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**HUMAN RESOURCES MANAGEMENT IN PUBLIC ADMINISTRATION UTILISING  
ONTOLOGY AND KNOWLEDGE BASES**

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**ABSTRACT**

In this paper we examine the management of human resources in public administration in The Republic of Srpska utilising ontologies and new software tools based on knowledge. We need knowledge in the new information system for a more efficient selection of personnel, their induction into the service system of public administration, motivation and promotion, the quality of their teamwork as well as for creating the perfect service teams and their effective connectivity. To get the highest quality staff to the most responsible positions and to have all staff working in places that match their knowledge, skills and abilities, it is necessary to manage them differently. We show that this can be achieved by utilising knowledge bases and new software solutions.

**Keywords:** human resources management, public administration, ontologies, utilising knowledge..

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**INTRODUCTION**

Currently public administration works in a complex environment which is constantly changing and which is far from a simple, stable and predictable. The changes in political and economic systems, new expectations and demands of citizens, as well as the implementation of European standards, require adjustment of the public administration to new circumstances.

To establish modern public administration in The Republic of Srpska it is not enough to change the legal framework alone. It requires the adoption of changes in all spheres, especially in training and human resources management.

Every ministry, every administration, administrative organization, or local government unit will only be as successful as the quality and success of its staff. To make the public administration of The Republic of Srpska more efficient and a better provider of better service, we must first analyse in detail the existing human resources system and then implement a different plan based on knowledge that meets all the necessary requirements. If the public administration in The Republic of Srpska decide to recruit new staff, they must have an established process for finding potential candidates that could fill the vacancies with an effective system of selection, and then to select the most suitable ones.

Knowledge and new technologies are increasingly linked in a single chain. Creativity, innovation, cooperation, skills and motivation with the application of new technologies are the necessary requirements for the success of any administrative body. The quality of human resources in public administration largely depends on the knowledge, its collection, adoption, dissemination and administration.

Human resources management in public administration is quite a complex process, and it starts with advertising the position, recruitment, decision-making about their rights and obligations, their accountability for their work performance, their placement, the assessment of the quality of their work and progressing with the assessment of their abilities. Each of these phases is complex and can be broken down into a number of sub-phases. For example, in The Republic of Srpska, the advertising of vacancies may be through a public announcement, internal announcements and/or public competition.

Currently the recruiting and monitoring of the personnel in the public administration of The Republic of Srpska are functionally divided between:

- Civil Service Agency of The Republic of Srpska which performs some horizontal (common) functions in this process, and
- Bodies of the public administration that perform specific personnel management actions. Every ministry or every administrative agency is responsible for carrying out the procedures of personnel management for its officers and employees.

This solution does not provide effective management of human resources, for the recruiting, placement and monitoring of promotion are based more on political decisions than on actual knowledge of the staff and the needs of public administration in The Republic of Srpska. Therefore, in this paper we propose a solution based on the knowledge of the staff and not their political party affiliation, or family relationship.

Without educated, motivated and qualified officers and employees (staff) in the public administration of The Republic of Srpska, there is no effective service or customer satisfaction. Therefore, all employees must have continuous training. According to the legal regulations of The Republic of Srpska each employee has the right and obligation to vocational training and education.

## **PUBLIC ADMINISTRATION**

The staff in the public administration are the employees who promote service and achieve excellence. These are creative human beings who, with their knowledge and skills, create new value, and thereby improve the quality of their personal work.

Intellectual capital is the product of continuous learning and it includes: abilities, skills, experience, creativity, innovation and motivation of employees. It is the driving force and the generator of human capital and other values in the service system. Intellectual capital is the "intelligent management" that produces new service solutions, innovations, programmes, projects, information, knowledge, laws and by-laws. [1]

Successful planning, organizing and management in public administration are almost impossible without scientific methods and specific techniques. Science and new knowledge suppress recurring service elements. The relationships between providers and users of services (public administration, legal and natural persons) require more attention, teamwork, new skills and abilities.

Science, knowledge and staff's ability act as direct service forces, while they provide public administration's users with the quality and satisfying service. In countries with a higher level of technological development, knowledge, education and creative skills become a necessary requirement for the use of appropriate resources and further progress.

If we want to effectively manage personnel, we must have adequate knowledge of:

- internal organization and jobs in the government (ministries, departments, administrative organizations and local government units).
- more efficient placement and utilization of personnel's potential,
- unique view of the data on human resources in public administration,
- a more efficient system of continuous education and training,
- monitoring of all processes related to the staff:
  - recruitment,
  - placement,
  - evaluation,
  - promotion,
  - improving and assessing abilities,
  - termination of employment.

These and all the other skills required for a different staff management, we can present via the Protégé platform that allows users to read and save ontologies.

Therefore, it is necessary to introduce different information system based on knowledge. It should provide: more efficient recruitment, proper career planning, better staff motivation, successful evaluation, promotion and rewarding, together with a better, more effective and efficient management of human resources in public administration.

## ONTOLOGY

The notion of ontology is very wide and is more a conceptual idea rather than a strictly defined formalism for expressing knowledge. In their paper, Chi and Hsu [2] define developing ontology approach as a process of inclusion and the acquisition of knowledge, its storage, retrieval and use.

Ontology describes a specific area through a given terminology, basic concepts, classification of these concepts and the connection among the concepts by defining the rules that govern them. That is a detailed description of the structure of an area of knowledge, with the formal definitions of mutual relationships and connections among the various elements of the area. [3] It is used for knowledge presentation, management and organization of knowledge, modelling and designing of databases, search and download of the required knowledge.

"An ontology is a formal, explicit specification of shared conceptualization" [4].

According to Boose and Gaines [5] ontologies describe knowledge of some domains in a generic way and provide an understanding of the domain.

That is a set of terms and relations between them, which describes a specific domain or area of knowledge. The domain can be any subject area, irrespective of its level of generality.

Here we can rightfully ask: Why develop an ontology in the management of human resources in public administration. In our case, we do it because of: efficient sharing of information and knowledge, as well as better utilization with analysis of the domain knowledge. The system based on ontologies would provide: software agents to take advantage of the necessary information and knowledge from all ministries, administrations, administrative organizations and local government units as well as for the knowledge required for the effective management of human resources.

Paulheim [6] gives three reasons for the utilisation of ontologies in business systems: better visibility, better interaction between systems and users, a unique knowledge base. Why these reasons could not be used in public administration?

One should be aware that there is no single approach recommending the right way (methodology) of ontologies development.

We will use an iterative approach and list the basic knowledge for the staff management. Following that, we will, through the review and improvement, arrive at the automated system foundations of staff management process. We need to think about several alternatives in order to ensure that the ontology is able to expand to provide the necessary information and knowledge for public administration.

To determine the scope of the ontology, it is necessary to create a list of questions that would enable a knowledge base to provide an appropriate response.

When it comes to knowledge bases, they should be created and filled first. Then, one should think about the tools (agents) for its search. The implementation of such a database in the public administration should start from the job and the required knowledge for the post, followed by the consideration of the agents who may bring in this knowledge in appropriate time and place and in the necessary amount.

The model that we propose should do the following:

- explicitly present the required knowledge for human resources management with special emphasis on the staff motivation.
- possess elements that provide automatic generation of the proposals for the allocation of existing and newly hired personnel in the appropriate places.
- monitor the development of human resources and propose improvements and the most efficient redistribution. (right staff in the right places).

The advantage of this model is that it can provide effective human resources management, semantic and ontological representation of the procedure in the process of employees' motivation, as well as reallocation of personnel for a more effective service.

The ontological model that we propose relies a lot on Savvas' [7] and Vassilakis's [8] research, who first introduced the method of modelling ontologies in the domain of e-Government. Those working on the

implementation of the new concept of service use the ontological model in order to provide semantic interoperability in a simulated multi- agent environment.

Ontologies provide a higher level of functionality through [9]: increased accuracy in searching, linking information and knowledge on sites associated with their knowledge structures and rules of inference, knowledge sharing between people and software, providing structure for the transmission of information in the field of linked data, as well as the possibility of upgrading and changing in order to meet the needs

Knowledge plays the key role in an efficient procedure of human resources management. When building a new system, we can consider three important factors related to knowledge: knowledge collection, knowledge presentation and knowledge utilization when it is needed.

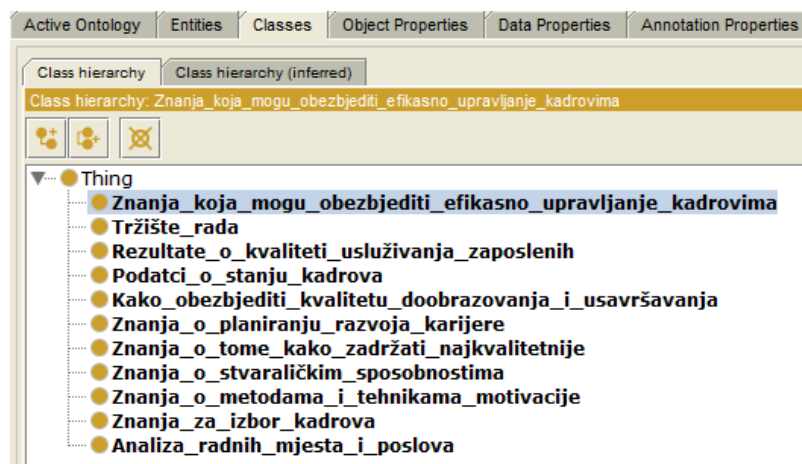
In this paper I would like to suggest part of the knowledge required to effectively utilise ontologies in the human resources management in public administration in Bosnia and Herzegovina (The Republic of Srpska). Due to the scope of this paper, we will discuss only the most important parts of the required knowledge so to understand the new concept of human resources management.

## PROTÉGÉ-OWL EDITOR

Now we have a large number of languages and tools for describing ontologies. Among the ontology languages OWL (Web Ontology Language) is most widely used as well as ontology editing tool "Protégé-OWL". OWL is the development environment introduced by the World Wide Web Consortium (W3C).

Protégé is an open source platform that allows users to: read and save OWL and RDF ontologies, update and visualize classes, define characteristics of logic classes and updates. Its purpose is to allow users to display the meaning of terms and the relationships among those terms. It provides a rich set of structures and modeling activities that support the creation, visualization and manipulation of ontologies presented in different formats. It was developed at Stanford Center for Biomedical Informatics Research at the Faculty of Medicine at The Stanford University in California. [10]

Here we used Protégé platform for reading and storing OWL and RDF ontologies and updating the required knowledge to manage human resources. Figure 1 shows a simplified presentation of the required knowledge, while a more detailed explanation is given in the text that follows.



*Figure 1. Required knowledge*

Within OWL it is possible [12] to define the cardinality of a property, synonyms for objects, classes and properties, constraints on the values of a property, as well as to define new classes by applying a set of operations on existing classes.

The first step in creating an ontology is to define the basic concepts, relationships and constraints of a given domain. The conceptualization and organization of knowledge play an important role in the development of ontology. The conceptualization task is the transformation of informal knowledge into an ontological concept. One should follow the W3C recommendations in order to achieve a formal description of concepts, terms and relationships in the Web Ontology Language (OWL).

## KNOWLEDGE PRESENTATION

In this paper we present the knowledge required when considering the needs of staff from their recruitment until their eventual departure to another business or retirement. Since this is a large amount of knowledge which would take a large number of pages to present we will only present the knowledge involved in staff motivation in this paper. The knowledge required for other phases will only be roughly outlined here.

### Job analysis

In job analysis one should start from the present and project all the solutions for the future. Firstly, a list of all jobs with job descriptions should be made. A well- done job analysis is the basis for a different design of a new service system. A workplace is the smallest organization unit at the lowest level of the organization structure in public administration. The workplace tasks are related to service activities, which may be more or less complex. The goal of the analysis is to assign each employee to a place that suits the candidate's knowledge and skills. To have the right person to the right place, it is necessary to have related facts about them, such as: education, knowledge, experience, health, desires, motivations, preferences and the like.

The required knowledge in the process of job analysis and planning of human resources imply knowledge for job analysis, changes in the service environment, and criteria for performance.

### Planning of human resources development

Planning of human resources development means human resources potential policy, planning of the needs and the development plan. Human resources policy should include the knowledge and principles related to recruitment policy, the exploitation of human resources, development and staff management. Planning of the needs for employees includes an analysis of the necessary personnel. Human resources development plan should include the amount and extent of additional training to be undertaken for new or existing employees. The planning is essential to implement because the errors can pre-detected and assessed. The planning targets, among other things include: the link between strategy and plans, knowledge management, the appropriate knowledge to be found in the right place at the right time and in the necessary amount, identification of needs, product quality (the necessary staff) and the service excellence.

Knowledge management and human resource management require an interdisciplinary approach in planning utilising the new technological solutions (e-Serving, m-Serving i-Serving or e-m-i-Serving [12]) in the service system of public administration. The required knowledge for career development are given in Figure 2 .

Regardless of all knowledge, all data and information, problems can arise in the planning and development of human resources, such as: erratic behavior, change in environment, the uncertainty in the labour market, rapid planning obsolescence, poor management of service processes, the impact of environment, the complexity of the services in the public administration, resistance to change, and the like.

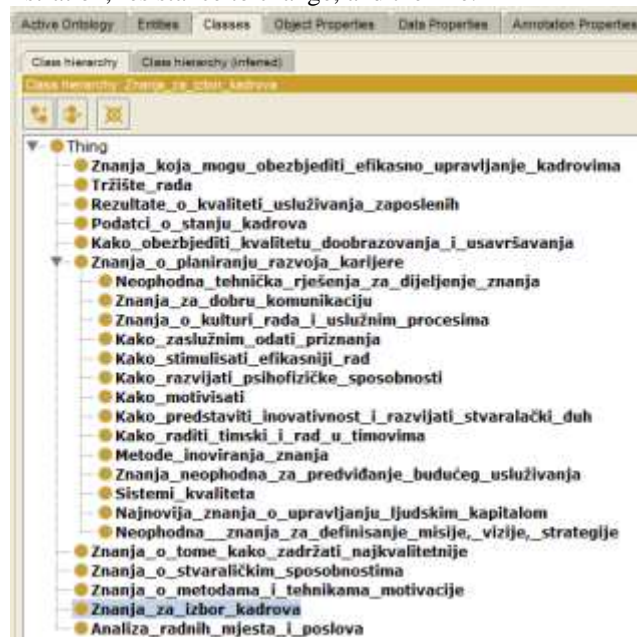


Figure 2 Required knowledge on career development plan

To be able to do a good assessment of the need for human resources in public administration the system based on knowledge must have the knowledge in the following methods: linear extrapolation method, comparison of direct estimates, projections trends, Delphi analysis, econometrics, etc.

### **Human Resources Benchmarking**

In the public administration, benchmarking is the process of introducing changes in the service system with the aim of continuous improvement of service. Its efficient implementation can provide an administrative authority with service advantage. The new information system based on the knowledge should be used so that good service solutions of others are implemented for our own purposes. Utilising good implementation of benchmarking, we can acquire the required knowledge for a better understanding of critical processes. We can also use it for more effective learning and higher motivation, for developing a service system that learns from the best practices of others. This should help the service system of public administration in The Republic of Srpska adapt to changes.

The required knowledge for the implementation of benchmarking in the service system of public administration is related to: Where to apply benchmarking? Where to find benchmarking information? How to use the data collected? Why it is necessary to implement it?

This will enable us to get the knowledge about the problem and its significance.

### **Recruitment and selection**

Provision of staff is a very important function and it requires appropriate knowledge in the new information system. One must have adequate knowledge in the field of human resources and appropriate procedures so that one can examine the characteristics of individual candidates. The knowledge is necessary for discovering the skills and experience of the candidates, their knowledge, ability to perform certain tasks, communication skills, team work, creativity, and flexibility.

The activity begins when a system operator receives a personnel request from the managerial staff in the public administration. The personnel data base is checked to see if the existing personnel meet the requirements. If there is no one, the candidates are sought out of public administration. The analysis begins by searching the data in the bases to determine whether there are adequate human resources that could be reassigned or promoted. If there are no appropriate personnel, it is necessary to look for them in the labour market by announcing the contest or advertising. What knowledge should the system or the team working on the selection of personnel have?

In any case, the knowledge is: How to identify and define communication skills? How to find out and determine candidate's persistence? How to assess the ideas and initiatives that candidates could practically use? How to determine if a candidate is ready for efficient work and how much work load can a candidate be given? How efficient is the candidate's memory and how quickly can the candidate adopt the necessary skills and knowledge for improvement and change? What is the candidate's mastery level of new technologies and to what extent can the candidate apply them? Does the candidate highlight his/her own personality or the service in the administrative authority? How loyal is the candidate and is the candidate a teamworker? What are the candidate's work and organizational skills? How good is the candidate at his profession and how much of the candidate's knowledge and skills can be used in an administrative authority? How meticulous and helpful is the candidate? Is the candidate responsible in the workplace and for the workplace? How to determine what the candidate's analytical skills and self-confidence are? How to find out whether the candidate is more geared towards the past, present or future? How to determine the candidate's potential for career development? How to determine whether the candidate can innovate in the future and offer better service solutions? How to determine how the candidate might react in critical and stressful situations? How to determine if the candidate's goals are consistent with the the company's ones? How to determine if the candidate is conscientious and responsible? How to determine the candidate's attitude in a team or with the service users? How to determine whether the candidate would respect the deadlines and provide the best quality possible? How to determine the motivation and the candidate's impact on others? How to determine how emotionally stable the candidate is? How to determine the candidate's potential for understanding the service system of public administration and its role in the system? How to determine the candidate's readiness for lifelong learning and training?

Which of the above mentioned and unmentioned should be entrusted to the computer system, and which to the team of people in charge of the recruitment? Can the computer system, which is less susceptible to human or political pressure, in the present circumstances, do all that? Can we entrust the complete recruitment process to an automated computer system? Can the already mentioned unique e-m-utility system meet these needs? What is the place of the public administration as a service provider and what about the users with their requirements, needs and technological solutions? Where are our limits and possibilities? Or should it be left with a new system based on different semantic web and software agents with much greater capabilities?

The required knowledge in the process of attracting and selecting candidates: needs anticipation, knowledge about ways of acquiring high quality candidates, methods and techniques of selecting candidates, testing and interviewing, how to rank the candidates, organization of recruitment, collection and placement.

### Recruitment and Induction into the Business

It is of interest to conduct an analysis of the required steps in a recruitment process and which parts of this process could be transferred to an automated information system. The induction of new employees into business is a very important activity and it is important that it is done properly and in a formal, but gradual manner. What information is needed by the system to assist in this induction? And how can the business motivate its employees to use an automated system?

It is clear that formal education alone does not provide the necessary knowledge to be successful in the world of work. It is necessary to supplement it with relevant additional to have a complete "profile". What knowledge and skills make up this supplement for a new employee?

New employees may have unrealistic expectations at the commencement of their employment. It is necessary to manage this issue in a sensitive way to ensure their expectations are more in line with the reality the business can offer. How can this be achieved?

New employees must accept the existing corporate culture and work processes. What is the required knowledge to be successful in achieving this?

If we accept the basic model that induction of new employees follows 5 basic stages: preparation, presentation, information, implementation and evaluation. The knowledge required for the recruitment and induction process are presented in Figure 3.

The knowledge required will vary in detail and complexity depending on where the new recruit is placed within the organisation.

An administrative authority should already have certain documents and information that would be useful in the induction process of a new employee to their job. These could include organisational chart of the management structure, strategic development, technical terminology used in the specific departments of the administration, rulebooks and employment responsibilities, job descriptions and the service process description (business flow), business directories of the administration's employees etc.

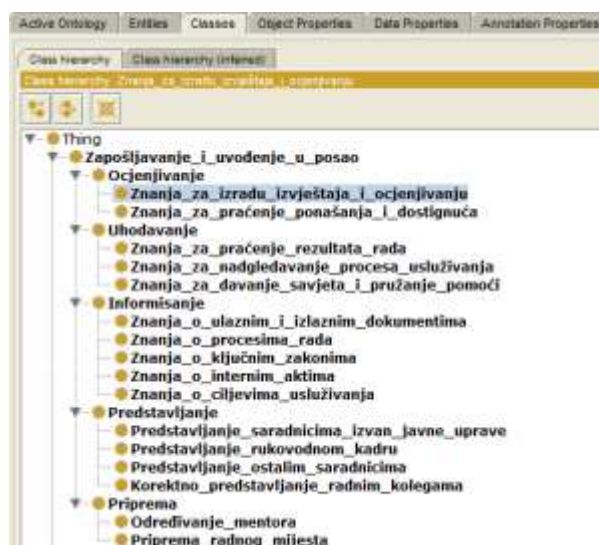


Figure 3. The required knowledge for recruitment and induction to work

### Staff motivation

Here we see motivation as a process that directs employees' behavior towards achieving a particular goal [13]. Motivation is a very complex phenomenon and cannot be given a simple definition. It is related to work and to a service authority while it starts and maintains the activity in the appropriate order. [14] Motivation is a term for all the factors that govern the physical and intellectual energies, direct behavior and determine the direction, duration, and intensity. Motivation can be seen in the context of our needs, desires, actions towards goals and satisfaction.

Motivation is the sum of all the factors that cause, enhance, organise and direct the behavior of an employee, or an action of a certain intensity and duration. What knowledge do we need to meet the desires and needs and thus achieve satisfaction? Here we must bear in mind that the motivation depends on the personal characteristics, the services characteristics and those of public administration.

The required knowledge on personal characteristics include: personal needs, individual attitudes, personal interests, work expectations.

The required knowledge on the service characteristics must be related to the structure of the service processes in the public administration of The Republic of Srpska, service culture, ethics and management styles.

The required knowledge on the characteristics of an administrative authority are related to the complexity of services, priority services and service methods, as well as autonomy in service.

The knowledge needed in the public administration is related to the following: How to attract the best people and keep them, how to provide customer satisfaction, how to encourage creativity and innovation in service, how to achieve service goals, how to provide a correct relationship between public administration and customer services (legal and natural persons).

Motivation should be directed towards increasing the satisfaction of users, service providers and quality services with the achievement of the goals. It should prompt the need and willingness in employees to achieve their personal goals through the quality of service and customer satisfaction. However, the variety of employees` interests should be taken into account as well as the fact that employees` attitudes differ. This means that the motivation has to be personalised and appropriate for each employee and it leads to the necessity to combine a variety of methods and motivational processes.

In order to present the knowledge more efficiently, we will present the knowledge as follows: 1. The Content Theories of Motivation and 2. Process theories of motivation as in Figure 4.

All these theories, presented in Figure 4 are based on the assumption that work motivation, as a driving force, can lead to more efficient service and satisfaction. The satisfaction then leads to higher motivation. The knowledge on the methods and techniques of motivation can be presented by utilising OntoGrafa Figure 5.

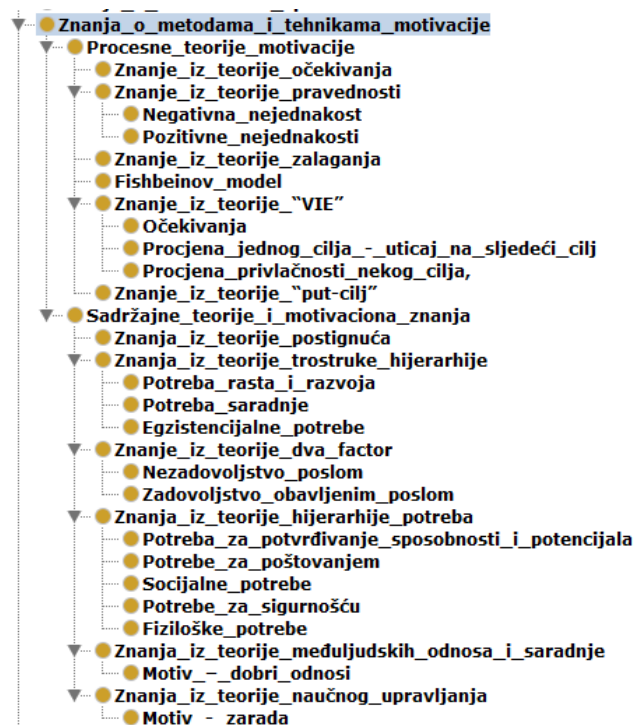


Figure 4. Required knowledge on motivation methods and techniques



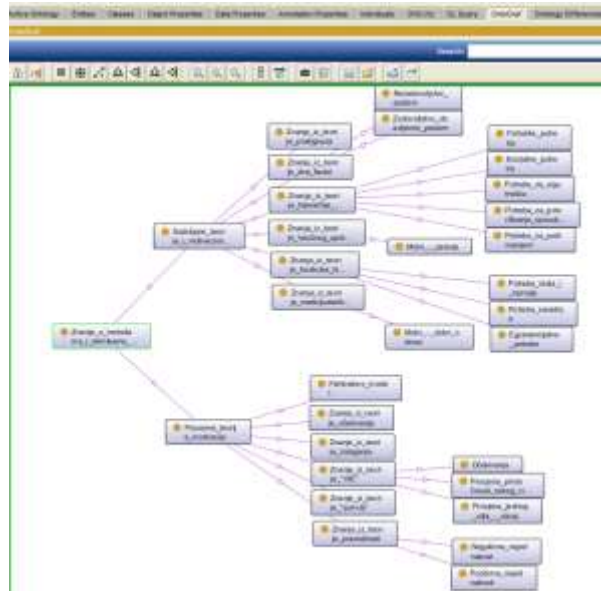


Figure 5. Motivation - Methods and techniques - OntoGraf

**Measurement of motivation and employee satisfaction**

Measuring motivation plays a very important role in the service process. However, it should be borne in mind that this is a complex and demanding process. To measure the motivation we need knowledge about approaches, indicators and instruments of motivation. We require the knowledge of the deep, indirect and psychological techniques to measure motivation, as presented in Figure 6.

The problem in these studies is that employees might want to present themselves in a good light so that some answers might be insincere. If this is the case, the testing loses the true meaning.

**Knowledge upgrade**

The constant training and learning gives employees greater confidence, independence, satisfaction and their users faster and cheaper services tailored to their needs. New knowledge can mean a more efficient service. It takes time to implement the new knowledge, thus it cannot be acquired only through education prior to employment.

It is a well-known fact that the only worthwhile investment is investment in knowledge. Developed countries have come to a stage where operational efficiency and service quality depend on the state of science and technology development stage. Therefore, various training should also be available to employees in these regions. Additional training in public administration in the Republic of Srpska should be viewed as a factor of improving and increasing the service efficiency.

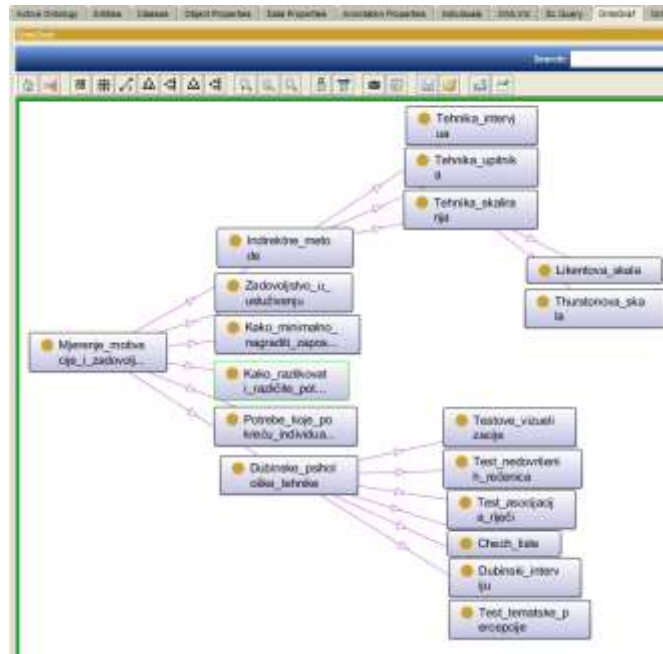


Figure 6. Measurement of motivation - techniques

To consider staff training, it is essential to have adequate the knowledge as presented in Figure 7.

The required knowledge that is essential for IS to fully respond to its role is as follows: communication, pedagogical, psychological, economic, demographic, technical, legal and so on. Can all this knowledge be easily and quickly gathered? In our present system for staff management in public administration of the Republic of Srpska it is not possible. However, by utilising software agents and semantic web it is possible to achieve it in the foreseeable future. New software agents could, if necessary, activate and provide the required knowledge from other databases in the right quantity and time. It is necessary to bear in mind that in such complex systems the multidisciplinary approach is essential so that the system could function effectively.

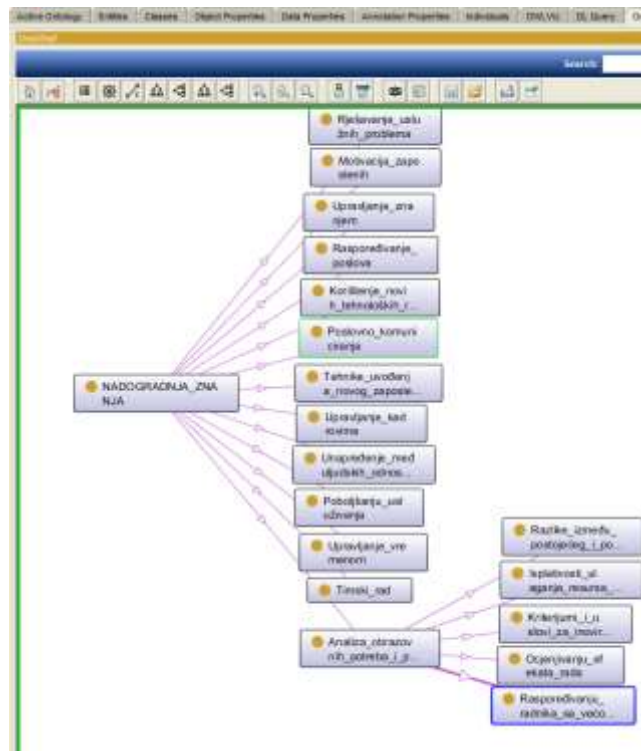


Figure 7. Knowledge upgrade - OntGraf

## CONCLUSION

Human resources management in public administration exceeds the limit of one body, one sector, service, department or ministry and it is an integral part of the functional and organization part of the entire administration. In this paper, we show that the management of human resources in public administration in The Republic of Srpska can be implemented in a different way by utilising new software tools based on ontologies and knowledge bases.

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