004; Holmes, 2009). However, other researchers have found negative impact of marital status upon alumni giving (e. g. Bruggink & Siddiqui, 1995; Belfied & Beney, 2000; Monks, 2003).

Parents with children under age 18 were more likely to give than persons without children of that age (Bureau of Labor Statistics, 2004).

One study found that people who were employed support at a higher rate than those who were unemployed or not in the labor force (Bureau of Labor Statistics, 2004), another showed no correlation between employment status and alumni giving capacity (Weerts & Ronca, 2008).

There is a positive link between alumni support and civic engagement. Alumni, who helped civic non-profit organizations by donation and volunteering, tend to give support to their alma mature as well (e. g. Miracle, 1977; House, 1987; Weerts & Ronca, 2008).

Total charitable giving is quite sensitive to tax deductions (Clotfelter, 1985; Auten et al., 2002; Gruber, 2004), but this issue has received little attention in the alumni giving literature. Clotfelter (2003) found no relationship between the tax deduction and alumni donations. However, Holmes (2009) asserts that charitable tax deductions are correlated with higher giving, but only among rich alumni.

Alumni who live near to their alma-mater are more likely to give support then those who live far away from the university (Hueston, 1992; Lindahl & Winship, 1994; Bruggink & Siddiqui, 1995; Weerts & Ronca, 2008; Holmes,2009).

Alumni who earned degrees in social science fields are more likely to make a contribution than those who earned in the arts (Haddad, 1986; Hueston, 1992; Okunade and Berl, 1997; Monks, 2003; Marr et al., 2005; Holmes, 2009).

The more a family obtains income the more this family donates (Lindahl and Winship, 1994; Bruggink and Siddiqui, 1995; Okunade and Berl, 1997; Hanson, 2000; Clotfelter, 2003b; Holmes, 2009).

Despite the existed numerous published studies which describe factors influencing on the alumni financial and volunteer assistance to their alma-mater, this area is still not very well investigated (Newman & Petrosko, 2011). This could be due to the fact that, in spite of the existing various hypothetic factors, the influences of the most of them on the alumni loyalty are ambiguously determined: some scientists confirm correlation between suggested factors and alumni contribution to the university; others deny it and assert the opposite. Moreover, this situation became worse since alumni research is relatively new topic in Russia as well in European countries in comparison with the USA, where scientists have been already examining it for more than 70 years. Therefore, issues regarding mathematical models and informational support implementation related to alumni loyalty are very important and pressing especially nowadays when government increasingly declines the state financing for university development.

MATHEMATICAL MODELLING OF THE ALUMNI–UNIVERSITY RELATIONSHIP

Analysis of information processing methods [4] in alumni management showed the appropriateness of using the statistical method of the second generation - structural equation modelling [3, 5]. Authors offered a hybrid model of alumni-university relationship which refers to the second phase of integration and called the "Model of intention to alumni loyalty" (MIAL) as (Fig. 1).
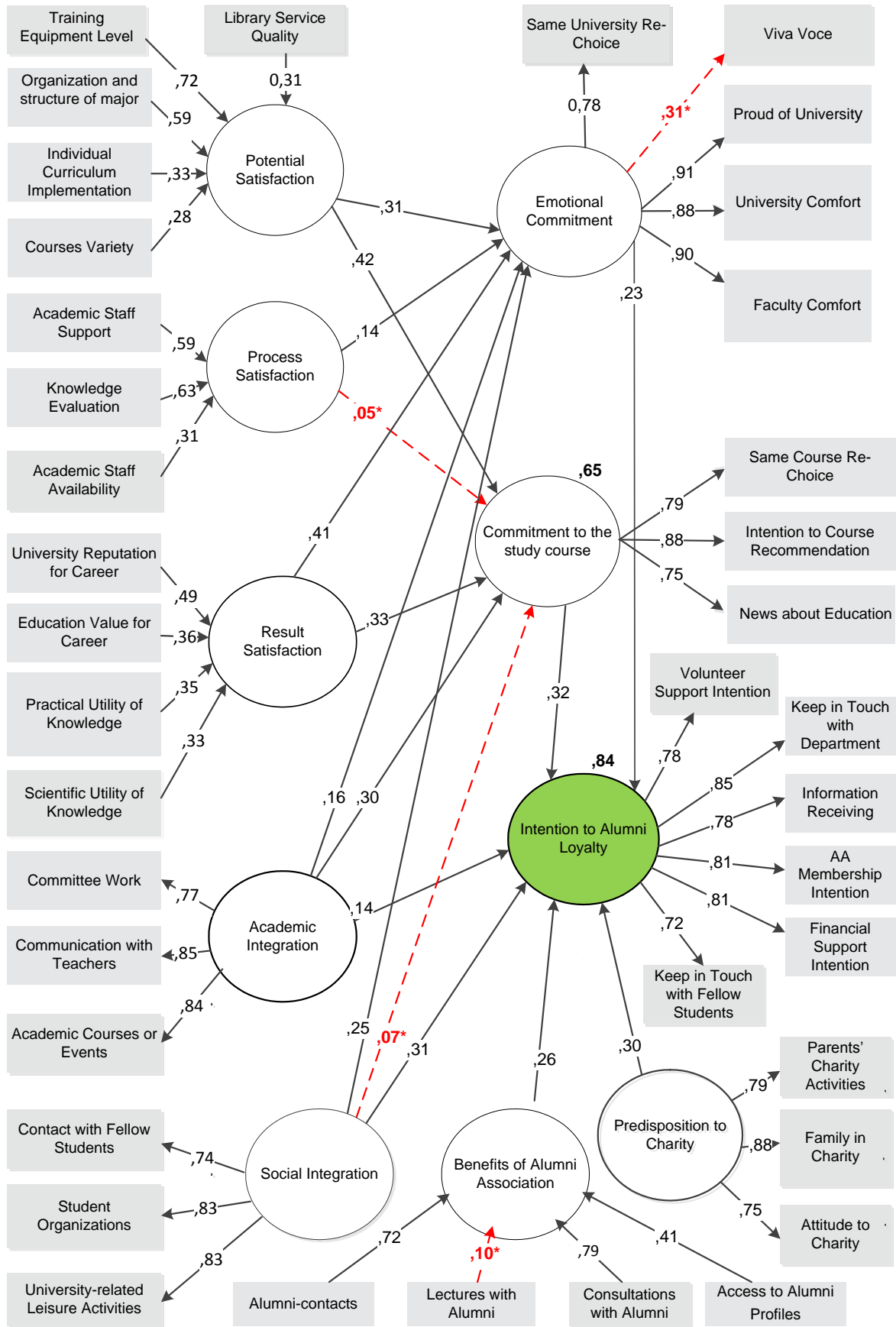
Fig. 1. Model of intention to alumni loyalty

MIAL has a hierarchical structure and includes the following factors:

• "Commitment to the study course" (CSS);
• "Potential satisfaction" (PS);
• "Process satisfaction" (PrS);
• "Result satisfaction" (RS);
• "Academic integration" (AI);
• "Social integration" (SI);
• "Benefits of alumni association" (BAA);
• "Predisposition to charity" (PC);
• "Emotional commitment" (EC);
• "Intention to alumni loyalty" (IAL).

In the frame of the MIAL the following hypotheses have to be empirically proved:

• The students' "EC" to the educational institution has a significant positive impact on "IAL" (*H1*).

• The students' "CSS" to the educational institution has a significant positive impact on "IAL" (*H2*).

• The students' "AI" (*a*), "SI" (*b*), into the academic and social system of a university respectively has a significant positive impact on "IAL" (*H3$_{a,b}$*) and etc.

DECISION SUPPORT SYSTEM IN THE ALUMNI MANAGEMENT

The DSS in the alumni management includes the models and rule bases, block of controlling and monitoring, block of model construction and modification [5–10].

The *model base* stores:

• known formalized *theoretical models*, which developed in the frame of specific theoretical approaches and describe "Alumni-University" and "Student–University" relationships;

• *model templates,* created by expert for spesific tasks based on *theoretical models*;

• *valid models,* designed based on *expert templates* and empirically examined in the alumni management;

Developed *model base* allows an expert to design a new model or to adapt previously created expert *templates* or *valid models* (particularly, "Student/Alumni Loyalty to University" models) for tasks related to the management of alumni – university interaction.

A *rule base* is used to store procedure knowledge represented as a production models set. Benefits of the *rule base*:

• an expert can develop a new "Alumni-University" relations model based on known prototypes or templates;

• model quality analysis could be automatically carried out;

• a decision maker could obtain some recommendation concerning alumni management (Fig. 2);

The *block of controlling and monitoring* evaluates main indicators of alumni management, such as: a level of material and financial support provided by graduates for their alma-mater; a number of alumni in the alumni association; a number of alumni-sponsors and alumni-volunteers. It also compares these indicators with appropriate indicators from other native or foreign higher education institutions. Moreover, this block assesses dynamics of alumni association development and strategic planning efficiency of alumni management.

Based on theoretical models and expert templates the *block of model construction and modification* develops a new model. Furthermore, this block automatically assesses model quality and adjustment based on statistical indicators in the database and inference algorithms in the rule base. Moreover, this block gives recommendations to decision maker for alumni interaction management and indicates critical situations, which require an expert assistance in decision making.

Our created DSS (decision support system) provides the following main functions:

• collecting, storing and processing of information about students, alumni, higher educational institutions and specialties;

• selecting an efficient "Alumni-University" interaction model for specific tasks of the alumni association;

• model development based on selected hypotheses and theoretical approaches, which are stored in the knowledge base;

• automated analysis of "Alumni-University" interaction models based on model quality assessment;

• correction of selected "Alumni-University" interaction model for certain tasks of an alumni association by taking into account collected statistical data;

• recommendation delivery to decision maker in order to improve alumni-university management.

In order to implement the DSS prototype, MS Visual Studio 2010 was chosen as the development environment and MS SQL 2008 was selected as the data storage; C# was used as a programming language.

RESULT INTERPRETATION

In order to perform the empirical validation of the developed hybrid model (MIAL), students from two leading universities (the USATU (Ufa, Russia) and the Technical University of Dresden (TUD, Dresden, Germany)) were selected.
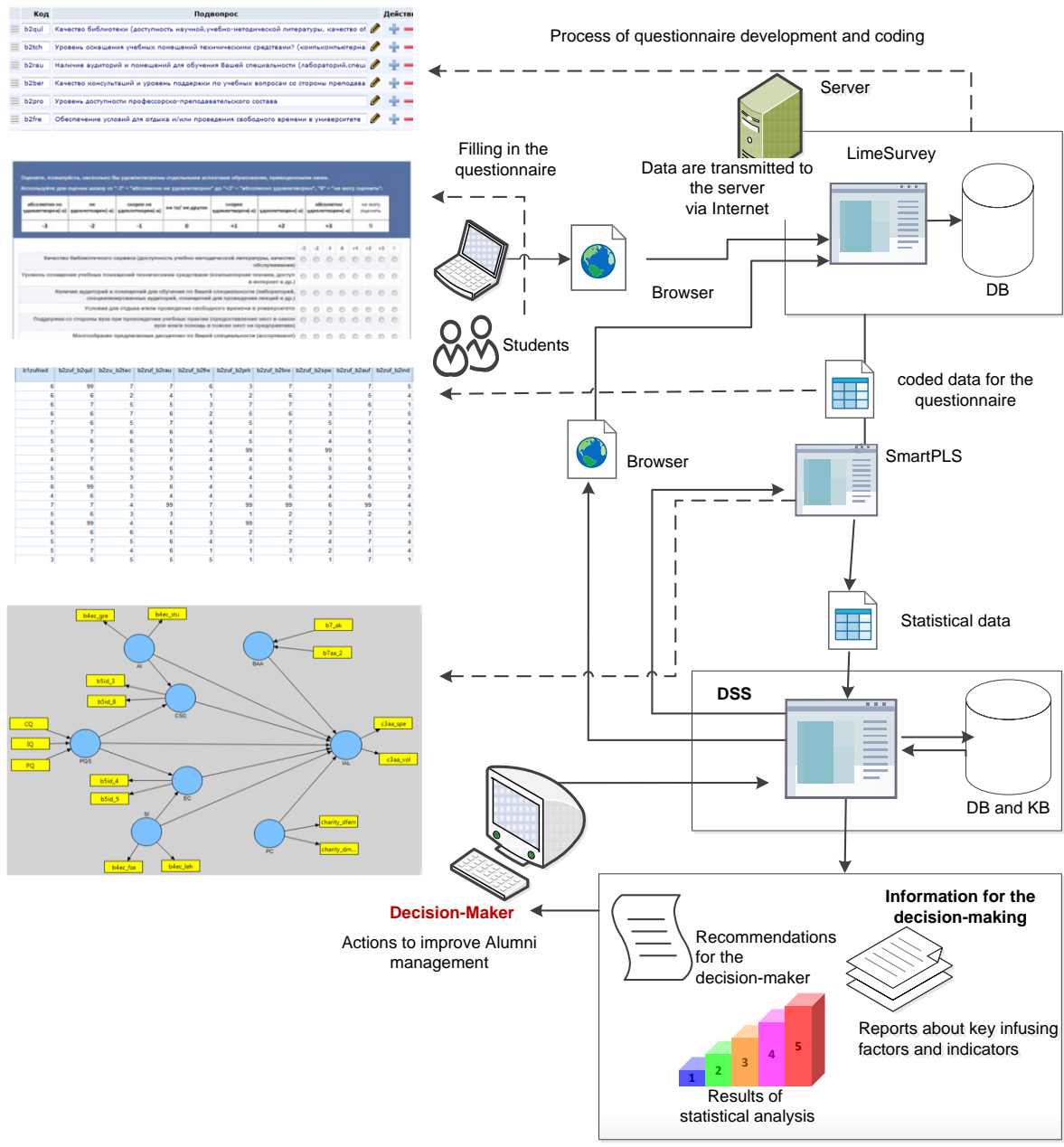
Fig. 2. Structure of the DSS information flows in alumni management

The obtained results and conducted qualitative analysis of the model shows, that the "Intention to alumni loyalty" could be enhanced by three main alternative strategic approaches:

• Benefits-based strategy;
• Student integration-based strategy;
• University service quality-based strategy.

For the both mentioned universities: personal contact and consultations with successful alumni stimulates education quality satisfaction. Results reveal that for students from the TUD individual conversations with lectors and professors promote in the highest degree student integration into university's life and thus, increase the IAL level.

In order to enhance the IAL for students from the USATU, it is necessary to conduct alumni meetings and cultural events, where alumni and professors could inform students about alumni association concept and agitate them to participate in various university activities.

Moreover, the following findings play significant role in the IAL increasing for both universities: the structure of major, training equipment level, knowledge evaluation (how professors assess students during exams), university reputation and the

practical utility of knowledge (to a certain degree how gained knowledge applicable for work activities). Particularly, flexibility in regulation of education plans (individual curriculum implementation) could enhance student's academic mobility and therefore increase education quality satisfaction.

Developed information model comprises: general directories ("Countries", "Universities", "Specialties", "Model variables"); tables for model ("Student/alumni – University", "Approaches", "Model prototypes", "Model prototype structure") tables for expert templates of the models "Student/alumni – University" ("Expert model templates", "Expert model templates structure"); tables for "Alumni – University" relations models with link coefficients between variables ("Models" and "Model structure").

CONCLUSION

The developed "Model of intention to alumni loyally" allows researchers to consider the economic, administrative, educational and other theoretical approaches, as well as regional and national characteristics of the university. Moreover, our proposed model could help to identify factors that motivate alumni to perform volunteer and financial assistance to their alma-mater, to join the alumni association and to liaise between alumni and their university department (or chair and fellow students). The MIAL could be easily adapted for both domestic and foreign universities in accordance with the specifics objectives of alumni management.

Empirical analysis of the MIAL shows a high coefficient of determination of the resulting factor called IAL corresponding to 83 % for both the Russian and German universities which is 10–80 % higher than in conventional known models. This fact means that factors included into the model are extremely important and play significant role in explanation of the IAL factor. The empirical validation shows that the MIAL could be used in both Russian and foreign universities to coordinate their activities better in order to increase alumni loyalty rates.

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Аннотация: В статье рассмотрены вопросы разработки моделей для организации поддержки принятия решений при управлении взаимодействием с алюмни университета, а также интерпретация результатов использования предложенной гибридной модели лояльности алюмни к вузу.

Ключевые слова: моделирование структурными уравнениями; системы поддержки принятия решений; алюмни менеджмент; гибридная модель лояльности алюмни к вузу; ключевые факторы.

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