

# Development of Expert System for Determining the Future Profession as a Way to Decrease Youth Unemployment Rate

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**Abstract:** Unemployment occurs when a person is actively seeking work but cannot find it. The authors of the article conducted an analysis of the labour market in Kazakhstan in order to identify the causes of youth unemployment and finding a solution to this problem. One of the main causes of unemployment – is the wrong choice of future profession among young people. In this article we have tried to explain the need for the creation of an expert system to determine the future profession in the field of Information Technologies, such as help for applicant for admission to higher education in the field of computer science.

**Keywords:** expert systems, Information Technologies, unemployment, education, future profession

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## 1 Introduction

Unemployment is never fairly distributed among the population of any country. Therefore, an important aspect in the diagnosis and – perhaps even more important in the “treatment” of unemployment is to identify those groups of the population in which it is most common. Statistics show that of the total number of unemployed in all age societies, women make up about 65%, or almost twice as much as men[1].

This is explained by the fact that at the point one of the main requirements for candidates for vacant positions is the availability of specialised technical education. But the most widespread unemployment is among young people under 25 years. Its share is 41.2% of the total population that has applied to the employment centers[2]. This is often connected to the fact that they just want to find a job they “like” and are considered to be unemployed while searching for a job. Another explanation is that our unemployment vacancies are filled mostly by specialists with a certain work experience. So young people with no work experience do not even given an opportunity to get it.

## 2 Youth unemployment rate analysis

Labour market (labour) – is an important multifaceted economic sphere and the economic and political life of society. On the labour market, the labour cost is assessed. It defines the conditions of employment, including the value of wages, working conditions, job security, access to education, professional development, etc. In the market, the law of supply and demand affects wages. There are buyers and sellers of labour. The sellers are professionals offering their labour power or their ability to work. labour groups and entrepreneurs are the buyers of the labour force.

In the modern market economy must be the optimal provision of workers to maintain the natural rate of unemployment. It equally contraindicated arithmetically full employment and too high unemployment. In the first case the economy lies in wait for demand inflation, low production efficiency, command methods of labour resources allocation across sectors and territories, stagflation and other major trouble. The second – a clear under-utilization of the labour factor of production, that is not only a violation of the social and economic human rights, but also downward pressure on public finances associated with the need to maintain a large number of unemployed, etc.

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**Fig. 1:** Youth unemployment rate in Kazakhstan

The labour market is the imperfect view of the market. Workers offering their labour power, as a rule, are not sufficiently informed about the existence of demand for their labour. They do not always know about all the free places of work, even within the city. Even worse, they are aware of the availability of jobs in other regions. Under market conditions, there is the economic law of labour changes, the essence of which is manifested in the fact that in order to improve their economic situation, it is necessary to work more actively, which implies the need for continuous improvement and consequently turnover forms of work during the entire period of working life.

According to statistics, the dynamics of the number of young unemployed in percentage terms as follows: July 2013 – 5.85%; July 2014 – 4.6%; July 2015 – 4.5%; January 2016 – 4.5%. [2] There is a descending trend in the unemployment rate.

We can highlight the following causes of unemployment in Kazakhstan:

- **Overprotection** by parents for their children. Parents do not allow their children to become independent, not allowed to work part-time (for jobs), while studying at the university, and so on;
- **Employers.** The rapidly changing world, a high pace of life, technology, competition, forcing employers initially aspire to optimize staff performance and efficiency, forgetting about moral obligations. Therefore, they do not want to hire people after age 40, women (due to the fact that they can get away on maternity leave), and gaining inexperienced (mostly illiterate) young people dismiss them without any problem under the fictitious reason to fire people, who often come to the hospital;
- Sometimes young people should blame themselves for the problem of youth unemployment; now we are talking about so-called *"infantilism" of young people in search of work*. Young people often do not have an active position in the pursuit of work, and therefore do not use many of the existing possibilities of finding work. This is may be due to the reluctance to get into the uncomfortable and hard situation of the labour market or with confidence that the parents will provide their work.

Also, one of the problems is the wrong choice of the future profession. To date, there is such a tendency that young people choose the profession not as desired and their inclinations and abilities, but as of cut-off scores and the number of grants allocated for a particular speciality. Explaining the fact that the state grant first prepares education, it does not matter for what speciality, and then go to the speciality, which wanted to study at all, but for a fee. Having in mind that will work for the first profession and to pay for a second degree. This is not the best prospect for the future. After all, if a person does not like the speciality, then there will be no desire to learn academic subjects, courses will be given difficult, therefore, will not be of interest to future professional activity and the desire to work on it[3]. And all this occurs because of a wrong choice of their future profession and the wrong approach to career counselling.

### 3 Problem statement

*In the 2–3 courses 30–35% of students believe that they are learning useless subjects and they are in the wrong speciality, – Cites Sheregi Franz, director of the Social Forecasting Center, Professor of the National Research Nuclear University MEPHI. – That is, a third of university students – is a ballast! And it is only those who openly admits they were wrong with the choice of profession... [4].*

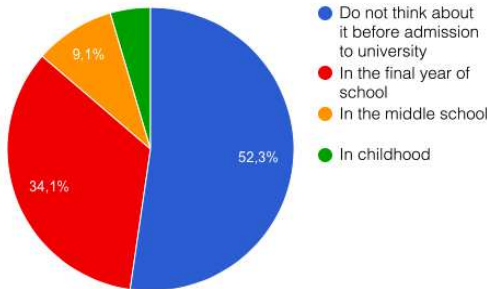
We decided to test empirically whether this is true by running a small questionnaire among students of 2–3 courses of Faculty of Information Technologies of Kazakh–British Technical University. The survey involved 44 people. They were asked 4 questions:

1. You have already knew what profession you will choose in the future. Possible answers:
  - (a) In childhood,
  - (b) In elementary school,
  - (c) In the middle school,
  - (d) In the final year of school,
  - (e) Do not think about it before admission to university.
2. Who helped you to determine your future profession. Possible answers:
  - (a) It is my decision,
  - (b) Friends,
  - (c) Parents (family),
  - (d) Other.
3. You have determine your future profession Possible answers:
  - (a) In the final year of school,
  - (b) When submitting documents to the university,
  - (c) Have not yet determined,
  - (d) Other.
4. Have you ever wanted to change speciality? Possible answers:
  - (a) Yes,

- (b)No,
- (c)Other.

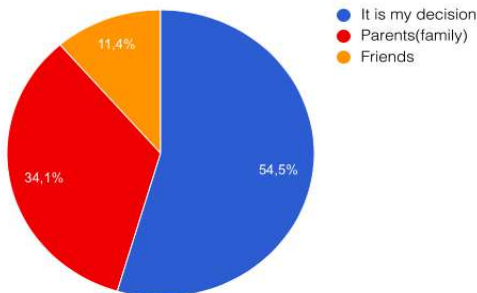
The survey results are shown in pictures 2, 3 and 4.

**You have already knew what profession you will choose in the future**



**Fig. 2: Survey results**

**Who helped you to determine your future profession**

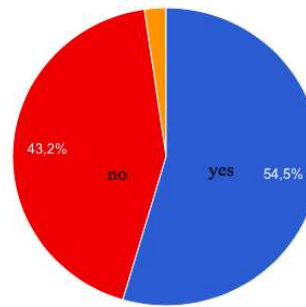


**Fig. 3: Survey results**

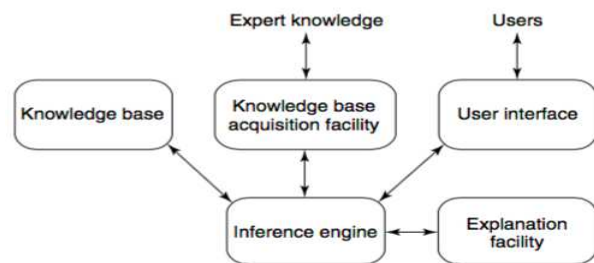
Let us analyse the survey results. More than a half of polled students (52.3%) did not think about choosing a future profession before entering a higher educational institution. 34.1% were defined only in the 11th grade. 54.5% claim that to the choice of the future profession they come on their own while 34.1% of the students were affected by their parents. 54.5% of respondents at least once in a lifetime had regretted about the choice of profession, while 43.2% had never thought about changing speciality.

If we take a look at the survey results in more detail, we can see that the majority of students, whose choice was affected by the parents regrets about the selection of profession and would like to change it. "In Kazakhstan applicants do not often choose their profession by their own. Psychology is that: where parents were studied, and

**Have you ever wanted to change profession**



**Fig. 4: Survey results**



**Fig. 5: Simple expert system scheme**

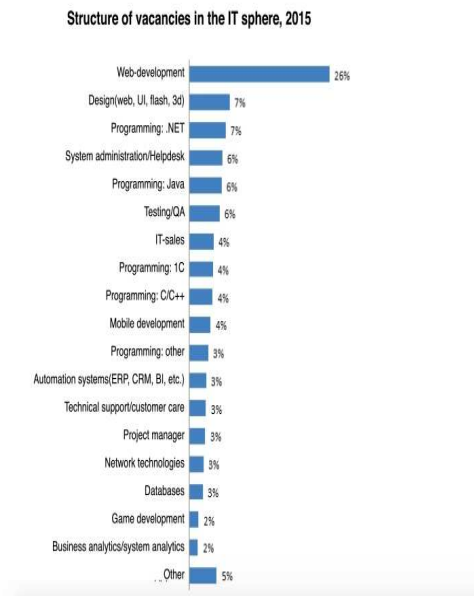
*there will come their child, – says Bakhytzhan Saparov, the director of "Entrant" Center for Career Guidance at the Kazakh National University named after Al-Farabi. – It is also a correlation between some of the region from the student has come to the and what profession he chooses." [5]*

#### 4 Multicriteria task speciality choice

For several years the first place in the ranking of the most promising professions hold IT-specialists. This is a global trend, which is affected by the development of technology and the growth of Internet users.

Due to the fact that not every one of us understands the essence of the Internet and the opportunities it provides for the development of business, there are many professions that are in demand and give a lot of prospects. Internet technologies are gaining in popularity and scope of activity is no longer offers general specialities, but very highly specialised fields.

There is a graph below, that shows the structure of vacancies in IT sphere, according to the website [www.rabota.ua](http://www.rabota.ua).



**Graph 1** – Structure of vacancies in the IT sphere according to the website rabota.ua

As we can see, in the field of IT there is a lot of narrow specialities, that can not be familiar to every enrollee.

Yesterday's students will not be easy to decide on the future trade in this direction without some assistance. So the idea of creating an expert system to determine future career in IT to help applicants find the speciality, that will be more suitable for them, appeared.

We solve the problem of multicriteria choice of speciality, belonging to the class of complex social problems by building expert system (ES) "The selection of the speciality for admission to the university (for example, USATU)" based on the IDEF technology.

The following factors characterise the problem:

- Uncertainty - with the information necessary for decision-making much of a qualitative character;
- Multicriteria presented and investigated in different scales of measurement (interval, nominal, ordinal);
- The need for simultaneous consideration of both quantitative and qualitative criteria for evaluating alternatives;
- The need to harmonise the views of the expert group;
- Multilevel system of private (local) criteria and their nonequivalence (criteria for making different contributions to the integral evaluation alternatives);
- Multiple selection processes;
- Compatibility of objective and subjective characteristics elements of the problem;
- Plenty of options (more than 70 specialities).

Thus, of the problem of decision-making about the choice Best speciality is the task of choice under uncertainty and refers to the class of non-trivial task. The information needed to decision-making is characterised by high-quality and incomplete. For solving problems of this class uses intelligent information system, namely, decision support systems – expert systems[6].

The problem multicriteria and more alternatives resolved as follows:

- *Step 1:* determining selection criteria of all received sets criteria for the construction of wood and their aggregation with generalised method of allocation criteria;
- *Step 2:* grouping criteria, so that each alternative It estimated only determining its criteria, without affecting the criteria other groups ( "foreign" clusters);
- *Step 3:* narrowing the search area of research. Decomposition alternatives into clusters for clustered characteristics;
- *Step 4:* find solutions within the selected cluster in advance certain criteria (criterion of "falling" in Cluster and Selection Criteria specialities).

Stages of aggregation criteria and clustering alternatives (specialities) can significantly facilitate the task of selecting the best decision (to reduce the scope of the search, the speed and accuracy of selection). Each solution (alternative) assessed only on those criteria, which it characterised criteria and do not affect the other clusters.

## 5 Expert system description

There is established the notion that an *expert system* is embodied in software components expert experience based on knowledge in such a way that the machine can give intelligent advice or make an intelligent decision on the processed features. It is desirable that the system was capable of on demand to explain the course of its reasoning clear to the user. Providing this requirement is carried out by programming based on formal rules.

That is why it was decided to create exactly an expert system, which could embody algorithm for computing profession and expert experience. One of the most important components of the expert system is a *knowledge base*. The *knowledge base* consists of rules of analysis of the information from the user on a particular issue. The expert system analyses the situation and, depending on the orientation expert system, make recommendations to resolve the problems.

As a rule, the expert system knowledge base contains facts (static information about the domain) and the rules – a set of instructions, which apply to the known facts, you can get new facts.

The implementation of the knowledge base is based on building the competent *ontology*[7].

*Ontology* is explicit formal specifications of the terms in the domain and relations among them [8].

Ontology, simply, is a description of the knowledge, made quite formally to be processed by computers[9].

Ontology of the content of knowledge base in the expert system is needed to improve the quality of the search engine in the knowledge base. An ontology

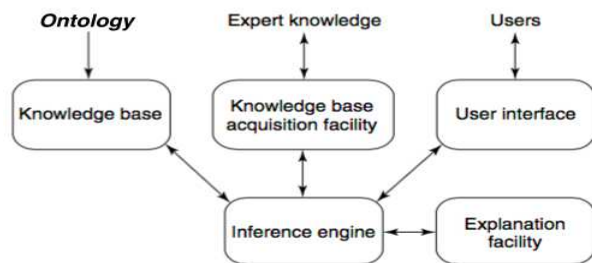


Fig. 6: Ontology in expert system construction

specifies a shared domain vocabulary to describe concepts, their properties and relations[10].

The program is a mere shell of an expert system using Mamdani inference system. It is designed to allow further consultation with the user in any application area (for which the full knowledge base is set loaded) to determine the probabilities of possible outcomes and uses this to estimate the plausibility of certain preconditions, obtained from the user.

As an illustration, consider the problem of determining the probability determining future profession. The program, in this case, acts as the interviewer (the expert), which defines an applicant questions about hobbies, and by the information gives answers.

The picture below shows the ontology for the expert system:

- **IT competence:** to describe the basic properties (quality) that makes the expert "potentially" competent in IT. IT competence has two sides: functional and behavioral, that construct the skills of the person.
- **Skills:** functional (abilities) and behavioral (character traits).
- **Speciality:** what speciality is the most suitable for the person based on the IT competence and skills the student has.

Moreover, it is desirable not to torture the applicant asking questions, and ask only the most important, the answer to which depends primarily on the final establishment of the profession. That is precisely what this expert system arrives. It asks the user to assess the truth of the most important evidence-based response adjusts the probabilities of outcomes and moves to the next testimony, again selecting the most relevant. Thus, we achieve the earliest possible to obtain results with a minimum number of requests.

The rule base is a set of rules, where each consequence mapped to a specific weighting factor.

The rule base might look like (for example, using the rules of various designs):

$$\text{if } x \text{ is } A \text{ and } y \text{ is } B \text{ then } z = C.[11]$$

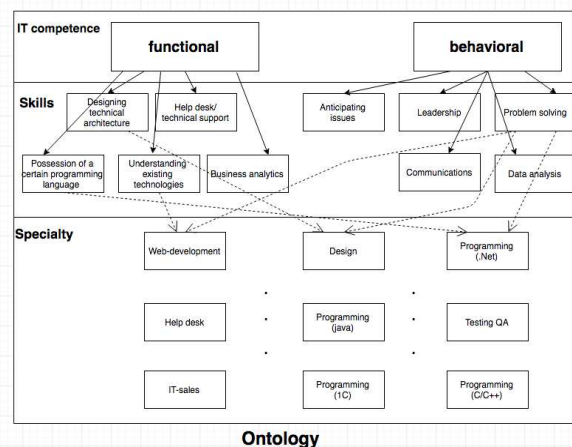


Fig. 7: Ontology for expert system to determine the future profession

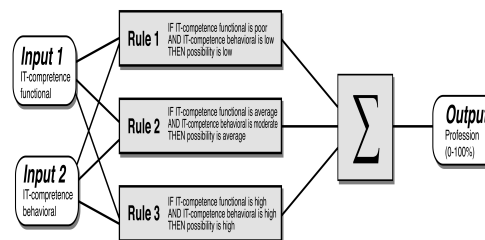


Fig. 8: Knowledge base rules

In the case of the expert system for the future profession rules will be as following (example):

*IF IT-competence (functional) is high AND IT-competence (behavioral) is high THEN speciality is highly possible.*

*IF IT-competence (functional) is high AND IT-competence (behavioral) is low THEN speciality is less possible.*

The inference system gets data from two inputs that represent IT-competence in functional and behavioral ways. Then it constructs the rules for making the precise picture of student's skills. The result it the possible future profession.

The following graph shows the example of how the rule-based system for choosing the future speciality works under the fuzzy logic.

We can see if functional competence as business analytics is poor and behavioral competence as data

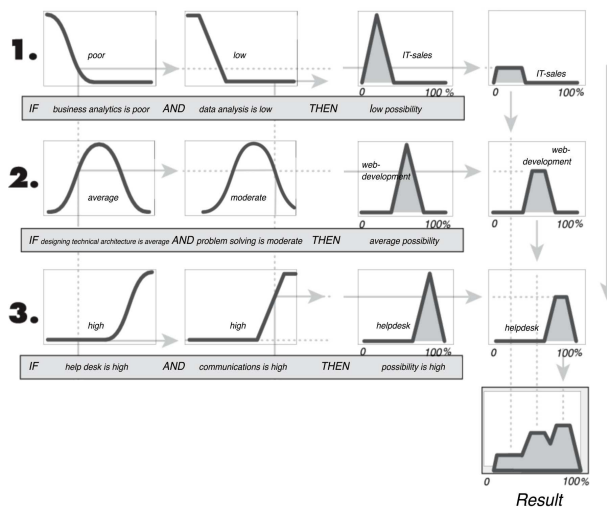


Fig. 9: Fuzzy logic in the inference system

analytics is low too, then the student could not become a manager in IT-sales because of lack skills. If the student has moderate skills in designing technical architecture and problem solving, he could think about the career in web-development. Finally, if the student had strong abilities to help desk and communications, the most suitable profession for him is to work in the help desk.

Using Mamdani inference system means that the information processed by the expert system is not entirely accurate, but is probabilistic in nature[12]. The user does not need to be convinced of the absolute truth or falsity of the evidence; it can respond to requests from the system some degree of confidence. In turn, the system displays the results of the consultation in the form of occurrence probabilities of outcomes.

## 6 The modular design of the knowledge base of expert system

To create a "choice of speciality for admission of expert system the university" we need the analysis and modeling of the subject area using a structured approach. The developed complex models (functional, process, info) yielded a complete and visual information investigated the domain, develop a knowledge base structure (BR) and the structure of the developed expert system to determine requirements hardware and software system. In this difficult task, but it allows to study the process in detail, as details the functional model to the individual studies.

Process model reflects a causal relationship taken making – decision-making procedures, and highlights the places where the user. We have to evaluate a number of

alternatives to the adoption of decisions on the basis of their knowledge and experience to make a decision[13].

When the decomposition process model to certain works is a set of actions that have to be to carry out the decision maker to select one of the possible solutions. To support the adoption of these solutions is used expert systems. Isolation of the decision-making process allows to consider a set of decision rules within each process. These the rules are the basis of the developed expert system – the knowledge base.

Design of the knowledge base structure ES "Choice speciality at admission to university" was conducted in two stages:

- The selection process model from the functional model (Process model is a submodel of the functional model. To decompose process within the operational model is more logical than pre-allocate all of the processes and build on each their process model);
- The conversion process model modules in the knowledge base. IDEF-methodology allows splitting model, highlighting the sub-models of existing model on any ground and combine to create a new sub-models model.

Thus, to solve the problems highlighted in the study process: Decision-making in the functional diagram, their hierarchy is defined on the basis of which created a new process model, which describes all the decision-making processes Process model "Adoption of alternative solutions" when built function decomposition model.

Process model is composed of 2 levels:

- Level 1:* Decomposition: decision-making on "contact" in the cluster and decision-making informational model is a logical database structure, and functional and process model is the basis for the design of knowledge base structure.
- Level 2:* To develop the knowledge base of the expert system Choice speciality admission to the university, based on a modular principle, the individual role plays a process model.

## 7 Conclusion

The results of the research showed that the biggest barrier between people and work is education. Youth unemployment remains one of the acutest problems in the workplace. Professional work activity, which precedes the right choice, is one of the most important factors that determine much of modern life.

A huge advantage of the future professional is in his choice. Independent choice of profession – is a "human rebirth" because of how the way of life depends on the social value of a person, his place among other people, job satisfaction, physical and nervous correctly selected - mental health, joy and happiness.

Naturally, the system measures to reduce unemployment among young professionals is not limited

by the examples cited the creation of an expert system, there is a vast field for the original search for ways out of the current labour market situation. But we would like to note the benefits of assistance in vocational guidance of our system for professionals in the field of information technology.

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