

# **Software Quality Assurance (SQA) Improvement plan for *Medicruit* company**

## **Created by:**

Merjem Sikiric

Muhamed Imamovic

Sara Filekovic

## **Course:**

SE407 Software Quality Management

## **Semester/Academic Year:**

Spring 2022/2023

## **PART 1**

### **1. Situation description**

Business of the company *Medicruit* is focused on providing a solution for the staffing crisis currently experienced in many healthcare systems, especially pronounced after the COVID-19 pandemic. The company's mission is to remove every obstacle between healthcare providers and patients that need care, as well as facilities in search for motivated and equipped clinicians. The focus is to digitize healthcare hiring processes and help clinicians discover job opportunities.

The company is consistently building on a software platform that allows healthcare workers, such as travel nurses, to apply for job positions themselves, as opposed to having a recruiter do it for them or through other, more complex and time-consuming procedures. The platform has also contributed to solving the problem of staffing shortages in healthcare facilities.

The work environment is an open, all-inclusive, and diverse environment with a culture built upon hiring individuals dedicated to providing care for others, especially during stressful times such as the pandemic that the world recently experienced. The company is structured in a hierarchical way, currently counting between 200 and 500 employees, organized through various departments (Client services, Software engineering, Marketing, Sales, etc.). Its main competition is coming from the likes of Trusted Health and other traditional recruiter-based staffing companies.

The current quality approach of the company is based on the belief that an organization can build long-term success by having all its members from low-level workers to its highest-ranking executives focus on improving quality, and thus delivering customer satisfaction. Also, they set specific metrics and standards across the organization called KPIs, or key performance indicators, which is a quantifiable measure of performance over time for a specific objective set by the organization. This can be related to the product itself or any process that is an integral part of production. The company currently uses process and output KPIs.

The attitude of engineers in the company is to develop high quality work and output with minimum waste based on customer requests, wants, needs, and demands. Engineering teams, as well as all other departments, are extremely aware of their responsibilities towards ensuring that the quality objectives are reached. Considering that this an organization that bases itself on the principals of total quality management (TQM), the attitude of the management is the same as that of the engineers and the rest of the team. Business goals of the company are currently en par for the most part based on the KPIs.

Processes within the company are followed in accordance with PDCA Cycle, or Deming Cycle. However, as with any large or international organization, the problems being experienced are primarily in that of minimizing waste or unnecessary workflows and processes. Major concerns for achieving a solution for this exist as a consequence of staff shortages during the COVID-19 pandemic, overprocessing, and sudden shifts in healthcare systems.

The company is considering switching to a lean six sigma methodology approach across the organization to account for the aspect of minimizing waste or unnecessary workflows and processes, which cannot be so easily done using total quality management (at least from an analytical or statistical viewpoint).

The entire team is welcoming of the change in quality approaches and methodologies; however, they are also aware that this will take a great amount of time, effort, and work to bring it to fruition and achieve desired results. It will include everyone in the organization having to train under the lean six sigma methodology for a few months.

## **2. Quality systems improvement objectives**

In this section, we consider the targeted quality objectives and the requirements for our SQA plan. As already mentioned in the previous section, the company's main quality target is minimization of waste, as well as unnecessary workflows and processes. The quality objectives listed below will mostly revolve around this main objective. By taking into consideration the scope of our plan, we must also address the timeline requirements.

The following quality objectives were identified:

- To gradually incorporate the changes needed for the company's teams to switch over and adapt to a new quality improvement methodology. Specifically, the objective is to switch from total quality management to a lean six sigma approach in product development and quality improvement. This is an ongoing process, so the estimation is that the company will take anywhere between 12 and 18 months to completely transform their quality processes.
- To provide training for the employees on the lean six sigma methodology, to at least the level of a white or yellow belt certification. This will enable employees to showcase their skills in business improvement and leadership, as well as allow the company to conduct their new quality improvement approach by following the standards. The training will approximately last for 3-6 months.
- To minimize waste and unnecessary workflows and processes by following the lean principles. Since the lean principles of the new methodology are expected to achieve this objective, it is important to be consistent with following the new business flow. This can be performed by strongly focusing on the activities that bring value to the customer for whom the product is built, improving, shortening and possibly automating the defect removal process, and reducing the number of delays in the project by assuring that production and deployment cycles are short, efficient and also monitored.

### **3. Current practices**

In the following subsections, current practices and the current quality approach in Medicruit are discussed. The areas covered include defect removal and reliability, product quality and customer satisfaction, and project management and in-process metrics.

#### **3.1. Defect removal and reliability**

For conducting and improving the defect removal and reliability processes, as well as almost all other processes within the company, reviews and small-scale studies are used as current practices. Specifically, the company is conducting the processes in accordance with PDCA cycle, or Deming cycle. It consists of the following steps:

- Plan: Recognize an opportunity and plan a change.
- Do: Test the change. Carry out a small-scale study.

- Check: Review the test, analyze the results, and identify what you've learned.
- Act: Take action based on what you've learned in the study step. If the change did not work, go through the cycle again with a different plan. If you were successful, incorporate what you've learned from the test into wider changes. Use what you've learned to plan new improvements, beginning the cycle again.

Sudden shifts and drastic, unpredictable changes that occur in the healthcare industry on a regular basis continue to affect the company, especially after the COVID-19 pandemic. By following the PDCA cycle, company is not simply managing those changes that bring about waste and overprocessing, but also their defect removal processes. This ensures that reliability of the company's products is increased and provides an analytical way to identify any limitations or areas for improvement in the defect removal process.

Additionally, for bug tracking and management in the company's software artifacts, the company is using project management tools, such as Jira and especially GitHub. Since Jira is extensible, the company often uses third-party tools for test execution, and the results of manual and automated tests are collected and tracked through Jira's Scrum boards. GitHub, on the other hand, has Issues as a simple bug tracking and reporting system, which developers in the company use in their daily work.

### **3.2. Product quality and customer satisfaction**

To fulfill their mission, the company strives to maintain direct involvement of their customers in the product development process. Since the mission is to remove obstacles between health care providers, and their patients and facilities that they are interested working in, it is essential to obtain regular customer feedback on the product. In this way, quality of the product is increased and developers gain confidence rather than lose it as the development cycle is completing.

Through regular meetings with the customers, which are mostly health care facilities searching for a platform that will enable their hiring managers to easily recruit motivated clinicians, product becomes more refined and sophisticated in a short amount of time. However, reaching high levels of quality and customer satisfaction require involvement and dedication from each employee of the company. Currently, company is utilizing total quality

management for this purpose. The challenge with this approach is the constant introduction of waste and overprocessing, which the company seeks to eliminate with a lean six sigma approach.

As mentioned in the introductory section, the company sets specific metrics across the organization called KPIs, or key performance indicators. This is a quantifiable measure of performance over time for a specific objective. In this case, it is focused on measuring quality levels, of both the product being developed and the processes involved. With regards to standards, the company is a member of the National Quality Forum (NQF), a non-profit organization which collects data and validates health care standards.

### **3.3. Project management and in-process metrics**

As already mentioned, the company uses reviews, small-scale studies and KPIs as metrics for project and process management, as well as in evaluating the quality of their software artifacts. On the other hand, specifically for process improvement, the company uses small-scale studies and complements them with workflow analysis software. Small-scale studies help the company in exploring possible opportunities, improvements and challenges by testing desired changes, whether within the software artifact or the software process itself. By complementing this with workflow analysis, results collected from the KPIs tell the company whether a specific process or workflow is performing efficiently, according to standards and how it evolves over time.

Data collection through the use of KPIs is performed at least monthly, assuring that process improvement is performed consistently and that the company is avoiding delays in progress. This will be especially relevant and monitored during the period of adapting to the new business methodology. The collected data is usually visualized for easy interpretation and the company reaches conclusions by always focusing on the target objective.

For reliability testing of its processes and workflows, the company is currently placing focus on small-scale studies, as mentioned previously. By introducing gradual changes in the workflow and daily practices, the company is tracking the performance of employees over a specific period of time, as well as how long it takes for them to adapt to the new ways of working during this period. The company analyzes the results after introducing workflow changes, and adapts the change plan in case the performance does not achieve the estimated

targets. Having a smooth transition process to the new methodology is essential for maintaining productivity and retaining valued employees.

In order to attain balance between the project scope, schedule, budget and product quality, the company strives to follow the standards they have devoted their attention to, as well as continue to follow the most valuable and efficient practices in their day-to-day work. The company maintains high regard for respecting deadlines in artifact delivery, hence their plans for introducing a new methodology which will decrease waste and workflow excess that they are currently experiencing, along with the high costs of overwork. This should help them reach deadlines in an easier manner, while also decreasing costs and increasing awareness of producing quality products.

Besides the relevant health care standards endorsed by the NQF, the company is following ISO 21500, Guidance on Project Management, which is an international standard. It provides them with a general approach and practices in project management, which they enhance with specific methods and daily practices of the company's business.

## **PART 2**

### **4. Defect removal and reliability**

In the following subsections, requirements listed in section 2 of Part 1 are addressed, in relation to defect removal and reliability. Section 4.1 introduces potential improvements and changes to be made in defect removal and reliability procedures. Section 4.2 discusses the metrics to be adopted in the company's quality improvement process related to defect removal and reliability, as well as the usage plan for the metrics. Finally, in section 4.3, the rationale behind the improvement proposals is explained.

#### **4.1. Suggested processes and practices**

In this section, we list the proposed changes within the current processes and practices in the domains of defect removal and reliability. To improve the quality and reliability of software deliverables, testing and defect removal processes, it is essential to incorporate the following methods into the existing workflow:

1. Automation of defect removal processes, and
2. Employment of practices that transform the current quality improvement approach into the lean six sigma methodology.

As a technical suggestion to support the proposed automation, some of the automated testing frameworks that may be extensively used in process improvements and future projects are Selenium and Cypress.

The company will, by following the above methods, ensure both a reduction in the number of software defects and software reliability.

#### **4.2. Suggested metrics and usage plan**

As metrics, defect removal efficiency (DRE) and test coverage can be used to improve the quality and reliability of the company's software products. They align with the main objectives of the company and can contribute to a reduction in waste and overprocessing.

DRE measures the development team's effectiveness in removing defects before the software product is released. It is calculated as the following ratio:

$$DRE = \text{total number of defects discovered} / \text{total number of defects introduced}$$



DRE will be calculated prior to the release of the product and can be performed during or after each software testing phase. In this way, teams will have the ability to track the evolution of the resulting value as the testing effort is added.

Test coverage demonstrates the percentage of application code covered by the executed tests. It can be calculated by using the following formula:

*Test coverage = (number of lines of code covered by software tests / total number of lines of code in the software) x 100*

Unlike DRE, test coverage can be calculated after running a test suite on the entire program.

### **4.3. Rationale**

Automating the defect removal process should shorten the delays often created in the development and testing phases but could also improve the quality of software artifacts themselves. We suggest that manual testing remains part of the process, but with a stronger focus placed on automated testing to reduce the risks introduced by human error.

Although having automated tests in the center of software development is a more efficient solution than the time-consuming manual testing, maintaining automated tests introduces a certain investment. The maintenance may include both the tests included and the environment in which they are executed, which may increase the total cost of software testing for Medicruit's digital platform from 25% to 30% [1]. Despite the increase in cost, it is a worthwhile investment since the main objective of the company (a decrease in workflow practices and waste) will be reached.

Using the lean six sigma methodology can help with quality improvement by increasing the performance of company's teams and decreasing the potential for introducing defects in software products. By making a transfer from total quality management to the lean six sigma approach, the company will be able to maintain a balance between having robust performance of business practices and reducing the number of defects in their products. As required by the company, waste and overprocessing are expected to be reduced by at least 30%.

## **5. Product quality and customer satisfaction**

Aspects of software product quality are discussed in the following subsections. Section 5.1 introduces potential improvements in the current practices aimed at achieving product quality

and customer satisfaction. Section 5.2 discusses the metrics to be adopted in the company's quality improvement process related to different aspects of product quality, as well as the usage plan for the metrics. Finally, in section 5.3, the rationale behind the decisions for change is explained.

### **5.1. Suggested processes and practices**

In this section, we list the proposed changes within the current processes and practices in the domains of product quality and customer satisfaction. The following potential improvements were identified:

1. Usability: to improve the product design, user experience and customer satisfaction
2. Maintainability: to continuously improve the product quality, with a focus on reducing the costs of waste and overwork.

### **5.2. Suggested metrics and usage plan**

For the usability metrics, Medicruit can use a System Usability Scale (SUS). After conducting a session for testing product usability with the participants, the scale can be used to measure the SUS score and compare it with the scores of other successful products that are in the healthcare niche.

For the maintainability metrics, the company can consistently track the status of the project and monitor the performance to estimate the future efforts to be made in the maintenance processes. Also, the Maintainability Index can be used as a combination of several metrics and can tell us about the effort required for maintaining a specific program.

### **5.3. Rationale**

It is important to mention KPIs, since they are related to product quality and the company already sets these metrics across their organization. KPIs have served their purpose for a long time when it comes to measuring performance, so keeping them as an important part of the company's quality approach is essential. These metrics have contributed significantly to the product and process quality and ensured continuous performance for the company's teams. Therefore, the topic of performance was not addressed in this section, although it demonstrated excellent results for product quality.

On the other hand, the decision to improve the usability of the company's product is not tied to any specific problem identified by customers. Rather, it is a suggestion that may drive more users to the digital hiring platform offered by the company and provide them with a great user experience. Many of the platform users may not be extremely proficient in using technology, either for hiring or applying for jobs, so providing a smooth process with a simple user interface is essential for market success and customer satisfaction.

To ensure the high quality of their software products, Medicruit needs to change their approach towards the maintainability of the software. The current approach involves the principles of total quality management, which is constantly introducing waste and high costs of overwork. This impact is especially evident and concerning in the domain of maintenance, due to maintenance staff shortages, short deadlines, and budget limitations. By transforming their approach to the lean six sigma methodology, the company's performance is expected to increase while decreasing the problems that come with overprocessing, as mentioned above.

## **6. Project management and in-process metrics**

In this section, we outline the proposed changes within the current processes and practices from the perspectives of process quality and project management. Subsection 6.1 introduces potential improvements in the current project management processes and practices. Section 6.2 discusses the metrics to be adopted in the company's quality improvement process related to project management, as well as the usage plan for the metrics. Finally, in section 6.3, the rationale behind the decisions for change is explained.

### **6.1. Suggested processes and practices**

In this subsection, proposed changes in the domain of project and process management are introduced, with the expectation of improving the quality and management approach of the company. The following improvements were identified:

1. Standardization and documentation: the company should standardize and document the business procedures to ensure consistency in workflow, which will enable them to reach higher levels of quality as well, and
2. Process monitoring: the company should establish standardized metrics and performance indicators to monitor the effectiveness and efficiency of business processes, as well as evaluate project performance.

## **6.2. Suggested metrics and usage plan**

The suggested metric for the purpose of improving project management and internal processes is simply a compliance assessment or audit, which can be performed monthly or in accordance with legal requirements.

This will not only allow the company to follow adherence to policies, procedures and guidelines, but also identify the risks that may occur with following certain practices or implementing decisions.

Continuous monitoring and reporting on the defined metric and its success can be included in the metric's usage plan. Important stakeholders, such as the management or even clients, need to be presented with the findings and results of compliance assessment, in order to improve the decision-making process.

## **6.3. Rationale**

Standardization, documentation, and continuous process monitoring help the company in ensuring that software and process defects are detected and resolved as quickly as possible. This, in turn, allows for a significant reduction in the costs of fixing problems in code or eliminating risks.

## **7. Implementation and analysis**

Implementation and analysis of the proposed quality improvements are covered in the following subsections. Planned schedule and timeline for the implementation are presented, along with the ways in which customer feedback is to be collected, how the responsibilities and assignments are distributed across teams, and other details related to the implementation.

### **7.1. Schedule**

- Example: We will introduce the new quality practices at Medicruit over a three-month period. Each month, we will focus on specific areas such as software development, testing, and customer support. This phased approach allows us to assess the impact of each set of practices before moving on to the next phase.

The timeframe:

#### Month 1: Preparation and Planning

- Conduct an in-depth analysis of the current quality management processes and identify areas for improvement.
- Define the specific quality practices to be implemented, considering the challenges and goals of Medicruit.
- Develop a detailed implementation plan, including resource allocation, training requirements, and milestones.

#### Month 2: Initial Implementation Phase

- Begin implementing the selected quality practices in a phased approach, focusing on one or two key areas.
- Conduct training sessions for the relevant teams to ensure a clear understanding of the new practices.
- Monitor and assess the initial impact of the implemented practices, collecting feedback from users and internal stakeholders.

#### Month 3: Full Implementation and Evaluation

- Complete the implementation of the remaining quality practices across all relevant teams and processes.
- Continue to gather feedback and monitor the effectiveness of the implemented practices.
- Evaluate the overall impact of the new practices against the original objectives set in Part 1 of the project.
- Conduct a thorough assessment of the quality improvements achieved and any remaining challenges or areas for further enhancement.

### **7.2. Feedback**

- Example: We will obtain feedback through a combination of informal feedback and structured surveys. We will conduct weekly team meetings to gather informal feedback on the adoption of the practices. Additionally, we will distribute a survey at the end of each implementation phase to collect feedback on the perceived value and effectiveness of the practices. We will also conduct external feedback surveys with our customers to ensure their satisfaction with the changes and new implementations to the products.

### **7.3. Responsibilities and assignments**

- Example: The Quality Assurance team will be responsible for creating the necessary artifacts, such as templates and tools, to support the implementation of the new practices. The team lead will oversee the artifact creation process and ensure their availability to the relevant stakeholders. In addition, every individual in the company across all levels will be responsible for performing their roles in accordance with their Six Sigma belt level.

### **7.4. Training**

- Example: We will conduct a series of in-person training sessions for all team members involved in the implementation process. The training will cover the rationale behind the new practices, provide step-by-step instructions on how to apply them, and offer hands-on exercises to reinforce learning. Training materials and resources will be made available online for reference. Training will also be conducted on a belt-to-belt basis to ensure that all stakeholders are properly equipped with the knowledge and experience to succeed in their designated roles.

### **7.5. Coverage**

- Example: Our suggested practices address all the original problems identified in Part 1 of the report. For example, we propose implementing a comprehensive automated testing framework to improve software reliability and reduce regression issues. Additionally, we recommend enhancing customer support processes to ensure prompt and effective resolution of user inquiries and concerns.

### **7.6. Effort Required**

- Example: Implementing the new practices at Medicruit is estimated to require an additional 15% effort from the software development and quality assurance teams. This includes time allocated for training, process adjustments, and adopting new tools. The effort required is considered manageable and aligns with our commitment to delivering high-quality services.

## **7.7. Value**

- Example: Based on our quantification analysis, the value added by implementing the practices is significant. We anticipate a 20% reduction in software defects, a 15% improvement in overall product stability, and a 10% increase in customer satisfaction. Workflow, overprocessing and waste are expected to be reduced as well, with the implementation of a new methodology. Considering the effort required, the anticipated benefits far outweigh the investment, making it a worthwhile endeavor. They may not be beneficial in the short term, but they will be in the long term.

## **8. Summary**

The schedule for the implementation of new quality improvement practices at Medicruit involves preparation and planning in the first month, followed by an initial implementation phase in the second month. The third month will involve full implementation and evaluation. Feedback will be gathered through team meetings, surveys, and customer feedback. The QA team will be responsible for creating necessary artifacts, and individuals across the company will perform their roles based on their lean six sigma belt level. Training will be conducted to ensure understanding and proficiency in the new practices. The suggested practices address identified problems, such as implementing an automated testing framework and enhancing customer support processes. The effort required for implementation is estimated at 15%, but the anticipated value, including reduced defects, waste and overprocessing, as well as improved product quality, makes it a worthwhile endeavor.

## **References**

[1] “Why test automation is more expensive than you think,” Rainforest QA, <https://www.rainforestqa.com/blog/2018-09-25-why-test-automation-is-more-expensive> (accessed May 21, 2023).