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**RESEARCH ESSAY**

Tasks for Course: ISSE01\_E – Seminar: Software Engineering

Task 2: Clean Code and Refactoring

How can an organization ensure that Clean Coding is applied in practice / organization?

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Nowadays, the IT market faces continuously growing requirements and innovations, which cause the growth of organizations, the widening of software teams, and respectively the increase of the software size and complexity. According to the current trend and modern needs, it’s crucial for an organization to create scalable, high-quality, and easily maintainable software solutions.

In the real world, where the software size is steadily growing, new technologies are appearing, but the deadlines remain at the same place, the willingness to sacrifice code quality in order to achieve some stated goals in schedule or to implement some new features can exist. But such an approach, which can probably help to finish some part of the software within the schedule can significantly affect further development. It leads to many issues that appear in subsequent development stages, such as code redundancy, poor code reusability, decreased readability, increased bugs, and many others.

Another is cooperation within a team. Modern development teams normally consist of many different experts responsible for a certain domain of software development. That fact makes it vital for an organization to organize the coding process in a way, that each participant can clearly understand the code and feels comfortable working with it. Otherwise, it can lead to slower development and a negative impact on team morale, since it’s not really comfortable to work with the messy code.

But how can an organization address these development issues? To create understandable, high-quality code, that can be easily extended and maintained in the future, an organization must establish consistent clean coding and refactoring practices. Mens and Tourwé's survey of software refactoring emphasizes the importance of the systematical usage of these practices to enable the appropriate software development process. The implementation of consistent clear coding practices is sometimes very challenging for an organization due to many reasons. Different expertise levels of developers, software complexity, and deadlines complicate the consistent usage of these practices.

This essay is aimed to research different methods how can an organisation ensure the consistent application of clean coding and refactoring within a project, which automated tools and metrics can be used for this purpose, and how to estimate the impact of applied clean coding and refactoring practices.

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To answer the research question, let’s dive deeper into the concept of clear coding and refactoring and understand its main principles, purpose, and properties.

Martin Flowler’s book “Refactoring: Improving the Design of Existing Code” is a fine source to gain a better understanding of how clean coding and refactoring work. Flower defines clean coding as the practice of systematical code modifications, that are aimed to make it more understandable for other people, to improve its extendability and maintainability in the future, without changing its behavior and functionality. He emphasizes, that the systematical refactoring and improvements in the code are equally important with its functional behavior.

In general, clean coding is the approach, that represents a set of rules, practices, positive code patterns, and code antipatterns, naming rules, which serve to enhance the code quality and enable effective software development. The one important aspect, that must be pointed out, is that clean coding is not just a design pattern, which is established at the beginning of the project, but rather the iterative process, where the appropriate code quality is achieved through small incremental changes, that happen during the entire project.

Since the organization can have peculiarities related to the development process, these rules can be considered as a basis for acceptable code quality. However, this set of rules and code patterns is not strictly defined and can be specifically adapted for current needs and requirements defined for a certain project.

Martin Flowler provides in his book a comprehensive set of best practices for clean coding, which serves as a basis for successful code improvements, but he also underscores that the application of these code patterns may vary depending on the project concept, boundaries, objectives of the development team, available technologies and the entire software development landscape. Moreover, in the modern industry, the development team and project requirements can easily be changed during the project, which requires clean coding practices to be flexible.

The flexibility of the clean coding enables effective decision-making within the project team and helps the organisation to prioritize, and modify the rules, to make them the most suitable for the current project situation.

After the terms, clean coding and refactoring are clearly defined, and all their properties and abilities are recognized, let’s understand in more detail, which benefits can an organization obtain by supporting the consistent application of clean coding and refactoring.

2

The primary advantage associated with the efficient application of clean coding is the increased maintainability and scalability of the software. By adhering to the stated rules, practices of clean coding, and implementing constant code refactoring, the organization can reach the appropriate code quality, which enables the efficient maintenance and extension of created software in the future.

Furthermore, well-established code refactoring can help an organization by means of business. The high quality of code can sufficiently decrease the cost for implementing some changes, which appear during the project and for adding some new functionalities or features since the work with the bad-structured and messy code can bring many unexpected costs, and delay the development.

Another impact is that the application of clean coding ensures less quantity of bugs and issues in the source code. Khomh and Gueheneuc's work illustrates, that the software created under clean coding rules and refactoring, will inevitably contain fewer issues and will have enhanced stability, which means, that fixing some bugs will require less expense.

In addition, the modern software development trends show, that the perisistent staff flow is the essential practice for an enterprise. Sometimes, during the project, it becomes clear that the development team lacks the expertise in some domain to implement some part of the software. In this case, some new specialists must be involved in the project. These specialists must be provided with high-quality code, to avoid unnecessary time expenses for familiarization and understanding how the project is structured.

Moreover, if the core developers of the project retire, their followers must have a well-structured code base to continue the development process without any obstacles.

But how can an organisation ensure that clean coding practise and refactoring activities are established at enough level within the project and bring all listed benefits. And how can an organisation overcome all challanges that are related with their efficient usage.

In the next part of the essay many different methods and practices for efficient application of clean coding and refactoring, measuring the results of their application, and assessing possible changes in the future will be researched.

3

The first challenge associated with the methodical implementation of clean coding and refactoring is the different expertise levels within the development team. In the modern enterprise, it’s common practice, that the development team consists of many programmens with different expertise levels. Some of them can be responsible for the execution of less important or routine tasks, while some more experienced developers can implement more valuable and game-changing features.

Despite this fact, to keep an efficient clean coding application, an organization must maintain a uniform level of awareness and understanding of clean coding rules established for a certain project. Each participant must gain a clear understanding, of how the code is structured, regardless of the level of the programmer, who wrote it. Otherwise, the organization will face many communication issues and misunderstandings within a team, which can postpone the project release or increase the estimated budget.

But how can an organization achieve this goal?

An organization can implement training sessions, workshops, or seminars, where more skilled developers can share their experience of clean coding and refactoring to supplement the knowledge of other developers with practical skills. Today’s market offers a lot of frameworks and good practices for conducting such events. The one important aspect, that must be considered, is that these training sessions or seminars must be conducted consistently and must be an inherent part of the development process.

Vasileva & Schmedding (2016) in their work illustrate, that this educational process is not a one-time activity, but rather a set of consistent iterations, that enhance the level of knowledge of developers, and must consider all emerging technologies, tools, and methods, which support the application of clean coding and refactoring.

Another detail, that can sufficiently increase the code quality and efficiency of refactoring is the right time scheduling. Sometimes, due to the short deadlines, the project governance can prioritize the implementation of some core features, that are crucial for the entire project, sacrifiсing the conducting of refactoring, but such an approach can lead to poor code quality that will affect the future development. Therefore, it’s very important to dedicate enough time for code refactoring activities, when the project schedule is created and agreed upon by the stakeholders.

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