

# DECISION SUPPORT SYSTEMS – THE HELP FOR VOCATIONAL GUIDANCE OF LAW GRADUATES

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#### **Summary**

Higher education institutions have to measure and validate their students' competences. It is not easy if all competences are considered but it is more difficult according to so-called soft competences like for example working under the pressure of time. But more difficult is to decide whether the graduate who acquired during their studies the special set of competences can do a special job effectively. The very interesting task is to choose the best graduate from the set of candidates on the basis of their competences and the demands of the employer. The paper presents the model of such a decision support system which can produce advices for graduates, employers and university authorities.

Key words: decision support system, higher education, fuzzy logic.

#### Аннотация

В статье рассматривается система принятия решений для оказания помощи работодателям при подборе наиболее квалифицированных выпускников для персонала юридических компаний. Вузы должны контролировать знания своих студентов в процессе учебы. Однако наиболее важным вопросом является: может ли выпускник эффективно выполнять работу по специальности, приобретенной во время своего обучения в вузе. Основная задача данного исследования состоит в том, чтобы выбрать лучших выпускников, будущих работников на основе их знаний и требований работодателя. В работе предлагается модель такой системы поддержки принятия решений, которая может произвести рекомендации для выпускников, работодателей и университетских властей.

Ключевые слова: система поддержки принятия решений, высшее образование.

#### 1. Introduction

It is not easy to find satisfying work after the law studies. This problem is discussed on the Internet, for example «The overall employment rate for new law school graduates fell to 84.7%» [1] or «Arizona State University's law school is attacking head on the growing problem of law school graduates — who are in the fifth year of a near-depression-level job market — not being able to find work. (...) Law schools have also been offering public interest fellowships to help recent graduates get a foothold in the legal market — and creating incubators to train solo practitioners [2].

The situation of law graduates in Poland is also difficult. As there can be read in Gazeta prawna that the economic crisis caused that law firms stopped recruiting in 2013, so as a result, very few of this year's applicants can find employment in a law profession [3].

#### 2. The competences of graduates of law

Graduates of law would like to work as a judge, lawyer, notary, solicitor, researcher, public prosecutor, law enforcement agency employee, bailiff, tax adviser, patent attorney and finally as a government employee [4].

The HEIs' authorities have to think over the key competences that students of law should study. As M. Borowicz says that the most important are soft skills like communication and negotiation because they will have to know how to conduct an interview with the client, how to convince someone, to advise someone to negotiate with someone [5].

### 3. The foundation of the decision support system

In daily life people do not use the precise language because it is not necessary. There is no need to know that from home to work is 3.462 km.

Moreover some phrases have different meaning for different people in different situations, for example the word «far» has a lot of variants when there are considered drivers, walkers or plane passengers. It is an important factor whether people have a lot of time or they are in a hurry.

The quality of education is in the field of social sciences. Unlike sciences and technology, the social sciences use very often unclear and blurred phrases during the process of gathering responses to some questions, for example, when people are asked whether they are prepared for their job, they can answer: «yes», «no», «so-so», «well prepared», «not at all», and so on. All presented answers are so called fuzzy.

Classical logic deals with situations when one can decide whether an considered object belongs to the set or not. For example, a judge can say that the accused person is guilty or not. But in fuzzy logic there can be considered more complicated situations when after one day of negotiations there cannot be say that for sure the lawyer will reach agreement between the parties.

This situation can often be observed in education. When graduates are asked how well they are prepared for their job, they can answer «very well» or «not at all» and the problem of preparation for the job can be discussed on the basis of classical logic. But this means that the respondents must limit themselves to only two answers so there can be discusses

more interesting situation when there are a variety of answers: «well», «not at all», «so-so», «a little», «very well» and so on. Now the problem can be discussed on the basis of fuzzy logic.

Let us consider the situation when graduates of law are assessed on the exam of jurisprudence. The teacher can describe their acquired knowledge and skills on studying this subject or the teacher is asked to put numbers which show the degree of preparation for this exam, for example the figure 0.8 can mean that the students know the subject very well and they make only small mistakes, whilst the figure 0.2 can mean that the students are not prepared well enough to pass this exam and they lack the required knowledge and skills.

#### 4. The decision support system

The definition of an expert system was given by Ketty Peeva and Yordan Kyosev: «An expert system is a computer-based system with artificial intellect that emulates the reasoning process of a human expert within a specific domain of knowledge» [13].

The expert system is an example of decision support systems. They have to following units: Knowledge Base, Data Base, Inference Engine, Decision Support

and User Interfaces (UI). The Expert or Experts are required to design the expert system because they give knowledge of the considered area. This knowledge is stored in the Knowledge Base using Fuzzy Relations. To make the system work there must be gathered same data stored in the Data Base. The Interference Engine is the main part of the system and it has to emulate the way of people thinking in the way to produce solutions to the problems posted by the User. The Interference Engine takes rules from the Knowledge Base and data from the Data Base. The Decision Support explains the User why the system gives such a piece of advice, asks more specific questions or shows the way it produces answers, predictions or advices. The User Interfaces is responsible for connecting people (the Experts and the Users) with the system.

### 5. The example of the operation of the decision support system

Let us consider two sets X – the list of competences of graduates of law, Y – the set of graduates.

The Knowledge Base for this decision support system will be represented in the form of a matrix of a fuzzy relation (between the sets X and Y). It describes the competences of graduates of law.

Tab. 1 Values of the fuzzy relation between
the acquired competences and graduates of law

Graduates Competences	Wysocki	Zielińska	Matuszak	Nowacki	Maliński	Kucharska
	1	2	3	4	5	6
x1	0.8	1	0.9	0.7	1	1
x2	0.9	0.8	0.8	0.8	0.9	0.9
х3	0.8	0.9	0.9	1	0.7	1
x4	1	1	0.9	0.8	1	1
x5	0.9	1	0.8	0.7	1	0.8
х6	0.8	0.8	0.7	1	0.9	0.8

Tab.2 Sorted values of the fuzzy relation between the acquired competences and graduates of law

Competences Graduates	<b>x</b> <sub>1</sub>	$\mathbf{x}_2$	<b>X</b> <sub>3</sub>	X <sub>4</sub>	<b>X</b> <sub>5</sub>	<b>X</b> <sub>6</sub>
Kucharska	1	0.9	1	1	0.8	0.8
Maliński	1	0.9	0.7	1	1	0.9
Zielińska	1	0.8	0.9	1	1	0.8
Matuszak	0.9	0.8	0.9	0.9	0.8	0.7
Wysocki	0.8	0.9	0.8	1	0.9	0.8
Nowacki	0.7	0.8	1	0.8	0.7	1

These competences were developed by students when they studied different subjects at university. The assessment was done by the academic teacher during the examinations. The levels of acquirement of the competences are figures belonging to the interval [0,1].

Let  $X = \{x_1, ..., x_5\}$  and  $Y = \{y_1, ..., y_6\}$ . The elements of the space X mean that a graduate of law:

- $-x_1$  has a comprehensive knowledge of the system of legal sciences and their essential to the understanding of the system and rules of its functioning,
- $-x_2$  has an extended knowledge of the various types of public institutions, in particular the organization and functioning of legislative bodies, public administrations and courts, and other law enforcement authorities in Poland and other countries,
- $-x_3$  can correctly interpret and explain legal phenomena,
- $-x_4$  can formulate opinions on functioning the various branches of the law, and put a simple hypothesis and verify them,
- $-x_5$  is able to communicate with specialists and non-specialists in the field of law
- x<sub>6</sub> behaves in a professional manner respecting the principles of professional ethics.

The elements of the space Y are surnames of graduates:y1 – Wysocki, y<sub>2</sub> – Zielińska, y<sub>3</sub> – Matuszak, y<sub>4</sub> – Nowacki, y<sub>5</sub> – Maliński, y<sub>6</sub> – Kucharska.

Assume that the head of law firm looks for a graduate of law who has acquired these competences  $x_1 - x_6$ . On his announcement, six candidates  $y_1 - y_6$  have applied for this job. Let the levels of the acquirement of these competences be stored in the tab. 1 using the fuzzy relation matrix:

This employer looks for the best one of the graduates but he considers that the first competence x1 is the most important for the job, the second one is a little less important than the competence x1 and so on. Hence, to find the best person the matrix will be transposed to the one presented in the table 1 and then data will be sorted according to the competence x1, then x2 and so on. The achieved data is put in the tab. 2:

Considering the data stored in the tab. 2 there can be easily seen that the best graduate for this specific job is Ms Kucharska, the next one is Mr. Maliński

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and so on. Hence, if the levels of acquired and demanded competences are given, it is not difficult to find the best graduate.

The more interesting problem is to find the graduate who acquired the competences on the at least minimal level required by the employer, so the aim of the considered decision support system is to find graduates of law who meet employer's demands for the required levels. To do this there must be solve the inverse problem which means that there must be found the solution of the equation:

#### (1) R o Y = B,

where Y – the list of graduates with their levels of acquired competences (not given), R– the matrix of the fuzzy relation, B – the list of required competences which was prepared by the employer.

To solve this problem there can be used the inverse problem solution which was investigated by Sanchez [10].

Let the employer has been looking for a graduate of law who has acquired the six considered competences on the levels recorded in the vector  $B = [0.8 \ 0.8 \ 0.8 \ 0.8 \ 0.8]$ 

The degree of possibility that Mr. Matuszak is well prepared for this job is equal to 0.8, so he can be recommended. In the case of other graduates the degree of possibility that they can do this work efficiently belongs to the interval [0; 0.7], so at this moment they are worse prepared to do this job than Mr. Matuszak. Thus,

the best graduate, who is recommended to the employer, is Mr. Matuszak.

### 6. Another example of the decision support system

Let us consider another example. Assume that the head of the law firm needs an employee who has acquired the following competences:

- $-x_1$  a graduate has a comprehensive knowledge of the system of legal sciences and their essential to the understanding of the system and rules of its functioning,
- $-x_2$  a graduate can correctly interpret and explain legal phenomena,
- x<sub>3</sub> a graduate can formulate opinions on functioning the various branches of the law, and put a simple hypothesis and verify them,
- x<sub>4</sub> behaves in a professional manner respecting the principles of professional ethics.

Assume now that the head has been looking for a graduate of law who has acquired all competences x1 - x4 and let four graduates of law apply for this job with the levels of the acquirement of these competences put in tab. 3:

Let the employer looks for a graduate who has acquired the competences x1 - x4 on the levels put in the vector  $B = [0.7 \ 0.6 \ 0.4]$ , respectively. Then, the decision support system produces two variants of the solution.

**First variant:** (Fig. 4, on the left) The possibility that Mr. Nowacki will fulfill the requirements of the employer belongs

Tab. 3 Values of the fuzzy relation between the acquired competences and graduates of law

Graduates	Nowacki	Kucharska	Zielińska	Siwicki
Competences	1	2	3	4
x1	0.7	0.8	0.7	1
x2	0.6	0.6	0.6	0.3
x3	0.4	0.2	0.4	0.3
x4	0.2	0.2	0.3	0.3

Tab. 4 Values of the fuzzy relation between the acquired competences and graduates of law

Competences Graduates	<b>X</b> <sub>1</sub>	$\mathbf{x}_2$	<b>X</b> <sub>3</sub>	X <sub>4</sub>
1	2	3	4	5
Nowacki	0.7	0.6	0.4	0.2
Kucharska	0.8	0.6	0.2	0.2
Zielińska	0.7	0.6	0.4	0.3
Siwicki	1	0.3	0.3	0.3

to the interval [0.4; 1], the possibility that Ms. Kucharska will be a good employee is equal to 0.7. In the case of the last two people the possibility of being an efficient employee belongs to the interval [0;0.2].

**Second variant:** (Fig. 4, on the right) The possibility that Mr. Nowacki can fulfill the employer's requirements belongs to the interval [0.7; 1]. But the possibilities that Ms Kucharska, Zielińska and Mr Siwicki will work efficiently belong to the intervals [0; 0.7], [0; 0,2] and [0; 0.2], respectively.

The goal of the system is to find the best candidates who meet the employer's requirements which were put in the vector B. Since the possibility that Ms. Zielińska and Mr Siwicki will full the employer's demands are less or equal to 0.2 in both variants and there are much better candidates for this job, so they cannot be recommended to the head. In the first variant of the solution, the level of the confidence (the possibility) that Mr. Nowacki is a good candidate is greater or equal to 0.4 (so if there will be considered the lower value, the possibility is too little; but if we consider the upper value, which is equal to 1, it is the greatest possible level of possibility) and in case of Ms Kucharska this confidence is equal to 0.7. Hence in the case of only first variant it would be impossible to choose the best candidate without more detailed demands of the employer. However, in the case of second variant the situation is different, because the possibility that Mr. Nowacki will be a good candidate is greater or equal to 0.7 but in case of Ms Kucharska the confidence is less or equal to 0.7. Summing up, taking into account both variants the best candidate, with the greatest degree of confidence, is Mr. Nowacki and he will be recommended to the head of the law firm.

## 7. Estimation and control of additional knowledge

During designing or developing the curriculum, for example the curriculum of law, the HEI's authorities have to describe the competences which should be acquired by their students. Very often on one subject there are taught a few competences (some knowledge, skills and so called soft competences), so the academic teacher has to decide how much time there should be devoted for each of these assumed for the subject competences.

The decision support system can also help in this situation because by using the optimization methods the system can evaluate time which should be devoted for teaching each of the competences during studying this subject.

Let us consider the degrees of acquirement of competences x1 - x4 by four graduates of law which are stored in tab. 4:

On the basis of the data stored in tab. 4, the current quality of education can be estimated. Namely, it could be estimated which competences are acquired by students at high or low levels, and then which subjects or their parts are studied well or which subjects or their parts are taught poorly and try to find a reason for this situation. For example, the data stored in the column 4 (competence x3) show not high level of acquirement for these students and the figures from the column 5 (the competence x4) show that this competence is learnt very badly.

In such a situation the authorities of law faculty should rethink the law curriculum and the syllabuses in order to help the students acquire the competences on the higher level. It means that there can be specified the optimization problem, namely the problem how to distribute the time of a subject to get maximal values in the matrix (tab. 4).

To prepare graduates better to the job market, there will be proposed the following control system. After graduating which is the end of Education process, the Testing will be organized and The Estimation of quality of education

will be carried out. The results will be sent to Decision making authorities. They can force teachers who teach particular subjects using Syllabuses to change course contents, methods of teaching and methods of assessment to help students acquire competences on the higher levels.

For example, let there will be a subject such that the teacher wants students to acquire three competences (x1, x2, x3). Each competence takes some time to be learnt, so let us assume that the time distribution of this subject is specified in the following way: 0.3 of the time for the competence x1; 0.3 for the competence x2 and finally 0.4 of the time for the competence x3. After the first cycle of the education process (the first loop) the average fuzzy levels of competences were acquired on the levels (0.7; 0.3; 0.8). Thus:

To optimize the distribution of time devoted to teaching these competences there can be used the optimization method. Our goal function is to maximize the objective function

$$f(x_1, x_2, x_3) = x_1 + x_2 + x_3 \text{ max.}$$

Considering the gathered data there can be assumed that functions between the time spent on teaching and the level of acquirement of competences are linear. Moreover, let us assume that if there is no time spent on studying, the level of acquirement of the competence is equal to 0.

Thus there can be calculated the following conditions:

Tab. 5 Values of the fuzzy relation between the average fuzzy levels of acquired competences and the time spent by the teacher for their acquirement by learners

The percentage of time spent to taught the competence	$t_1 = 0.3$	$t_2 = 0.3$	$t_3 = 0.4$
The level of the competence	$x_1 = 0.7$	$x_2 = 0.3$	$x_3 = 0.8$

Tab. 6 Optimal values of the relation between the levels of acquired competences and the time spent by the teacher for their acquirement by learners

The percentage of time spent to taught the competence	$t_1 = 0.3$	$t_2 = 0.4$	$t_3 = 0.3$
The level of the competence	$x_1 = 0.7$	$x_2 = 0.4$	$x_3 = 0.8$

$$x_1 = 7/3 t_1$$
;  $x_2 = t_2$ ;  $x_3 = 2 t_3$ .

Since the degrees of acquirement of these competences must be high, there will be assumed that in each case the level is bigger or equal to 0.4 and of course not less than in the previous loop. Hence, the limits of the optimization problem can be described:

1) 
$$x_1 = 7/3 t_1$$
;  $x_2 = t_2$ ;  $x_3 = 2 t_3$ ;  
2)  $t_1 + t_2 + t_3 = 1$ ;

3)  $x_1 \ge 0.7$ ;

4)  $x_2 \ge 0.4$ ;

5)  $x_2^2 \ge 0.8$ .

After solving this problem, we get data stored in the tab. 6:

Thus it can be easily seen that changing a little the distribution of the class time devoted to the subject, there can be improved the level of acquirement of the competence x2.

#### 8. Conclusions

It is really important to help graduates find a job which is compatible with their qualifications acquired during their studies. HEI's authorities are more and more responsible for helping their graduates. Because there are a lot of data which should be taken into account while conducting the process of designing or developing curricula, for instance the levels of acquirement of competences by graduates, the requirements of the labour market, the abilities and dreams of students, the organizational capacities of education institutions and so on, it is really difficult to design the curriculum which fulfills all the needs.

Because of that the decision support system will be very convenient for all these stakeholders. The model of the system which is based on fuzzy logic, lets solve the problem of searching the best graduate. Moreover, the designed model allows to evaluate the correspondence between curricula of HEIs and demands of the labour market and help all the stakeholders solve the problem of vocational guidance very efficiently.

Though it is very useful to compare the compatibility between HEI's curricula with competences which graduates should acquire and current demands of the labour market. The generalized methods and tools for this goal have not been developed so far. So the perspective direction for the research is to find:

- 1) the most suitable operation o, the importance of this operation must be examined by research carried out in the area of higher education,
- 2) the best graduates, who applied for the posts and whose competences should meet the demands of the employer, by solving the inverse problem with the new operation.

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### ЗАРУБЕЖНАЯ ПРАКТИКА РЕГУЛИРОВАНИЯ ТРУДОВЫХ ОТНОШЕНИЙ С НАДОМНЫМИ РАБОТНИКАМИ

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#### **Summary**

In the article considered the legal regulation of labor homeworkers. The experiences of the EU countries, countries of the former CIS is analyzed. Separately paid attention to the exponential experience of Austria in this sphere. Having considered the practice of normative and practical solutions homeworkers working in several countries (including the post-Soviet and Western), objectively most noteworthy labor practice settlement of homeworkers in Austria: the work of such workers is regulated by the general and special legislation.

Key words: homeworker, labor, regulation, foreign practice.

#### Аннотация

В статье рассматриваются особенности правового регулирования труда надомных работников. Изучается опыт стран ЕС, стран бывшего СНГ. Отдельно уделено внимание показательному опыту Австрии в данном вопросе. При рассмотрении практики нормативного и практического урегулирования труда надомников в ряде государств (в том числе и постсоветских, и западных) объективно наибольшего внимания заслуживает практика урегулирования труда надомных работников в Австрии: труд таких работников регламентируется и общим, и специальным законодательством.

Ключевые слова: надомник, труд, правовое регулирование, зарубежная практика.

постановка проблемы. Для достижения поставленной задачи предполагается рассмотреть отдельные предметные области в разных странах, такие как, например, понятие «надомник» в законодательстве разных стран; подходы к трудоустройству надомников; уровень участия государства в проблеме урегулирования труда надомников. В результате планируется сделать соответствующие выводы по поднятому вопросу с определением концепции усовершенствования национального законодательства.

Актуальность темы исследования связана с необходимостью урегулирования этой сферы в Украине, в которой на сегодня нет специальных норм, которыми разрешались бы особенности такой деятельности.

Состояние исследования. Отметим, что в нашем исследовании мы больше опираемся на практику урегулирования отношений в указанной сфере, а потому обращение к научным разработкам в данном случае не является целесообразным, хотя некоторые моменты и были изучены учеными (например, Р. Азмухановым, И. Аксеновым, А. Мышкиной и др.).

**Целью и задачей статьи** является изучение и анализ зарубежной практи-

ки регулирования труда надомников. Для достижения поставленной цели необходимо выполнить следующие задания: рассмотреть особенности правового регулирования труда надомных работников; изучить опыт стран ЕС, стран бывшего СНГ, а также опыт Австрии в данном вопросе.

Изложение основного материала. Практика урегулирования трудовых правоотношений надомников и работодателей в мире является неодинаковой, учитывая правовую систему того или иного государства, его менталитет, традиции и культуру права. Так, например, в Эквадоре такие правоотношения реализуются через посредников. При этом по поводу такого посредничества в целом существуют следующие позиции: 1) неопределенность (например, в законодательстве о надомничестве и Украины, и Белоруссии, Казахстана, РФ, Узбекистана отсутствуют нормы, прямо запрещающие или разрешающие такое посредничество); 2) прямой запрет вмешательства посредника в правоотношения между надомником и работодателем (например, Доминиканская Республика, Италия, Мексика и некоторые штаты Соединенных Штатов Америки); 3) деятельность посредников и их роль в указанных отноше-