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ORGANIZATIONAL AND ECONOMIC PROBLEMS OF APPLYING QUALITY MANAGEMENT SYSTEMS AT ENGINEERING COMPANIES

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Different management systems, including quality management systems, are widely used in enterprises and organizations nowadays. The procedure for establishing and effectively using quality management systems is regulated by the system of national standards. At the same time, the approaches to organization and the performance of quality management systems in enterprises depend on the personnel's training, knowledge and understanding of existing regulations in the field of standardization and technical regulation. The main problems of effective quality management using quality management systems arise from inept application of existing regulations and a formal approach to organization and management of quality management systems. This primarily happens due to lack of involvement of the staff, lack of understanding of the role and responsibility of the process owner. Ensuring the required quality of processes is achieved by hiring competent managers and specialists for the enterprise. This means that human resources are sufficiently prepared, with a quality system of motivation and a high corporate culture. The company has created a system of information support, electronic document management system. In many enterprises, QMS documents are maintained by quality services, which are perceived as units solely responsible for maintaining the quality management system in working condition. Unfortunately, the functions of quality services are often limited to maintaining the QMS documentation in working order. However, all units of the enterprise must have the required documentation for the QMS available and keep the records prescribed by the QMS documents, the employees should know the contents of QMS documentation, have the skills necessary for document management. A formal approach to quality management systems in enterprises means that the resources allocated to maintaining the management system are used inefficiently. The article gives a brief analysis of the specific problems arising in application of quality management systems and the main directions for eliminating non-compliance of systems with the requirements of federal legislation and normative documents in the field of standardization. We have emphasized that the basic principle of building a quality management system in the enterprise should be the adapting the system to the needs of the enterprise while complying with the national standards of the Russian Federation. This paper presents a generalized view of scientists and specialists on actual problems encountered in implementing QMS in enterprises. We have proposed specific practical solutions (recommendations) formed on the basis of practical construction and application of the QMS.

Keywords: management system, import substitution, process approach, quality records, local normative documents, national standardization system, audit, planned documents of quality assurance

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ОРГАНИЗАЦИОННЫЕ И ЭКОНОМИЧЕСКИЕ ПРОБЛЕМЫ ПРИМЕНЕНИЯ СИСТЕМЫ МЕНЕДЖМЕНТА КАЧЕСТВА НА МАШИНОСТРОИТЕЛЬНОМ ПРЕДПРИЯТИИ

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В настоящее время на предприятиях и в организациях широко применяются различные системы менеджмента, в том числе системы менеджмента качества. Порядок создания и эффективного применения систем менеджмента качества регламентируется системой национальных стандартов. Вместе с тем подходы к организации и результативность системы менеджмента качества на предприятии зависят от подготовленности персонала, знаний и понимания действующих нормативных документов в области стандартизации и технического регулирования. Основные проблемы эффективного управления качеством с применением систем менеджмента качества возникают при неумелом применении действующих нормативных документов и формальном подходе к организации и управлению системой менеджмента качества. В первую очередь, из-за недостаточной вовлеченности персонала, непонимания роли и ответственности владельца процесса. Обеспечение требуемого качества процессов достигается при наличии на предприятии компетентных руководителей и специалистов. Это значит, что кадровые ресурсы имеют требуемый уровень подготовленности, качественную систему мотивации персонала, высокую корпоративную культуру. На предприятии создана система информационного обеспечения, электронная система документооборота. На многих предприятиях ведение документов СМК возложено на службы качества, которые воспринимаются как подразделения, исключительно ответственные за поддержание системы менеджмента качества в рабочем состоянии. К сожалению, функции служб качества часто ограничиваются поддержанием в рабочем состоянии документации СМК. Вместе с тем в подразделениях должна быть необходимая документация СМК и должны вестись все предусмотренные документами СМК записи; работники должны знать содержание документации СМК, умело её оформлять и обеспечивать документооборот в соответствующей части. Формальный подход к применению систем менеджмента качества на предприятиях приводит к неэффективному использованию ресурсов, выделяемых на ресурсное обеспечение системы менеджмента. Дан краткий анализ конкретных проблем, возникающих при применении систем менеджмента качества и предложены основные направления по устранению несоответствий систем требованиям федерального законодательства и нормативным документам в области стандартизации. Подчеркнуто, что основным принципом построения системы менеджмента качества на предприятии должно быть построение системы менеджмента качества под нужды предприятия, с соблюдением требований российских стандартов. Получено обобщенное мнение ученых и специалистов по актуальным проблемам, возникающим при реализации СМК на предприятиях. Предложены конкретные практические решения (рекомендации), сформированные на основе практического построения и применения СМК.

Ключевые слова: система менеджмента, импортозамещение, процессный подход, записи о качестве, локальные нормативные документы, национальная система стандартизации, аудит, плановые документы обеспечения качества

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Introduction: Creating and maintaining quality management systems (QMS) at machine-building enterprises can be stimulated by several objective needs, including:

– the need to ensure the competitiveness of products;

– compliance with the terms of contracts for supply of products;

– compliance with the mandatory requirements of regulatory documents for certain types of products.

At the same time, as practical experience of machine-building enterprises shows, introducing QMS causes certain difficulties for company managers. A number of significant problems arise in practical implementation of QMS, first of all, of overcoming the internal resistance of workers to changes in work organization. The problem that occurs quite often when building a QMS is that specialists or managers of the company do not always fully understand the amount of work they will have to do after they receive the QMS certificate. The lack of necessary time and human resources for developing QMS leads to the situation when the QMS becomes ineffective and is a pile of outdated and obscure documentation [1].

The following problems were identified in maintaining QMS. First of all, the cost of maintenance is too high for external audit; employee motivation is low there is little continuity. A separate problem are frequent internal audits. An important problem is the lack of material incentives from the state. If the enterprise's specialists have to spend additional time on creating the QMS, with the enterprise spending extra funds on improving their skills, lack of material support certainly has a negative effect on the economic performance of the enterprise [2].

The authors of the works on QMS [3–] also highlighted a number of problems arising from implementation of QMS in terms of domestic production. There are two classes of problems:

– problems of introducing the QMS;

– problems of maintaining the QMS.

Enterprise management are often incapable of redefining their responsibilities. There is some inertia in the thinking of specialists. The increase in workflow due to using QMS proved problematic for specialists. Identifying and analyzing the risks of the production process caused difficulties. Additional complications were caused by planning the integration of QMS due to additional load on the staff of the enterprise.

If the specialists of the enterprise have to spend additional time on creating and maintaining the QMS and the enterprise spends funds on improving the skills of the specialists, lack of material support, of course, has a negative impact on economic performance of the enterprise. As a result, the QMS is often viewed as a perfunctory measure that has to be taken for the sake of appearances. There are enterprises where QMS is implemented only nominally.

One of the main problems of Russian quality management is that the economic conditions in the country differ from the conditions in which the principles of Western quality management were born, i.e., it is a tool for solving problems that the Russian manufacturers have not yet faced. Using the tool for purposes other than the ones it was intended for leads to different results [6].

According to researchers, about 80% of all defects detected in manufacturing and using products are due to insufficient quality of the processes of developing the concept of the product, design and preparation of its production. The reason for about 60% of all failures that occur during the warranty period is in erroneous, hasty or imperfect development. It was revealed that development and manufacturing of a product has a tenfold cost rule: if an error is made at one of the stages of the product quality circle and detected at the next stage, 10 times more money has to be spent on correcting it compared to what it would take if the error was detected on time. If the error is detected in the second stage after it was made, 100 times more money has to be spent, 1000 times more in the third stage, etc. [7]. We come to another conclusion [8]: in addition to the control functions, serious analytic tools are mandatory for use in the QMS, and the analysis should be presented in business terms that are clear to management.

Taking into account the identified problems that occur in construction and application of QMS at the enterprises of mechanical engineering, the topic of the study is relevant and calls for developing solutions to eliminate these problems.

The goal of the study is to analyze the organizational and economic problems of applying the quality management system at a machine-building enterprise and to develop practical proposals (solutions) for improving this system.

Research methodology: Based on analysis of positive (effective and efficient) experience in implementing the QMS at machine-building enterprises of the Russian Federation, practical experience and expertise in managing QMS at machine-building enterprises of serial and individual production, we have highlighted significant problems in application of QMS, proposing methods solving these problems in practice.

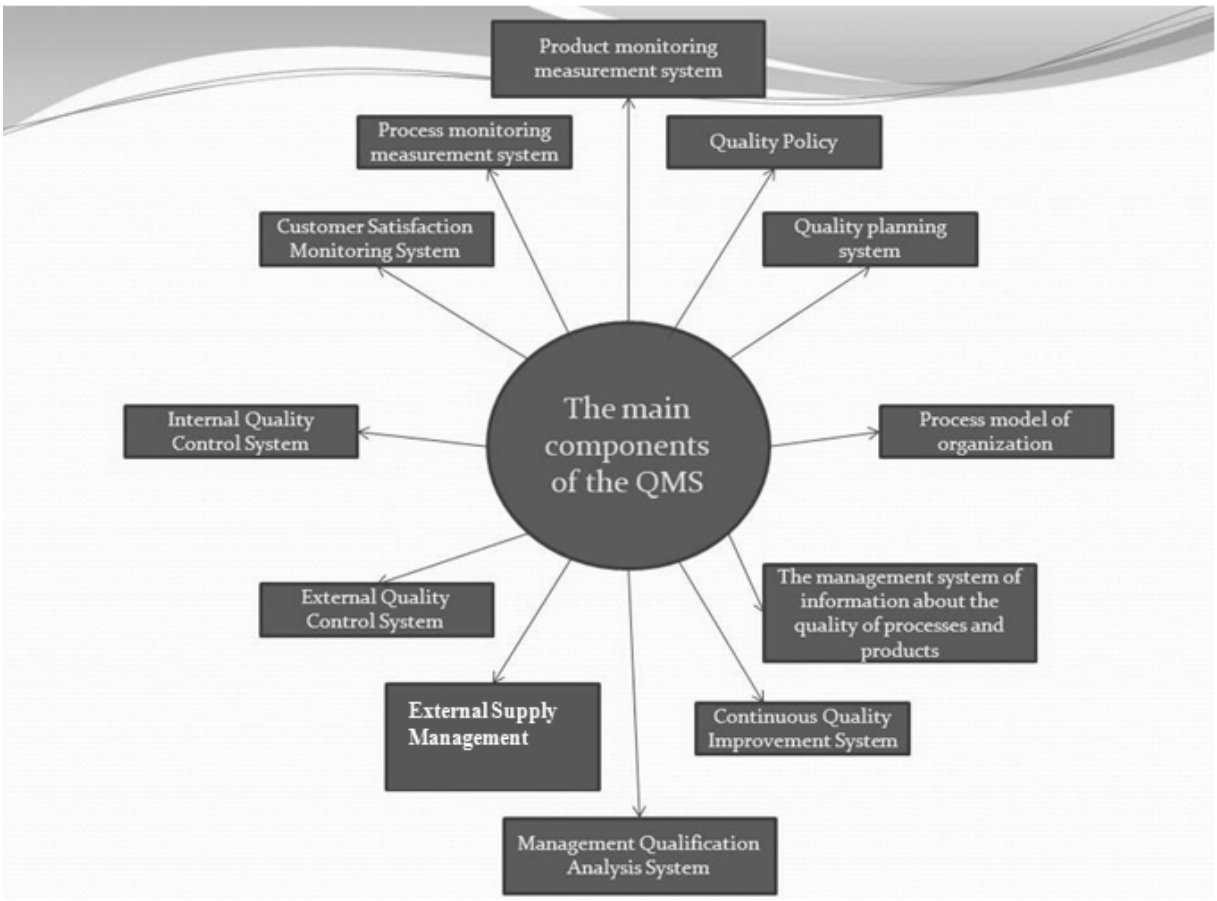
According to modern views [9], the QMS includes a number of components that allow implementing quality management in full (Figure).

Let us consider the typical cases when QMS do not comply with regulatory documents, principles of system and process approaches that occur in industrial enterprises with respect to all elements of quality management systems.

1. Competence in continuous quality improvement. Organizational problems.

Personnel training for implementing QMS processes may either skip the planning stage or involve redundant planning with unreasonable expenditure of resources.

The process of personnel training is not always focused on study of local regulations describing the processes of the first level.



Main components of QMS (9)

Local regulatory documents do not always comply with the requirements of regulatory legal acts (documents of federal legislation, regulatory legal acts of an enterprise, and requirements of national and interstate standards). The most important condition for successful functioning of the QMS is forming an understanding of the essence of the QMS and the role of the employee's personality, instilling the desire to work effectively within the QMS. While that is certainly true [10], a company's employees can be given the best tools, machines and equipment, but if they do not want to work efficiently, all of the employer's efforts will be a waste of money and time. Ideology is needed to form public opinion. For example, the principle «It is a shame for a good person to work badly» is promoted in Japan. In the US, quality is often compared with religion. People cannot be made to believe in God. The same principle works for quality. Employees cannot be forced to do something, but they can be convinced, with an appropriate motivation built up for projects, companies or the whole society. An understanding of the psychology of the employee is needed in order to be able to convey the basic principles of quality to the employees.

Solutions: Creating a unified plan for training personnel on QMS, forming annual financial applications for training in sync with the formation of the enterprise budget. Training employees to understand their role in the QMS. Forming an understanding of the role and business qualities of process owners.

2. System for managing the information on quality of processes and products. Documented information management.

Problems: There is no systematization and normalization of records on the quality of manufactured products or services (no catalogs of documents on quality, no record of forms, no requirements for the composition of details and attributes). The staff is not acquainted with and/or is not guided by the requirements of Part 1 of Article 17 of the Federal Law of October 22, 2004 N 125-ФЗ «On Archival Affairs in the Russian Federation», including the List of typical archival documents formed in the scientific, technical and production activities of organizations indicating the storage period (approved by Order of the Ministry of Culture of Russia dated July 31, 2007 N 1182), in accordance with which employees of the enterprise are obliged to preserve records on quality. A significant systemic problem is the lack of coordination of the requirements of local regulatory documents (enterprise standards/organization standards) with the regulatory legal acts of the enterprise (regulations, manuals, instructions). This problem [11] is due to lack of documented procedures for conducting legal expertise of documents in the field of standardization, including those describing QMS processes.

Solution: Organizing archives and repositories for storing records at the enterprise. Organizing legal expertise of projects of local regulatory documents at the enterprise.

3. System of internal quality checks. Internal audit.

Problems: The requirements of the standardization work plan are not always taken into account in audits of business units within the framework of QMS. The competence of auditors on internal audit issues is not always controlled, which significantly reduces the effectiveness of scheduled inspections. The possibilities of unscheduled audits (including control of volatile production) initiated by the enterprise quality service based on analysis of statistics on failures (non-conformities) are not fully realized. There is a lack of human resources (competent specialists) for conducting audits.

Solution: Maintaining a single plan of work on standardization in the enterprise. Directing competent employees from the technical services of the enterprise to conduct audits.

4. System for controlling external suppliers. Analysis and evaluation.

Problems:

4.1 The possibilities of statistical analysis of product quality are not fully realized within the framework of the quality management system in industrial enterprises, especially those manufacturing serial products, and the process is often formal. The enterprises of individual production are also not fully implementing the results of statistical analysis of inconsistencies that arise during product verification and processing complaints.

4.2 When organizing verification (input control) of materials, semi-finished products and components (hereinafter referred to as CMSFP), enterprises do not always take into account the CMSFP share in the cost of manufacturing products, which does not allow rationally allocating resources for implementing input control operations. Statistics of inconsistencies caused by suppliers is not taken into account. Modeling of verification, in particular to substantiate that it is carried out at the territory of suppliers of CMSFP, is not always applied. Organization of verification, taking into account the quantity of CMSFP nomenclature used, is subject to modeling using economic criteria and cost items (including accounting for storage, transportation, depreciation of storage facilities, etc.).

Solutions: Input control and analysis of claims and reclamations provided by competent specialists from departments. Standardization of the list of works on analysis of statistics of inconsistencies (development and application of the organization standard), terms of information processing and decision-making reflected in the local regulatory acts of the enterprise.

5. System of continuous quality improvement. Improvement.

Problem: The dynamics of improvement in the QMS of enterprises does not fully correspond to the dynamics of new risks, which entails untimely redistribution of resources for implementing QMS processes.

Solution: Providing for an adequate reserve of financial resources for overhead costs in planning the budget of the Quality Service for the year preceding the planned one, based on analysis of statistics of inconsistencies.

6. Process model of organization. Leadership.

Problems: Creating and organizing the operation of the unit for standardization and technical regulation deserves special attention. The most important factor hindering the process of introducing and certifying QMS [11] in our country is not so much unstable economic situation of the enterprise or lack of economic incentives to intensify activity in the industry but insufficient level of knowledge of managers and specialists of enterprises about international standards and new approaches to issues of quality.

It is commonly believed that, according to the system of ISO QMS standards, [12], what matters the most is not blind adherence to standards but orientation towards competitive quality. The latter includes not only contractual relations between the supplier and the customer, but also complete satisfaction of the needs of the client (consumer). The desire to please the client, the continuous monitoring of quality and its constant «improvement» create a culture of quality that is significantly different from that based on a system of simple adherence to standards.

At the same time, it is impossible to ignore the fact that standardization works are the implementation of state economic management, for which an enterprise should have a specialized unit (center) organizing information support of the enterprise, carrying out standardization planning, organizing development, application and control of executing standardization documents including QMS documents. An important aspect in organizing standardization is subordination of the standardization unit to the top management of the enterprise. Combining the functions of the QMS unit and the standardization unit creates unreasonable redistribution of management functions, contradictions in organization of standardization planning.

Solutions: Separating the standardization unit into a separate functional unit answering to the top management of the enterprise.

7. System for managing information about the quality of processes and products. Infrastructure.

Problems: When building (upgrading) the QMS, attention should be paid to the information support of the QMS processes.

Description (normalization) of processes in an enterprise, as a rule, is carried out in the form of standards of the organization (enterprise). Standards set requirements to implementing processes, the procedure for developing standards, their implementation and use, relating to the types of activities and processes in a given organization. The design and content of standards of an organization must comply with the requirements of GOST R 1.4-

2004 «Standards of organizations. General Provisions» and GOST R 1.5-2004 «Standardization in the Russian Federation. National Standards of the Russian Federation. Rules for the construction, presentation, design and designation».

The main tasks within the framework of QMS information support are creating a complete set of standards describing the QMS processes and keeping them up to date. Considering the significant time resources required for developing (cancellation) and updating of standards (from 2 to 9 months for development and approval of a draft standard), the work should be carried out in a planned manner, taking into account the load of the executive units.

Information support may also include procurement and application of foreign regulatory documents, which also requires significant financial and time resources. Of particular note are possible risks of using foreign regulatory documents, namely the risks of using documents that have lost their relevance and the risks of violating license agreements. If foreign standards are used, attention should be paid to licensing of technical translations of standards.

The modern economy is developing in terms of digitalization and is characterized by transition of all its constituent sectors to the information telecommunications platform [13], including transition to using standardization documents on electronic media and placing them in electronic databases of enterprises. The problem of risks (intentional and unintentional) [14] of information leakage arises in the given conditions of information support. The information included in the standards may contain trade secrets, which implies the development of a system for protecting information placed on paper and especially on electronic media.

As a rule, the acquiring, account and storage of regulatory documents in the field of standardization (including original documents) are carried out by the standardization department, which also calculates their needs, reproduces them in the required quantity, and provides copies to the corresponding departments of the enterprise.

Regarding the documentation acquired for execution of contracts, special attention should be paid to the deadlines for production of these documents and timely financing of the process of procurement of documents in the field of standardization. There are risks that contracts might not be fulfilled if the documents are delivered with delays.

Solutions: Creating a system for accounting (on electronic and paper carriers), reproducing and delivering regulatory documents in divisions at the enterprise. Keeping statistics on the cost of procurement and translation of regulatory documents. Timely execution of budget requests for financing information support of production in the year preceding the planned one. Organizing continuous monitoring of the relevance of regulatory documents used by employees in departments of the enterprise when implementing QMS processes.

8. Activities at the stages of the life cycle of products and services.

Problems: In ensuring the conformity of products, it is important to technically and economically justify organization of operational and acceptance controls at the stage of production, performance of works, and provision of services.

So, for example, the main factor in the quality management system in construction organizations [15] is technical quality control, including such active factors as self-control of direct executors, continuous operational control by line production personnel (foremen and workers) and statistical operational sampling control carried out by special personnel of quality management services. The system of operational and acceptance control of product conformity is also widely used at the enterprises of mechanical engineering.

Significant risks of inconsistencies and defects during operational and acceptance control may result from:

8.1. Using metrological assurance tools that do not meet the requirements of the design and technological documentation;

8.2. Involving incompetent employees of technical control units;

8.3. Delayed decisions to eliminate inconsistencies (implementation of corrective and preventive actions);

8.4. There may be risks of mismatch between the amount of resources used in implementing preventive actions and expected losses in case of potential inconsistencies;

8.5. An essential aspect of organizing quality control is the completeness and relevance of control operations in the manufacture of products (performing works and providing services). As is known, control operations are formed and included in technological processes, as a rule, at the stage of development. In this regard, it is important for the division implementing the QMS management functions to ensure timely identification of the necessary control operations (guided by previous experience in manufacturing products) and including them in the technological processes at the stage of development.

8.6. Understanding the role of the QMS at machine-building enterprises [16] is often reduced to organizing control by quality departments, preparing corrective and preventive actions and implementing them by production units. The QMS also stands above the processes and achieves product quality by other means: by controlling the quality of the processes through internal and external audits, calculating KPI. The report on defects for the QMS is only a «signal»: the defect could have occurred not during the final operation, but in any link in the chain. The task of the QMS is to find the causes and outline measures to eliminate the defects. It may be necessary to change the supplier, or the design of the site, or technology, up to developing a new project for modernization of production. The result of this analysis are the ongoing measures on quality and large investment projects.

According to Deming, quality control is an unnecessary function. Quality must be built into the product and process. Unfortunately, for the majority of Russian enterprises focused on physical labor, quality control is the most important element of the process. Therefore, participation in the QMS, the use of QMS tools is a function of all interested employees, from shop personnel to enterprise management.

8.7. An important activity of the quality management division is the preparation of planning documents for ensuring the quality of products. A formal approach to the preparation and application of this category of documents entails the risk that the products are not delivered on time.

Let us consider typical problems in design and application of quality planning documents:

– including operations that do not correspond to the applied technological processes in the control plans;

– including forms of reporting documents on quality (records) not used by the given enterprise in the quality plans;

– status of control points does not correspond to significance of control operations;

– not including planning documents about quality in the terms of the contract;

– procedure for inviting representatives of the customer to monitor operations and notify departments of the enterprise is not carried out on time.

Solutions: Considering the significant resources of the enterprise (with large amounts of employees involved in QMS) necessary to ensure effective use of the existing QMS, complex automated control systems within the existing QMS are vital for resource provision.

Organizing the work of the chief metrologist in accordance with the requirements of the national standards of the Russian Federation.

Developing and organizing the execution of the documented procedure governing the preparation and execution of planning documents in the field of quality.

Researchers note [17] that the management of many companies seeks to obtain an ISO 9001 certificate to achieve a purely tactical marketing effect. Such activities are aimed more at imitation than at fulfilling the requirements of the ISO 9000 series.

Considering the above typical inconsistencies arising from implementation of the QMS in enterprises and in order to build an effective QMS of the enterprise, it is important:

– to implement the above features of the processes at the stage of creating the QMS;

– take into account the comments of certifying authorities when modernizing the QMS;

– when training personnel, to ensure that the employees understand production and QMS as a social and technical system;

– pay special attention to the rigid connections of interacting processes (to ensure the coupling of the inputs and outputs of the processes).

Thus, we have formulated specific proposals for improving the existing quality management systems, taking into account the generalized and practical experience of the enterprises of mechanical engineering of the Russian Federation, recommended as guidelines when creating the QMS.

Findings. In order to solve organizational and economic problems arising in application of quality management systems in machine-building enterprises, we propose practical solutions (coinciding with the views of a number of researchers) to ensure the effective functioning of the QMS in machine-building enterprises, including:

1. Form models for developing QMS for the enterprises based on the given resource opportunities;

2. Justify and propose a method of choosing a rational structure of QMS for a particular enterprise taking into account the nature and scale of production.

3. Justify and propose methods and tools for the management factors in the sustainable operation of the QMS of the enterprise.

4. Find opportunities [18] to continuously improve and perform, carry out the measures needed to fulfill the needs of consumers and meet their demands.

5. Make sure that employees of the enterprise understand their role as owners of processes [19, 20], providing legal independence and specific responsibility within process implementation that are certain and clear to the worker.

6. Apply the practice of legal expertise in developing local regulations, including standards.

7. Ensure legal coordination of the units developing documented procedures.

8. Reduce the time to make decisions to eliminate inconsistencies based on the results of statistical analysis of product quality.

9. When implementing QMS processes, take into account the requirements of standardization documents incorporating elements of the state economic policy. Find a compromise with QMS documents. Make legally sound decisions.

10. Organize information support of the enterprise taking into account requirements of the state and international legal documents.

11. Particular attention should be paid to application of documents in the field of quality. Provide the appropriate legal status, regulated treatment, competent use and storage in accordance with applicable law for these documents.

In order to successfully implement the above proposals for addressing the problems of QMS application in engineering, it is advisable to be guided by the principles of complexity and consistency of decisions.

The solutions we have proposed for solving organizational and economic problems of the QMS at the enterprise imply that the management makes purposeful and conscious changes to the philosophy of organizational development towards quality, increased responsibility and motivation of the staff.

Directions for further research. Further research on the experience of creating and applying QMS in industrial enterprises will be dedicated to analysis of inconsistencies with the requirements of QMS regulations and to developing practical techniques and methods for improving quality management systems.

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