

competence; target preparing; PLM-systems

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## RESULTS OF TARGETS PREPARATION OF SPECIALISTS FOR AUTOMOTIVE BRANCH WITH USE OF CONTEMPORARY BUNDLED SOFTWARE

**Summary.** There are features of the automobile profile specialists' information competence forming are considered in the article. The role of employers in professional order for specialists' preparation forming, forms of their interaction with educational institutions while maintenance of hi-tech and high technology manufactures problems decision by the highly skilled personnel, that is capable to use science and technologies achievements during formulated goals decision are mentioned.

## РЕЗУЛЬТАТЫ ЦЕЛЕВОЙ ПОДГОТОВКИ СПЕЦИАЛИСТОВ ДЛЯ АВТОМОБИЛЬНОЙ ОТРАСЛИ С ИСПОЛЬЗОВАНИЕМ СОВРЕМЕННЫХ ПРОГРАММНЫХ КОМПЛЕКСОВ

**Аннотация.** В статье рассматриваются вопросы, связанные с формированием информационной компетентности специалистов автомобильного профиля. Показаны роль работодателя в профессиональном заказе на подготовку специалистов, формы их взаимодействия с образовательными учреждениями для решения проблем производителей в области высоких технологий высококвалифицированным персоналом, который обучен использованию научных и технических достижений для достижения обозначенных целей.

### 1. INTRODUCTION

Current state of educational system is characterized by increasing distance between loss of education quality and growing personnel's competence requirements, which are caused by acceleration of technological progress and perfection of technologies. Discrepancy between subject matters and growing requirements of different social-practical situations defines the global crisis of higher education field, which is underway against the background of worldwide trends, including wide distribution of education, its commercialization, and finally formation of informational society.

In such conditions the topical question is the looking for such directions of vocational educational system development, which could provide for accordance of specialists graduation structure with labour-market requirements, and also could allow satisfying of the consumers' requirements to quality of graduating students' preparation. The purpose of domestic education modernization is to create the mechanism of educational system's sustainable development. At the same time as the main task of Russian educational policy it is possible to mark an assurance of contemporary quality of education

based on conservation of its fundamental nature and accordance with relevant and perspective needs of individual, society and state.

The training of personnel for automotive branch is a topical question due to its rapid development. It is reflected in Strategy of motor industry development in Russian Federation for the period till 2020 year [1] in which the discrepancy of graduating specialists quality with branch demands and is noted and the most efficient ways for taking the issue forward are marked: «... for the preparation of high quality experts which are able to ably solve assigned problems on working out and manufacture of modern and perspective production, it's necessary to teach them under the multilevel program of higher education including good fundamental preparation, sufficient skills in professional work during industrial, design, technological and pre-diploma practice».

It is possible to achieve accordance of graduates' quality with employers' requirements only by modification of educational system paradigm. Nowadays many researchers when considering the possibility of «education during the whole life» concept realization are citing the different mechanisms of providing with unified educational area. Harder is that educational system is inert enough. Thus, the educational cycle in several times, but in most cases even in several orders much longer than the manufacturing one, so, considering that changes in manufacturing system under severe competition conditions happen more quickly than it is necessary for specialist training, the educational system in it's own classical version will permanently run after the manufacturing one. If the measures to cardinal changes of both processes and specialists training approaches will not be taken then displeasure of employers will only increase.

One of the serious problems is the imbalance in skill-mix production professionals in vocational education at all levels with labor market needs. This applies both quantitative relations and qualitative characteristics of professionals. On the one hand, technological developments and new technologies contributes to economic well-being of society, on the other hand, they provide very serious problem of finding competent person who shall design, produce, maintain, new technology and use advanced technology. Because educational system has different inertia, its development should outperform the economy and only in this case, trained professionals will be really in great demand by production.

## **2. THE TARGET PREPARATION OF SPECIALISTS FOR AUTOMOTIVE ENTERPRISES**

During the working travel to Khakassia president Dmitry Medvedev said that «... engineer is manufacturing-centric, piece and address product» and offered to businessmen to suggest to universities which specialists they really need [2]. Creation of the target preparation system is one of the possible ways to satisfy employers' requirements in highly skilled personnel in terms of dynamically developed economics.

For realizing the similar system of education it is necessary to use the innovative approach both to its construction, and to realization. Thus orientation to requirements of the employer and using of innovative technologies of education is the primary factor. In our opinion, it is possible, if at curricula of the expert preparation forming in a concrete direction maintain the principle of "consecutive accumulation of knowledge» and forming of competencies with the use of received skills. The conception of «target preparation» nowadays is determined by the new meaning: practically it means the specialists' preparation based on individual educational trajectory.

While analyzing the experience of universities in creation of integrated learning systems we can find out the unity of principles of coordination between universities and enterprises. It includes the curriculum and graduate works themes concordance, strengthening of practical-oriented systems by involving students into manufacturing process during the training, leading additional subjects into basic curriculum and development of additional curriculum containing relevant for enterprises subjects, attraction of leading experts of enterprises to conduct lessons and masterclasses and also to manage the course and graduate projects [3-12].

Nowadays the automobile branch is one of the most dynamically developing branches where both the state of the economy and well-being of the whole nation is reflected. One of the whole factors defining dynamical development of the branch is the presence of the highly skilled personnel.

The requirement of the highly skilled personnel is very high now. It is confirmed by the fact that one of eleven primary goals which are required to be solved within the frameworks of The strategy of Russian Federation's automobile industry development for the period till 2020 is the necessity of the perfection of «... automobile industry specialists' preparation's systems including new programs for a specialists' education creation according to international standards».

In particular the acute problem of education for automotive branch is facing in Naberezhnye Chelny, for which KAMAZ, the leader of the Russian cargo motor industry, became an enterprise forming a company town, but not only for named town, also for Kama economic region of republic Tatarstan. Another one intensive developed large automobile concern – Sollers is located both in Naberezhnye Chelny and in a special economic zone "Alabuga".

Forming of HR potential which meet the requirements of the branch; development of new and modification of existent educational programs and programs of mid-career education to provide automotive branch by the personnel of a new type; development of the system of scientific-research, engineering and industrial personnel training for the purpose and tasks of automotive branch.

In «The strategy of Russian Federation's automobile industry development for the period till 2020» considered risks associated with restructuring and modernization of the automotive business, which may lead to increased social tensions. It states that «... it is possible to reduce these risks through effective implementation of development projects automotive clusters – supporting regional cluster initiatives - through the formation of coordinated programs with the companies targeted training and retraining». Thus, the formation of human resources, meets the needs of industry, development of new and modification of existing curricula and training programs for the automotive industry, a new type of personnel, development of training research, engineering and manufacturing skills for goals and objectives of the automotive industry – are the challenges included in the package of measures to create conditions for sustainable innovation in the automotive industry in Russia.

To staff the enterprises of Kama region's and Naberezhnye Chelny city's automobile branch the General cooperation treaty between Kama State Academy of Engineering and Economic (INEKA) and KAMAZ JSC was concluded in 7th June of 2008 whereupon a number of specialists target contract preparation treaties with KAMAZ JSC departments was concluded.

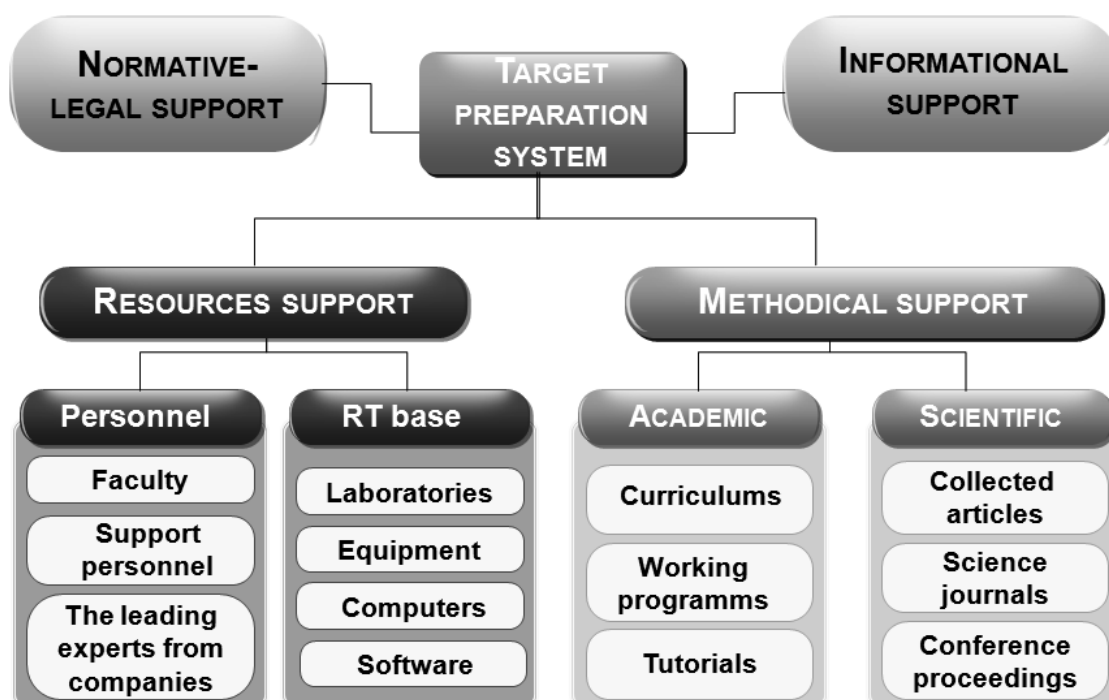


Fig. 1. The target preparation system support

Рис. 1. Обеспечение системы целевой подготовки

One of areas of cooperation is educational groups for target preparation forming. It assumes: from the side of high school – solution of the organizational problems connected with presentations, interviews and competitive selections of students by departments and enterprises of KAMAZ, JSC; from the side of KAMAZ, JSC, - direct carrying out of the mentioned actions. As a rule, target audience are the students of 4-5 courses taking part in competitive selection from calculation of 3-4 persons on one place offered by the customer.

According to mentioned contracts INECA has engaged the resource base forming (the laboratory equipment, the software, the literature) for realization of target contract preparation, and also the conditions for its realization support (fig. 1).

Target preparation is realized on the basis of the tripartite contract between high school, the enterprise and the student in which conditions of the specialist preparation, undergoing industrial and pregraduation practical training, job placements for the period of target preparation and after it ending, and also other details of relationship.

Under the organizations-customer's request INEKA develops schedules of educational process for target preparation of students, and also curricula of target preparation. The list of disciplines, volume of theoretical and practical training on each of them, studying terms are coordinated with customers and chairs, which graduate students. To conduct the lessons under the curricula confirmed in a bilateral order both leading teachers of profile chairs of INEKA, and leading experts and production workers are involved. Such specialists develop working programs of disciplines in courses which are provided by curricula of target preparation.

### **3. IT-COMPETENCE FORMING WHILE TRAINING THE SPECIALISTS OF AUTOMOTIVE BRANCH**

The requirement for the experts that exploiting and serving the automotive technology, remains high. Expansion of a lineup and growth of cars modification number demands from experts in service high level of competencies, in particular these requirements are typical for the dealer-service network enterprises experts certificated under the standards of manufacturers. The requirement in engineering staff owning the modern methods of working out the design documentation and engineering analysis, and also in process engineers that are capable to work out innovative manufacturing technologies and renovation of products is still high.

The unique way in construction of effective system of professional training of the competitive expert – orientation of the educational institutions on requirements of a labor market and interaction with the customer. The competence-oriented formation, creation of a target preparation system – the singular way of employers requirements satisfaction in qualified personnel in the conditions of dynamically developing economy. The core is not that set of the information which graduate of educational institution has received and «has acquired», its ability to solve the supplied problems, using skills that they received.

For realizing the similar system of education it is necessary to use the innovative approach both to its construction, and to realization. Thus orientation to requirements of the employer and using of innovative technologies of education is the primary factor. In our opinion, it is possible, if at curricula of the expert preparation forming in a concrete direction maintain the principle of "consecutive accumulation of knowledge» and forming of competencies with the use of received skills.

In such a case the computer becomes the basic tool both for teacher and the trainee, and IT technologies becomes the technologies of work with the information in the course of training. As requirements of employers in our days assume knowledge of IT technologies, while training courses are constructing it is necessary to be guided by acquisition of skills by students of use of those software products and mathematical models which are used for the decision of the problems, similar themes which it will face in professional work, in our opinion [13]. Competence of the specialist will be expressed in its ability to orient in all variety of the information, to choose the necessary data, to analyze it and make relevant conclusions. At all stages of work with the information – gathering,

processing, analysis –the software connected with specificity of branch and a concrete workplace is used.

IT technologies should become habitual toolkit for the decision of the problems connected with professional activity. In order for the student to be prepared for use of specialized software products while he is studying the special disciplines, he should possess a necessary minimum of knowledge and competences in the sphere of IT technologies. To ensure this, it is offered to construct an educational program so that it met the requirements of tomorrow.

Considering the structure of informational competence, the majority of researchers consider that it assumes the ability to work with the computer technologies, to use modern software products, to involve means of information technologies for carrying out the mathematical calculations, processing the data of experiments, search of the necessary information, for business correspondence and communications, and also means rational activity in the field of development and use of the information technologies resources. Informational competence constitute, on the one hand, is a base (key), on the other hand, it is considered as an important component in structure of professional competence.

Base informational competence, being overprofessional, overobjective, includes uniform for all categories of users circle of questions in the field of base technical and computer facilities software, knowledge and experience in which the expert of any profile should possess. Informational competence as a component of the professional one includes a range of the specific questions corresponding to the level and the maintenance of computerization within the limits of the concrete professional environment, knowledge and experience in which the expert of the given profile should possess. Besides, it is supposed that the expert should be able to improve the knowledge and experience in professional and adjacent areas. Formation of the informational part of professional competence should be provided with a certain set of disciplines, educational situations and practices, simulating real professional tasks.

Informational competence as a component of professional competence of the automobile profile specialist is formed at studying of disciplines of a special cycle and inseparably connected with the subject-oriented information technology which is using to solve scientific research, design, industrial-technological and organizational-administrative problems. Thus, while studying the discipline of a special cycle the orientation to a concrete kind of professional work is provided.

Realization of this principle in a practice assumes use of such bundled software, which will be used by trainees in the conditions of real production. Thus, one of the INEKA automotive faculty's strategic targets is introduction in educational process of modern bundled software for scientific researches, visual designing and the engineering analysis. As the faculty has initially been organized for preparation of highly skilled engineering personnel for the automobile branch, its structure includes specialities, which correlate practically with all stages of automotive engineering life cycle. While constructing training courses for each speciality the proper program toolkit – from software of marketing researches and economic efficiency estimation to CALS-technologies for engineering analysis – is used at faculty (fig. 2).

Each specialist of automobile branch should be able to estimate efficiency of the enterprise activity and to predict demand for the product taking into account dynamics of market conditions. Thus, demands are made to graduates of our faculty on knowledge of bases of the automobile market segmentation, forecasting of demand for car sales, service and traffic volume, the competitive analysis, the analysis of efficiency of dealer-service networks. In this stage it is necessary to use the software, which allows to carry out all above-stated kinds of data analysis. For these purposes the KONSИ software is used.

The main condition when preparing the automobile profile specialists is teaching to methods of visual designing and engineering analysis of automobile knots and units. Almost all students of automobile profile specialities study bases of designing and calculation of automobile systems, calculations of dynamics and durability of products, methods of the engineering analysis and etc. The basic software product used in the field is Siemens NX, intended for development of mechanical and electromechanical systems of the car, engineering analysis of mechanical and electromechanical systems, etc.

The following class of software is used for designing and optimization both industrial systems, and service systems. On older courses students of automotive faculty design infrastructure and technological processes of the enterprises, which produce cars, facilitate service and transportations engaged. Modelling of real industrial systems allows not simply to teach bases of production and service systems functioning, but also to teach methods of optimization and management decision making in these systems.



Fig. 2. Use of modern information technology while preparing the automobile profile specialists

Рис. 2. Использование современных информационных технологий для подготовки специалистов автомобильного профиля

In the field of operation and service the software suites AnyLogic, Siemens Plant Simulation and Technomatix Jack are basic for studying. To solve practical problems of workplaces ergonomics definition at the automobile branch enterprises, comfortableness and ergonomics of a driver's place students study Siemens Technomatix Jack software. Siemens Plant Simulation allows to rapidly create realistic simulation models of dynamic warehousing and logistics operations, so it is an important part of learning process [14].

Such approach in a combination to development and adoption of training individual programs under contracts with employers and undergoing of industrial practices on places of the future industrial activity will allow to reduce terms of adaptation of the specialist on a concrete workplace, will raise its competence both in professional sphere, and in the field of high technologies that will provide its competitiveness on a labor market.

#### **4. RESULTS OF APPLICATION OF THE INNOVATION APPROACH TO EDUCATIONAL PROCESS**

Considering sharp requirement for highly-skilled personnel for scientific and technical center (STC) and technological center (TC) of KAMAZ, JSC, since 2008 the preparation of specialists for the mentioned departments has been organized. Educational groups in demanded directions of preparation have been formed, curricula are made and coordinated, and working programs of disciplines are developed. Theoretical and practical training, carrying out of master classes by leading experts of STC and TC has been included in the training program. Students carried out course and degree projects on the themes coordinated with project manager - experts from the enterprise. Thus, in 2008 important in practice degree project connected with working out of methods of operational reliability of KAMAZ frames increase has been executed (fig. 3).

The students training within target preparation, receive additional possibilities: use of the laboratory equipment, library fund of the technical literature, drawings, the technical, organizational-administrative and economic information of the enterprise-customer during all term of target preparation; participation in real scientific, technological, design workings outs while carrying out the course and degree projects and a possibility to begin work on them before the students trained under the usual program can do it, so far as they can get to know in advance the design object, learn it and collect and process necessary material.

Level of progress of the students, which are training within target preparation, as a rule, surpasses level of progress of the students trained under the usual program (fig. 4). It is connected with motivation growth to increase professional competence and competitiveness, and also with works in real design groups over the decision of the assigned industrial problems. Leading experts of STC and TC are involved in degree designing management, and also in working as a part of the State certification committee in the time of degree projects protection. A number of degree projects protections are spent directly at the enterprise.

#### **5. CONCLUSION**

Such organization of target preparation allows the enterprises to receive the competent specialists involved in production at a grade level that allows to consider own requirements to potential workers at training, and also to improve contents of the higher vocational training programs in conformity with changing requirements of innovative processes in technics and technology area.

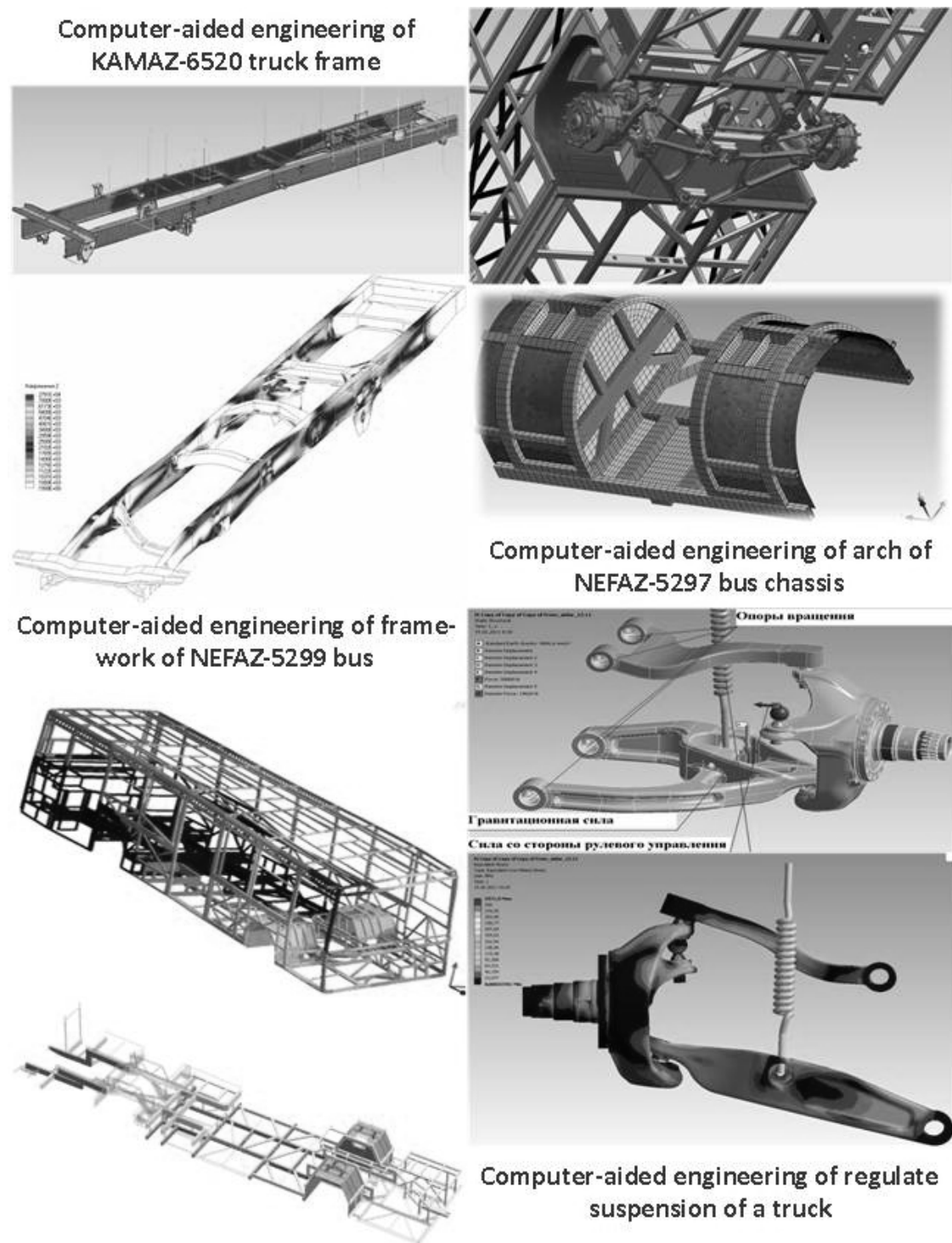


Fig. 3. Results of graduate project execution by the students, which trained by the target preparation program with use of Siemens NX software

Рис. 3. Результаты выполнения дипломных проектов студентами, обучавшимися по программе целевой подготовке, с использованием ПО Siemens NX



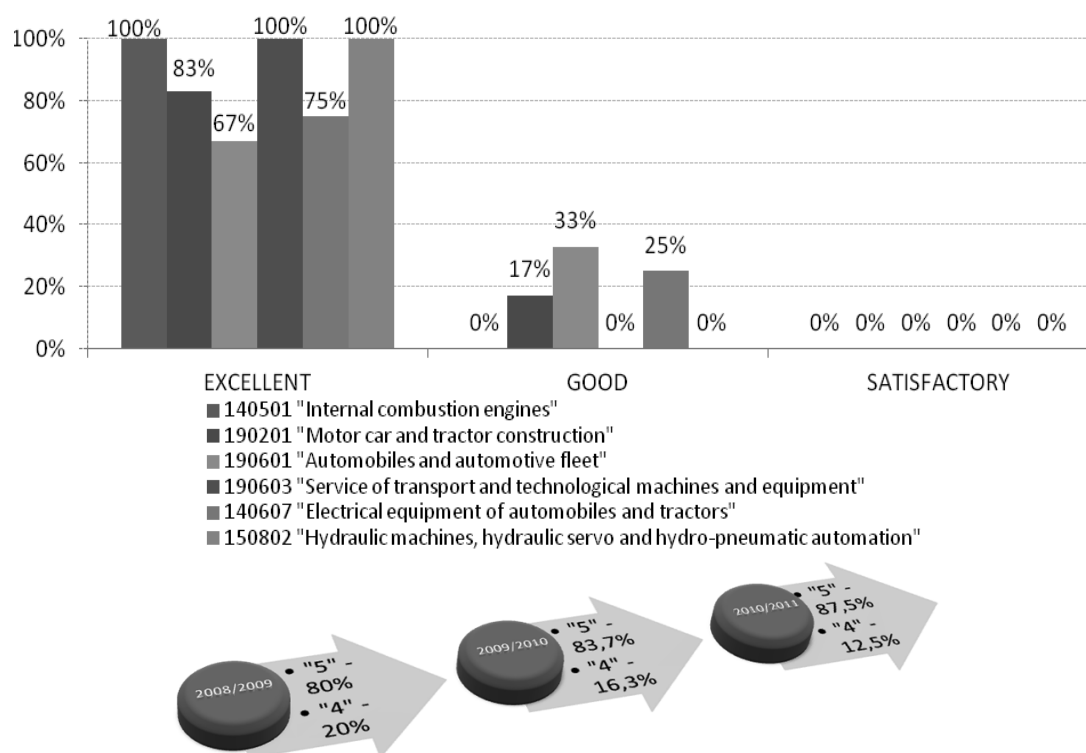


Fig. 4. Results of degree projects protection by students, having training within biennial target preparation (2008-2011 years)

Рис. 4. Результаты защиты дипломных проектов студентами, проходившими двухгодичную целевую подготовку (2008-2011 гг)

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