

Implementation of IIS "Maturity Level Assessment" with Agile at the agro-industrial enterprises

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Abstract. The article discusses various issues related to the implementation and refinement at the enterprises of agro-industrial complex of the intellectual information system to assess the level of maturity of the organization. Justification of the choice of methodology of development and management of this project is given. The nuances of integration with information systems already available at the enterprises, which provide QMS operation, are considered. Real experience of finalization and implementation of web-oriented software with the help of agile development methodology using the shortest possible sprints is described.

1 Introduction

The main task that faces the quality engineer at the enterprise of agro-industrial complex in the implementation and development of QMS is the implementation of actions that can significantly improve the performance of the enterprise in the long term, which will ensure stable functioning and sustainable successful development.

ISO 9000 series standards regulate the basic provisions necessary for building a productive QMS at an enterprise of any industry. The content component of the standards can serve as a fundamental basis for the development of documentation on the introduction, construction and development of QMS at an enterprise with any characteristics. [1] This universality of standards is their indisputable advantage. Of particular interest from this point of view is GOST R ISO 9004-2019 "Quality management. Quality of an organization. Guidance to achieve sustained success" [2]. This document is positioned as the only one in the covered series, aimed at achieving sustainable success of the organization in a continuously changing environment.

However, most of the arguments of the standard require revision, which will allow the QMS proposed in the configuration under consideration to be implemented at a particular enterprise, i.e. subjected to practical realization.

A promising vector of development is the use of intelligent information systems (IIS), developed on the basis of expanded and supplemented provisions given in the standard.

The problem of realistic determination of the maturity level of the organization according to the self-assessment procedures complying with GOST R ISO 9004-2019 standard is solved

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by an intelligent information system, either embedded in the existing QMS in the organization, or used as a standalone system.

2 Materials and Methods

As any QMS in accordance with GOST R ISO 9001:2015 “Quality Management Systems. Requirements” must be based on the seven principles of quality management, including the process approach, we believe that the key to the successful implementation of the above project, the application of modern, meeting the conditions of a constantly changing environment, project management system. [3]

In the modern world, the innovative stage of development of national and global economic systems requires the implementation of complex, comprehensive intelligent information systems. The main purpose of such systems is to ensure the integration of all company resources for the successful execution of core and additional business processes. The realization of such intelligent information systems involves a number of difficulties associated with their multifunctionality, the need to adapt to changes in the environment and the involvement of many versatile specialists. Various design methodologies turn product development into a streamlined process that improves the efficiency and effectiveness of the company's employees. As a result, the project realization process is divided into understandable and efficient business processes.

The company's management can choose from a wide range of design methodologies: Rational Unified Process (RUP), Microsoft Solutions Framework (MSF), Agile, Scrum, eXtreme Programming (XP), "Waterfall Model", "Incremental Model", "Spiral Model". [4]

The correct choice of methodology taking into account the specifics of local business processes at the enterprise of agro-industrial complex determines the success of the whole event. [5] After analyzing the scientific literature on the practical application of various design methodologies, we conclude that the cascade models (Waterfall), which have become classical, are not fully suitable for the implementation of such IIS. The main claims are the difficulty of making adjustments “on the fly”, after the start of the project, too high rigidity of the algorithm. [6]

Agility of the implementation process is not a wish, but a requirement, a basis for success. Modern agricultural enterprises carry out their activities in the conditions of constantly changing internal and external factors, so the flexibility of the applied methodology of development favorably affects the result. Applying agile development methodologies after trying to follow classical approaches has yielded quick results. Moreover, the IIS software product "Organization Maturity Level Assessment" has already successfully passed the stages of design and development, as well as tested at specific enterprises. As a result of approbation, the product has demonstrated its high efficiency and positive impact on enterprise performance. The purpose of further research is to enhance the capabilities of the IIS and improve the efficiency of the implementation process.

3 Results

The research process led us to use a popular adaptive project model - Agile Model. The main arguments supporting our choice are presented in Table 1, which shows the compliance of Agile Model features with the principles of quality management, according to the provisions of GOST R ISO 9001:2015 and recommendations of GOST R ISO 9004-2019:

Table 1. Comparative analysis of the specifics of Agile Model design methodologies and quality management fundamentals.

Criteria	Feature of the Agile Model	Quality management principles and recommendations in accordance with the provisions of GOST R ISO 9001:2015 and GOST R ISO 9004-2019
Flexibility of the management decision	Application of Agile Model allows to develop an infrastructure capable of quickly adapting to new project conditions. In accordance with the Agile Model concept, quality and flexibility are synonymous. Building an agile infrastructure is possible only with full consolidation of all business processes of the enterprise. This allows changes and additions to be made at any stage of project implementation, which significantly mitigates the risks of losses in conditions of instability and crisis situation.	Process approach. Continuous improvement. Ability to adapt to change. The ability to establish a process for implementation in order to maintain the enterprise's ability to quickly develop activities aimed at adapting to changes in the organization's environment.
Relationship with partners	Organization of well-coordinated work and interaction with business partners	Strive to establish relationships that enhance own capabilities and those of suppliers and partners to create value for the mutual benefit of all parties.
Personnel management. Teamwork.	The key to successful project implementation is the organization of well-coordinated team work, building a clear structure of interrelationships between employees, based on direct communication. Management and constant search for intellectual abilities of talents. Involvement of motivated specialists of the company in the project.	Human interaction. Relationship management. Leadership. Incentivizing teamwork. Organization of internal environment containing employees involved and committed to achieving the goals of the organization. Establishing and maintaining teamwork. Implementing an appropriate system of formal recognition, based on an assessment of employee achievement, to encourage achievement of results.

Based on the principles of Agile Model design methodology, let's model the work on implementation of intelligent information system "Organization Maturity Level Assessment" at the agricultural enterprise.

In our case, implementation of IIS at the customer's enterprises in an unchanged form is not always correct. All organizations are unique, the structure of business processes in each case has a specific structure. According to our previous studies, a sufficiently accurate self-assessment is possible on the basis of 6 main groups of criteria or 9 key elements (in case of express analysis) according to GOST R ISO 9004-2019 standard. At the same time, when

implementing these approaches in organizations, there is an urgent need to supplement the list of evaluated criteria reflecting the peculiarities of a particular organization or industry. We propose to consider the very process of our software implementation as a project with its identifiable processes, the description of which is the essence of our study. [7] It has been established that classical software development methodologies are inapplicable in our case, as they do not provide a proper level of flexibility and speed of development. We propose to approach the database and software logic revision in an iterative manner, ensuring an extremely short interval between releases.

At the initial stage of software implementation for self-assessment of the organization maturity level, the team formed by the integrator, first of all, fixes together with the management of the client organization the conditions of satisfaction and the period of sprints comfortable for the customer's team, at the end of which the release will be tested. [8] Since the Customer, according to our experience, is interested in receiving an effective quality management tool as soon as possible, a sprint of 1 week in length, taking into account the possibility to correct parts of the business logic of the web-application from the web-interface without involving programmers and without updating the server software (backend edits) - seems quite adequate. [9] After 2 successful implementations the basic proposal to the customer company is to conduct 3-4 joint Daily Scrum and one Sprint Review within a week. The MVP is derived from the results of the first Sprint, and the two or three subsequent ones are designed to adjust the criteria, implement logic for Customer-specific departments, and adjust the scale of the output variable. [10] It is important that the first attempts to integrate with the Customer's existing IT systems take place in the second and subsequent sprints, and the Customer receives the MVP in the form of a web-application available on a public web resource. Customer's specialists are given access details to an individual instance created for a specific organization. Downloading of the final data into the document management systems, ERP, CRM systems, etc. available at the enterprises is one of the main requirements of the Customers. - is one of the main requirements of the Customers, but without initial identification of the organization's peculiarities it is inexpedient to implement it even in test mode, as the data on self-assessment in unified scales will be insufficiently representative (except for the values of the criteria common for all types of enterprises, for which an objective result can be obtained immediately due to their universality). [11] The main task of the Integrator is to identify the most specific business processes of the Customer during the first two sprints. [12] If a specialist specializing in server-side logic development (backend) is involved, then after the second sprint, and only if specific business processes cannot be taken into account with the help of already available functionality in the client part of the web-interface of the application. Its main work will be to ensure compliance with the format of manual or automatic uploading of self-assessment results to the IT systems already working in the organizations. We, as an Integrator, offer Customers two options of work - SAAS or installation of "box" solution on the servers of the enterprise, the first option, of course, is preferable, and because of the complexity of updating the knowledge bases and algorithms used, and because of the difficulty of further support. The commercial component is also extremely important.

The main KPI for the second and subsequent sprints should be the degree of involvement of all departments and divisions of the Customer involved in the self-assessment. According to the results of the first sprint during the MVP use, the statistics of involvement for each of the groups defined by the Customer in advance (in accordance with the standard) starts to be formed. The criteria for successful completion of development and implementation will be 100% involvement of the Customer's subdivisions and complete absence of questions and objections concerning both the content of questionnaires (these objections come from subdivision employees) and the final conclusion with the result of self-assessment with recommendations (come from top management).

We propose to limit the number of sprints to 5, we consider this option quite realizable in practice.

Application of Agile allows to quickly estimate the planned financial and time costs of rework/implementation both for the Integrator and the Customer. [13]

Guided by the principles of continuous improvement, continuous evolution, we recommend the web version as a backbone direction, as the delivery of new logic and algorithms to the Customer in this case is the fastest and most convenient.

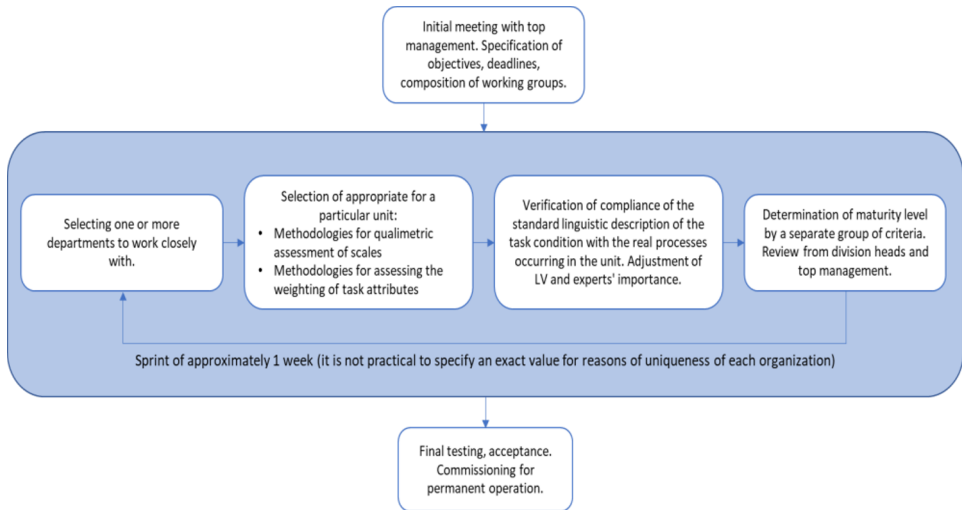


Fig. 1. Process of finalization/implementation/integration of the organization maturity level assessment system according to the agile methodology

Fig.1 shows the process of finalization/implementation/integration of the organization maturity level assessment system according to the agile methodology. According to this process, at the initial stage the organizational structure is built in accordance with the vision of the management and the QMS objectives. Within the framework of this stage the peculiarities of the enterprise's business strategy directly related to the specifics of operation are identified, goals are set, project realization (implementation) terms are determined, the subject area is identified, the possible volume of involved human and material resources is estimated.

In accordance with the Agile Model policy: the formed Agile-team of specialists is the greatest value of the whole system, incomparable in its importance even with documentation packages. The customized work of a group of employees who are able to quickly make changes in the course of the project and interact coherently, has an exceptional superiority over any other, even with large amounts of resources at its disposal. The main requirement for the specialists of the Agile-team is instant response to changes, readiness to generate new ideas and ways to achieve goals, as well as the elimination of functionalities that have lost their relevance due to changes in the environment of the organization. The result of the work of such a team will always be a quality product.

The number of sprints to be realized in the process of project implementation depends on the size of the enterprise and the peculiarities of its operation. The first review, upon completion of the first cycle (sprint), is expected within a week after the start of active work at the customer's enterprise. The timing is floating and has a direct correlation with the size of the unit and its importance. Thus, for example, for a large livestock enterprise the duration of the sprint when working with the supply department is significantly higher in comparison with a similar subdivision of a small farming association. In the case of work in an

organization belonging to a small business, it is possible to conduct parallel sprints simultaneously in two or more divisions. When choosing any scheme of work, a mandatory condition is the delivery of a workable product at the end of each iteration (MVP). For the IIS under consideration in this article, the MVP at the end of the iteration will be the maturity level of the organization (for a division or the organization as a whole).

4 Discussion

In the developed IIS the self-assessment of the enterprise maturity level, on the basis of which the organization maturity level is established, is carried out according to 6 main groups of criteria: Organization Environment, Leadership, Process Management, Resource Management, Organization Performance Analysis, Improvement, Lessons Learned and Innovation. In total, there are 31 evaluation criteria in the method [14]. It is important to note that there may be situations in the process of integrating the IIS "Organization Maturity Level Assessment" at the enterprise, when the client is completely satisfied with the standard composition of evaluation criteria and their weights, qualimetric scales (corresponding to them) proposed by the integrator, so the duration of the sprint can dramatically decrease even at the first scrum meeting. In the opposite case, the EIS needs to be finalized. It should be noted that despite the fact that the coefficients of the methodology are universal and they reflect almost all aspects of any enterprise, to improve the performance of the IIS, the need to expand the groups of criteria we consider appropriate when conducting self-assessment at a particular enterprise.

Almost all groups of criteria should be substantially revised if the company is, for example, a foreign trade company. The groups of criteria should be expanded with coefficients reflecting the peculiarities of commercial activity abroad, which has a systemic impact on the functioning of the entire company: the peculiarities of sales, procurement, financing, R&D, etc. The task can be realized by two methods: expanding the existing groups of criteria or expanding the existing ones. This task can be realized by two methods: expansion of already existing groups of criteria or addition of new groups. For example, for a foreign trade company, an independent group of criteria "Foreign trade activity" is added to the IIS, the criteria of which can reflect all the above-mentioned peculiarities of activity and even evaluate the company's work on the speed of adaptation to changes occurring in the international market, including marketing models, study of national peculiarities of legislation and culture of the countries for which products (services) are manufactured. This improvement requires the expansion of the scheme of business processes that take into account the import and export activities of the organization. With the expansion of the number of input data, the score scale will also be subject to change.

Changes in the structure and composition of the groups of evaluation criteria provide for adjustments in the calculation of the assessment of the significance of input attributes (criteria, groups of criteria). It is likely that for an agricultural company with off-trade activities the groups will have a high weighting: Organization environment, Resource management and the newly formed group Foreign trade activity. The program's capabilities allow us to change the indicators for assessing the importance of experts individually for each customer. These activities may be necessary if the number or composition of the expert group changes.

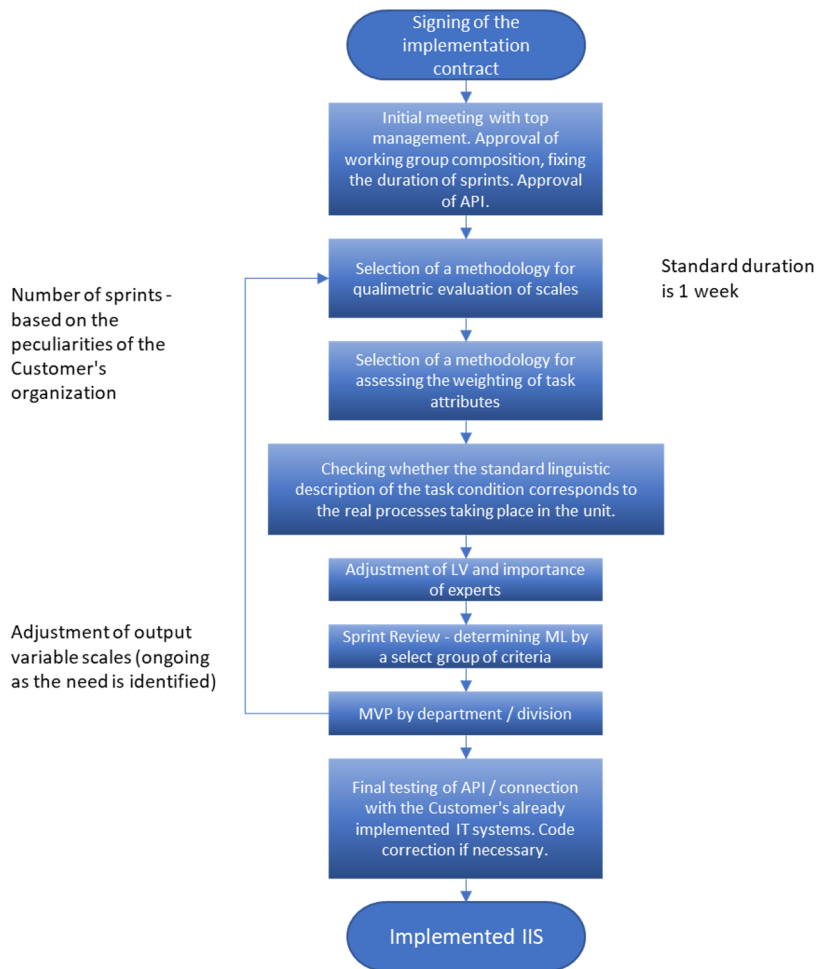


Fig. 2. Algorithm of implementation of intelligent information system "Organization Maturity Level Assessment"

Fig. 2 shows the tested algorithm of IIS implementation at agro-industrial enterprises with developed QMS using Agile methodology.

5 Conclusions

The undeniable advantage of the Agile Model toolkit is the possibility of returning to any stage of the sprint in the process of IIS implementation.

The final stage of application of the IIS "Organization Maturity Level Assessment" is to obtain a specific value of the organization's maturity level measured on a five-point system and the corresponding recommendations. On the basis of which, in the future, reasonable management decisions should be made to improve the ability to achieve sustainable success or maintain the existing level.

The result of the IIS application will be continuous improvement of the quality of manufactured products (rendered services) of the enterprise on the basis of the constantly improving QMS.

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