

A risk management mechanism for ensuring product quality in order to identify quality reserves

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Abstract. The article examines the basics of risk management while ensuring the quality of the products produced, helping to identify quality reserves in the activities of contemporary industrial enterprises. The rationale is rooted in the fact that the potential unpreparedness of enterprises operating in the digital economy to regularly emerging new threats and challenges leads to the need to form a risk management mechanism. The article presents a mechanism for identifying quality reserves and determining the level of acceptable risks, which would significantly improve the sustainability and competitiveness of industrial enterprises in the contemporary market in the digital economy.

Keywords: risk management, risk management mechanism, product quality, quality reserves, product life cycle

1. Introduction

In order to carry out research to ensure the quality of our products in conditions of limited resources, we need to identify and effectively implement unused reserves. For the Russian industry, this task is aggravated by integration with the world market, as a result of which a significant saturation of the domestic market with foreign products only increases the rigidity of the competitive struggle.

In recent years, attitudes towards risk management in Russia have begun to change. We must create our own, corresponding to Russian conditions, risk management mechanisms, especially with the purpose of further identifying reserves of product quality, making maximum use of both domestic experiences and the experience of developed countries.

2. Materials and Methods

The methodological basis was the provisions formulated and created by the works of the leading representatives of domestic and foreign scientific schools in the field of management theory, management. The research used the methods of functional, structural and objective analysis; basic provisions of a systematic approach; methods of scientific typology and modeling, economic and statistical research methods, as well as functional and structural analysis.

3. Results

The risk of product quality is the risk of material losses associated with non-compliance of product quality with the requirements or standards during the product life cycle, and implying liability for damage caused to manufactured or used products.

As a classification of risks in the field of product quality management, we suggest using a matrix (Table 1), in which the types of risks that manifest themselves at different stages of the product life cycle are marked with “+”.

Table 1. Classification of the risks in the field of product quality management.

Types of risks	Stages of product life cycle										
	Marketing	R&D and development	Purchases	Design	Production preparation	Production	Control and assessment of compliance	Warehousing and Logistics	Installation and operation	Post warranty service	Recycling
Anthropogenic risks	+	+	+	+	+	+	+	+	+	+	+
Information and technology risks	+	+	+	+	+	+	+	+	+	+	+
Organizational risks	+	+		+	+	+	+	+	+	+	+
Material risks			+	+	+	+	+	+	+	+	+
Production and technical risks				+	+	+	+	+	+	+	

In the framework of the classification of risks proposed by the authors in the field of product quality management, the following can be attributed to the main factors of their manifestation in industrial enterprises:

- *Anthropogenic risks*: illegal actions of staff; mistakes of designers, technologists, production workers; “human factors”;
- *Informational and technological risks*: irrelevance and unreliability of regulatory and technical, design-technological and production-control documentation; using outdated technologies;
- *Organizational risks*: losing the controllability in the quality management system due to changes in the external environment of the enterprise;
- *Production and technical risks*: depreciation of equipment, tools and accessories, wasteful work and unplanned downtime of equipment;
- *Material risks*: instability of the values of parameters and characteristics of the quality of raw materials and materials, instability and irregularity of raw materials receipts.

According to the authors, the main focus in risk management policies (including product quality risk) should be done on various preventive organizational and technical measures, as well as taking measures to limit the extent of damage in the event of adverse situations.

Measures to reduce the risk of product quality should include the following:

- Compliance with safety requirements when developing product designs;
- Using safe materials and technologies in the production;
- Using effective process control systems;
- Compliance with the rules of operation;
- Special training and retraining of personnel.

The measures to limit the extent of damage include:

- Creating alert systems for staff and the public about emergency situations;
- Equipping with technical means to limit the effects of damaging factors;
- Preparing the means and measures to protect people;
- Organizing operational medical care.

To analyze the risk of the quality of industrial products, it seems necessary to calculate the risk coefficient of product quality, which would justify the need to insure the manufacturer's liability for product quality. The coefficient is calculated by the following formula:

$$K_{r.a.p.q.} = 1 - \frac{S_{f.c.}}{S_{f.c.} - S_{r.a.p.q.}} \quad (1)$$

where $K_{r.a.p.q.}$ is the risk of the analyzed products quality; $S_{f.c.}$ is the sum of the financial capabilities of the enterprise, $S_{l.l.}$ is a limit of liability.

If the risk coefficient of product quality is of a negative value, then the company's own payment abilities are sufficient to cover the possible costs associated with the liability for damages caused by inappropriate quality goods. If it has a positive value, then the company's own financial capabilities are not enough to cover the liability limit. In this case, it is simply impossible to do without concluding a contract for insuring liability of the manufacturer for product quality, since the manufacturer's own financial capabilities would not be enough to cover potential damage.

When managing the risk of product quality in an industrial enterprise, in order to analyze it and establish its permissible limits in connection with safety requirements, management requires the following:

- An availability of information system;
- Obtaining information about the proposed areas of production and technical solutions that may affect the level of safety;
- Developing technical and economic strategies to increase security;
- Determining the optimal cost structure for managing risk;
- Establishing organizational structures and expert systems.

The principle of the development mechanism of the quality reserves when managing product quality risks should be based on the use of the order of the chain of events preceding the origin of quality reserves. Thus, according to a specific history of the origin of quality reserves, it is quite possible to determine their physical characteristics and to organize a search and carry out their prediction. In order to streamline and simplify the process of building the developed mechanism for managing reserves, any fact of non-compliance with product quality should be considered as a cause of the quality reserve. The estimated history of the origin of quality reserves, based on the author's approach to their perception, as a result of the negative impact of interaction processes between subjects and objects on the main production process, and the principle of quality reserves development based on it are shown schematically in Fig. 1.

Please note that the scenario of the processes presented in Figure 1 can be changed if the prerequisite is eliminated in advance, without waiting for its transformation into the cause of the quality reserve, as it is shown in Figure 2.

In this case, the actual reserve of quality does not arise, since the origin of its cause is not allowed. In this case, the quality management system of an enterprise undertakes actions to eliminate one of the negative prerequisites. Therefore, the process of eliminating the prerequisite should also be considered as the process of implementing the quality reserve (not actual but expected). If the premise had not been eliminated, then the reason would have arisen and the need to eliminate it through implementation.

When developing a risk management system for product quality, an important point is to ensure an integrated (systemic) approach. In this study, according to the authors, the most effective way to manage product quality risk is insurance.

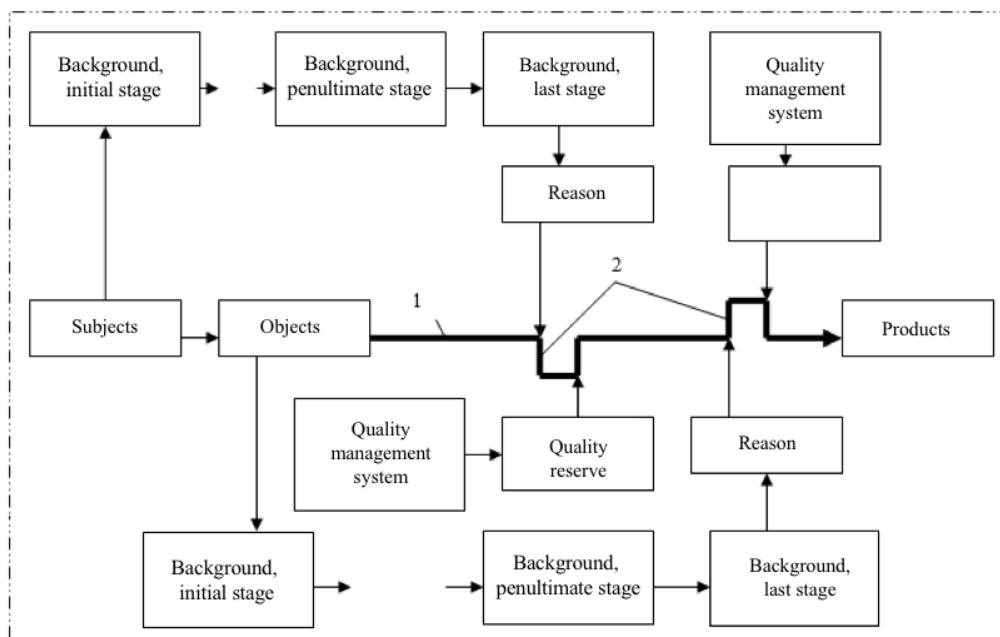


Figure 1. History of the origin and development of actual quality reserves in enterprises [Developed by the authors], where: 1 – the main production process of manufacturing products of the enterprise; 2 – deviations from the normal course of the main production process.

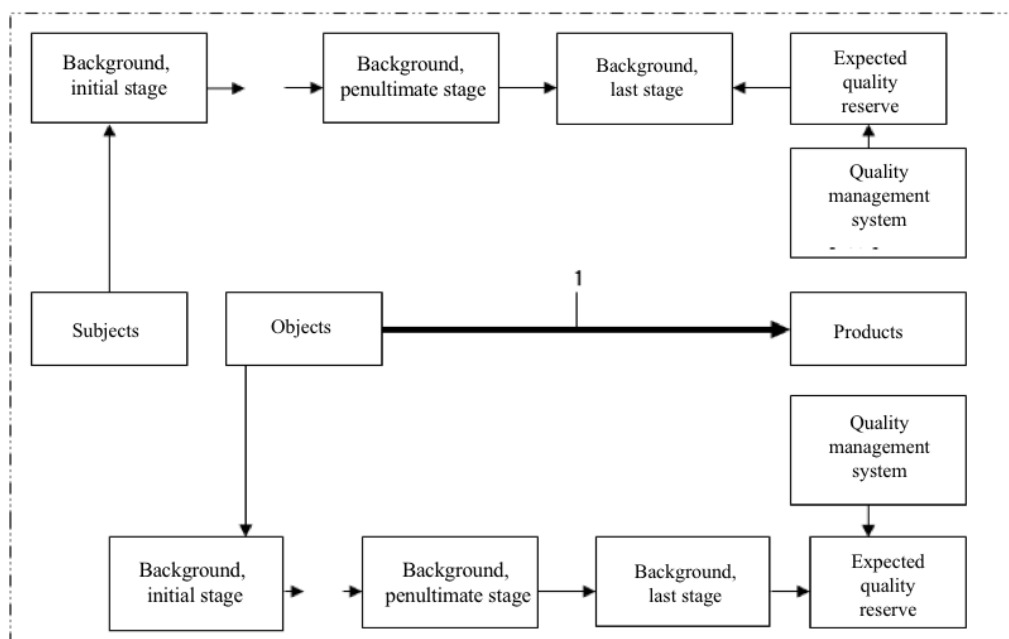


Figure 2. History of the origin and development of the expected quality reserves in enterprises; 1 – the main production process of manufacturing products of the enterprise [Developed by the authors].

The transfer of risk to an insurance company can bring the following benefits to an industrial enterprise:

- Reducing the number of possible negative consequences of quality risks;
- Strengthening the financial stability by controlling risk;
- Reimbursement of damages through cash compensation;
- Improving the authority of the enterprise and its management;

- Getting specialized advice from the insurance company;
- Transferring the loss settlement procedure to the insurer;
- An application of work through an insurance broker;
- Using financial resources of the insurance market, and not their own.

Liability insurance of enterprises refers to selecting special products used in industrial insurance. Insurance of liability of commodity producers to consumers (third parties) for harm caused to their life, health, property as a result of using products (work, services) produced (sold or provided) with disabilities is a developing and promising type of quality risk management in the insurance market of Russia.

4. Discussion

Discussion of the research results showed that the task of forming the mechanism of quality reserve management at an industrial enterprise while managing risks ensures the competitiveness of industry in contemporary conditions. Based on the solution of the problems posed by the authors, the following conclusions can be formulated:

- Using a quality management mechanism allows the use of quality reserves in practice;
- Dedicated attributes of quality reserves allow you to organize a search and implement their forecasting at an industrial enterprise;
- The methodical approach proposed by the authors to the formation of a quality reserve management system makes it possible to consider its widespread use in modern conditions in the real sector of the domestic economy.

5. Conclusion

We can argue that the following benefits exist when using insurance as a product quality risk management mechanism:

- An attraction of insurance capital to compensate for losses of the enterprise caused by inappropriate quality of products manufactured by them;
- Reducing uncertainty in financial planning activities;
- Cash release;
- Reducing risk management costs.

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