

Automated reporting in the Automotive Software Industry: Impact, Benefits and Challenges

Georgiana-Alexandra VOICU

National University of Science and Technology POLITEHNICA Bucharest,
Faculty of Industrial Engineering & Robotics, Bucharest, Romania

ORCID ID: 0009-0006-1770-7733

voicugeorgianaalexandra@yahoo.com

Irina SEVERIN

National University of Science and Technology POLITEHNICA Bucharest,
Faculty of Industrial Engineering & Robotics, Bucharest, Romania

ORCID ID: 0000-0002-0296-4730

irina.severin@upb.ro

Abstract. This study explores how Quality Assurance (QA) engineers perceive the impact, benefits and challenges of automated reporting processes. Based on a structured survey distributed to 108 respondents from Romania and other countries such as the Czech Republic and India, the study explores how two key independent variables – QA experience and entry path into the field – influence their opinions about manual or automated reports. Despite expectations that experience level would lead to differing opinions, the results show a strong agreement among respondents, including a consistent recognition of the challenges associated with manual reporting, such as human error, data inconsistency, and time inefficiency. Respondents showed strong support for automation, emphasizing its potential to improve efficiency, accuracy, and overall software quality. Real-time access to quality reports was very important, indicating a common need for timely and reliable information in QA workflows. These findings help prepare for future analysis that will explore the strength of relationships between the key variables and identifying factors that influence the adoption of automated tools in QA.

Keywords: quality assurance, survey, automation, software, processes, improvement, reports.

How to cite: VOICU, G.-A., & SEVERIN, I. Automated reporting in the Automotive Software Industry: Impact, Benefits and Challenges. *International Conference of Management and Industrial Engineering*, 12. <https://doi.org/10.56177/12icmie2025.133>

Introduction

The automotive industry has undergone significant transformation in recent years, largely driven by the integration of embedded systems within software development. These specialized computing systems, designed to perform dedicated functions in larger mechanical or electrical systems, have become essential for controlling a wide range of automotive functions such as engine management, safety features, and entertainment systems. The integration of embedded systems in automotive software development has not only revolutionized the sector but also increased the need for high-quality, reliable, and efficient software to meet the rising complexity of modern vehicles. The integration of quality in the automotive industry is essential - from the planning to the final product delivery to the customer, every phase of the hardware and software lifecycle is carefully monitored to prevent failures [1], [2].

The integration of automation into the SW QA process brings substantial improvements in compliance and process efficiency. Automated tools can consistently monitor and enforce adherence to standards such as IATF, ensuring that quality requirements are met throughout the entire production cycle. Automation enables teams to continuously assess processes, track deviations, and implement necessary adjustments to maintain efficiency. However, while automation offers numerous benefits, it is not without its challenges. One of the main drawbacks is the high initial investment required to set up automated systems, including purchasing software, hardware, and training staff. Automation also demands a skilled workforce that can design, implement, and maintain these systems, which may be a challenge for some organizations. Furthermore, the complexity of integrating automation into existing processes can lead to implementation difficulties, especially for teams with limited experience [3], [4].

Literature review

As automotive software systems become more intricate, with critical applications in safety, performance, and connectivity, the demand for automation in development processes has grown. Automation helps reduce manual

effort, minimize human error, and accelerate the development cycle, all while ensuring compliance with strict industry regulations and safety standards.

In their study, Haneen Thuhayr, Amal Alshaer and Bayan Alnahdi emphasize that automation enhances efficiency by reducing manual effort, minimizing errors, and accelerating development cycles. Their study also highlights the importance of selecting appropriate automation tools and balancing automation with human competence to maximize effectiveness. Furthermore, by automating key processes, including testing, defect detection, and performance monitoring, developers can maintain high levels of quality across the entire software lifecycle. His approach ensures that automotive software meets rigorous quality standards, including functional safety requirements such as ISO 26262, IATF 16949 for automotive quality management, and security standards to safeguard against cyber threats [1], [3].

Haneen Thuhayr, Amal Alshaer and Bayan Alnahdi highlight the role of automation across the phases of the Software Development Lifecycle, showing how it optimizes requirements gathering, system architecture and design, coding, testing, and deployment. Their study underscores that while automation improves efficiency, accuracy, and cost reduction, it must be balanced with human decision-making and collaboration. Additionally, the research suggests that automation in deployment is becoming standard, with many organizations aiming for full automation to streamline release cycles and minimize errors. By applying these automation approaches while preserving human supervision, organizations can ensure robust, dependable, and high-performing software solutions. To maximize these benefits, a balanced approach that combines automation with manual effort is essential, as manual testing is still crucial for exploratory testing and identifying edge cases. Research by Jani et al. highlights that automation plays a crucial role in maximizing efficiency and quality by ensuring comprehensive test coverage, early defect detection, and consistent execution of test cases. However, their study also emphasizes the importance of maintaining human oversight in testing strategies, as manual validation continues to play a vital role in refining complex scenarios and edge cases. Noone Srinivas explains in one of his articles how automation is changing software quality assurance by making processes faster, more scalable, and reducing defects [3], [4], [5].

This paper aims to explore the role of automation in software development, evaluating its advantages, disadvantages and challenges. While previous studies have largely focused on theoretical frameworks or tool-specific evaluations, this research provides novel findings by gathering practical insights from QA teams, highlighting the actual benefits, challenges, and effects of automation on daily development workflows. Also, this paper aims to fill that gap by collecting firsthand insights from QA teams, examining the tangible benefits, challenges, and real-world impact of automation on their workflows. By combining analysis of current tools, processes, and human expertise, this paper fills a gap in the literature and contributes to a more clear understanding of automation's impact in practical software development.

Methodology

In this research, a variety of materials and tools were utilized to analyze and explore the potential of automation in generating reports during the software development process, with a focus on the automotive industry.

Survey tool (Google Forms) was used for a survey designed and distributed to gather insights from quality assurance (QA) teams in the automotive software development process. The tool allowed for easy collection of responses related to the challenges and benefits of automating report generation. The responses helped identify key areas where automation could improve efficiency and software quality.

To achieve the objectives of this research, a primarily quantitative method was used, with some qualitative questions to get more detailed opinions. The main objective of the survey was to find out how automation affects reporting in QA teams, with the assumption that automation can make work more efficient and accurate. The other objectives were to identify the main benefits of automation, the challenges faced by QA teams, and the impact of automation on QA processes.

The survey had 16 carefully chosen questions covering four main areas: benefits of automation, challenges, ways to implement it, and its impact on QA processes. This ensures that the questions are relevant to the objective of the study. The survey was distributed through professional networks, industry-specific communities, and direct outreach to various software development teams, to reach a varied group of respondents.

Importantly is that the questions 1, 4, and 14 – 15 are single-choice (closed) questions that generate single variables, question 2 is an open answer question designed to explore respondent experiences and questions 3, 5, 6 – 13, and 16 are multiple-choice questions, generating multiple variables. The sample consisted of QA engineers from Romania, as well as international engineers. The diversity in professional background and experience was captured through a dedicated question within the survey. Data collection took place between March and May 2025. The survey was distributed online via professional networks such as LinkedIn, and through direct contact with QA engineers in Romania and abroad. In total, 108 valid responses were collected and offer a solid base for understanding the perceived impact, benefits, and challenges of automating reporting

processes in QA. The collected responses offer valuable insights for assessing both the benefits and challenges associated with implementing automated systems within QA teams.

Results and further discussions

This section examines the various stages of the SDLC to identify opportunities for automation that can improve the development process. A particular focus is placed on automated report generation, which is essential for enhancing both efficiency and software quality. Due to the complexity of the development lifecycle, the manual creation of documentation and reports is often time consuming and prone to errors.

Based on the SDLC model, a process overview presented in Figure 1 **Error! Reference source not found.** has been created to highlight the mandatory documents for each phase, providing a clear perspective on the documentation needed throughout the software development process.

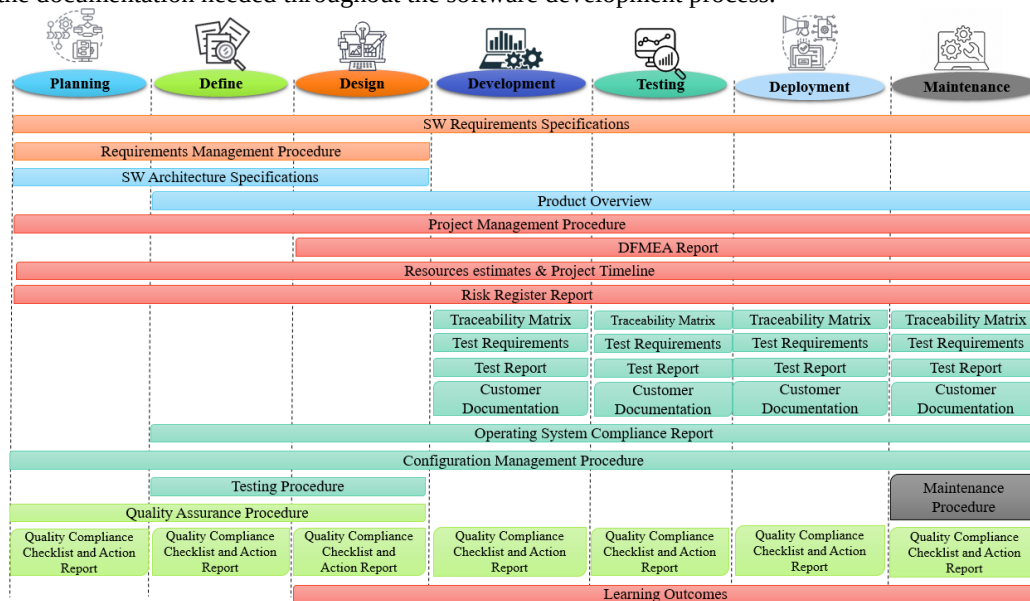


Figure 1: Process overview

Source: Author's own contribution

An increasingly adopted solution in the industry is the automation of quality report generation and review, which has the potential to improve team efficiency, increase the accuracy of the information provided, and facilitate quick and informed decision-making [4], [6], [7].

In the context of the research conducted, five hypotheses were formulated regarding the impact of automating reporting processes in QA within software development. The aim is to investigate whether QA teams perceive automation as a significant benefit in improving efficiency, accuracy, and decision-making, while also evaluating potential disadvantages or challenges associated with it. This research seeks to identify the real impact of automation on QA processes.

Table 1 outlines the hypotheses related to both the benefits and challenges of automating QA reporting processes. These hypotheses form the basis for the analysis conducted in this research and aim to assess the impact of automation on efficiency, accuracy, decision-making, and overall team performance.

Table 1: Hypotheses on the Benefits, Challenges, and Impact of Automation in QA Reporting Processes

Hypothesis	Description	Relevant Articles
1. Automating reports related to quality significantly improves the efficiency and effectiveness of QA teams.	Automation of quality reports minimizes the time and effort required for manual tracking and analysis, leading to faster decision-making and improved collaboration.	[7], [8], [9], [10], [11], [12], [13], [14], [15], [16], [17]
2. Real-time access to automated quality reports is essential for successful QA processes.	Having up-to-date and instantly available reporting allows teams to swiftly address quality issues, identify trends, and prevent escalations. Live dashboards, alerts, and live metrics ensure better control over the development lifecycle and accelerate feedback processes.	[14], [17], [18]

3. Manually generated quality reports present significant challenges that automation could resolve.	Manual reporting can be slow, prone to errors and inconsistent. Automation addresses these drawbacks by creating standardized reports, improving correctness.	[10], [11], [12]
4. The main obstacles to implementing automated reporting are technical complexity, data quality, and internal organizational pushback	Despite the clear benefits of automation, its implementation is often slowed down by outdated infrastructure, inefficient data frameworks, and stakeholder hesitation to adopt new methods. Identifying these hurdles is critical for successfully incorporating automation into QA processes.	[19]
5. Quality assurance engineers believe that automating diverse report types will improve software quality and compliance across the development lifecycle.	Through the automation of various reports like KPIs, audits, defect indicators, and others, QA teams gain better control and transparency over software quality, while also supporting regulatory compliance, traceability, and continuous progress.	[7], [8], [13], [16]

Source: Authors' own research.

The hypotheses were formulated based on existing literature and industry practices related to software quality management and automation.

The survey used for this study was designed to explore the perspectives of professionals in the field of Quality Assurance (QA) regarding the impact and benefits of automating reporting processes. The questions focused on various aspects of automated reports, including efficiency, accuracy, and quality management in software development. A total of 16 questions were designed to address these topics.

In order to support the process of testing the previously formulated hypotheses, a preliminary analysis of the relationships between the survey questions was conducted. The following section outlines the main hypothetical connections between the survey questions, as established based on the research logic and the specific context of software quality assurance: Therefore, the structure of the survey is based on two key independent variables (factors), which are hypothesized to influence responses of respondents across multiple dimensions of the research. The first one is experience in the Quality Assurance (QA) field – captured in Question 1 (Q1), this represents the length of time respondents have worked in QA, measured as an ordinal variable with four levels. Given the strong distribution toward mid to senior engineers, this variable is considered to be expected to influence responses of respondents regarding perceived challenges and benefits related to manual and automated reporting. The second is entry path into Quality Assurance (QA) field – captured in Question 2 (Q2), this variable reflects how respondents began their careers in QA.

The survey results provide data that address all five hypotheses, showing how experience, entry path, and other factors influence perceptions of automation and the challenges of manual reporting.

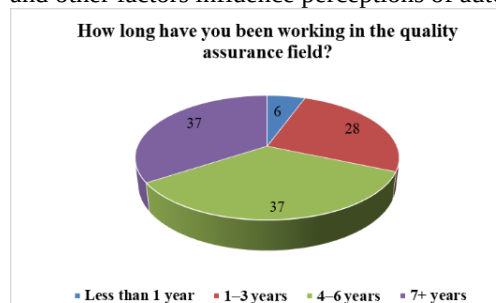


Figure 2: Question 1 (Q1)
Source: Author's own contribution

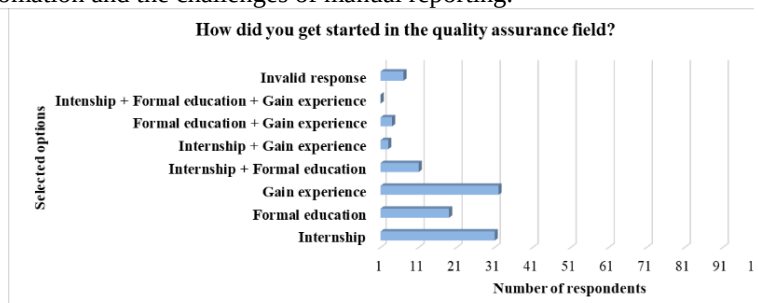


Figure 3: Question 2 (Q2)
Source: Author's own contribution

Figure 2 shows the distribution of responses from 108 QA engineers regarding their years of experience in the quality assurance field. This question allowed only one response per respondent and provides context about their experience level.

Analysis of responses shows that the data reveals that the sample is largely composed of engineers with substantial QA experience. A total of 74 respondents reported having more than 4 years of experience, indicates that the answers from the survey mostly come from people with solid experience in the industry, while only 6% beginners in the QA field. This distribution enhances the credibility of subsequent findings.

Figure 3 shows the respondents began their careers in quality assurance. Although this was an open question, the answers were grouped into categories such as internships, studies, or past work experience. The responses shows a variety of entry pathways, reflecting the diverse backgrounds of QA engineers.

These results show that while there is no single standardized route into QA, hands-on experience – either through internships or other roles – is very important for starting a career in QA. The relatively lower percentage of formal education – only responses may suggest a gap in specialized academic programs or a preference for learning by doing in quality assurance fields.

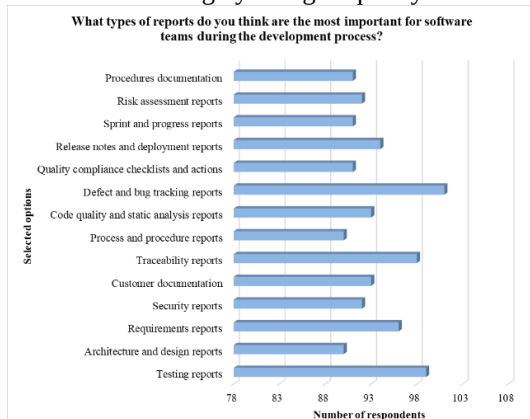


Figure 4: Question 3 (Q3)
Source: Author's own contribution

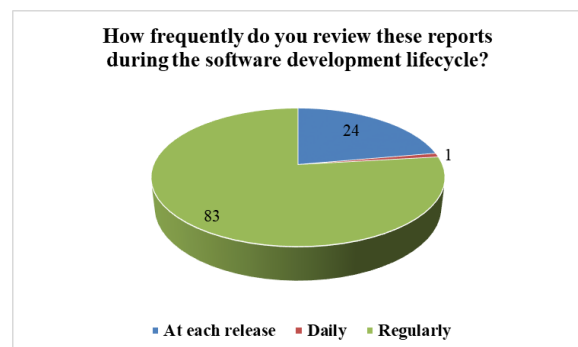


Figure 5: Question 4 (Q4)
Source: Author's own contribution

Figure 4 shows the distribution of responses regarding the types of reports considered most important during the SDLC. This question allowed multiple responses per respondent and reflects the varied priorities.

The data reveals that the sample is preferring documents that facilitate traceability, bug monitoring, and requirements compliance verification.

Figure 5 shows how frequently engineers review quality reports during the SDLC. Most respondents answer that they review quality reports regularly, meaning reports are analyzed at key points throughout the SDLC such as releases, sprint reviews or milestone completions.

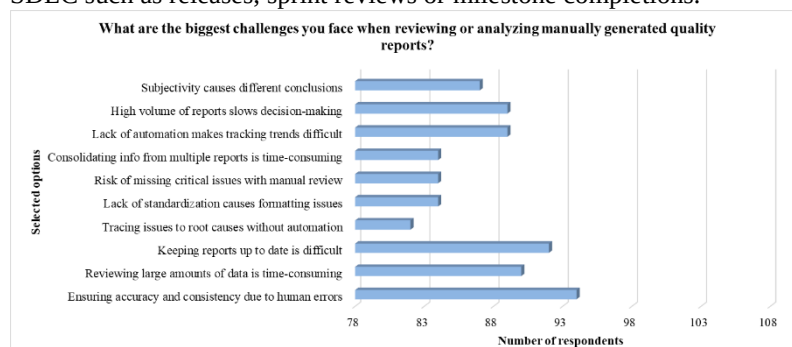


Figure 6: Question 5 (Q5)
Source: Author's own contribution

Figure 6 shows the biggest challenges that the quality assurance engineers face when reviewing or analyzing manually generated quality reports. Analysis shows the biggest challenges faced when reviewing or analyzing manually generated quality reports shows several important issues commonly experienced by QA engineers.

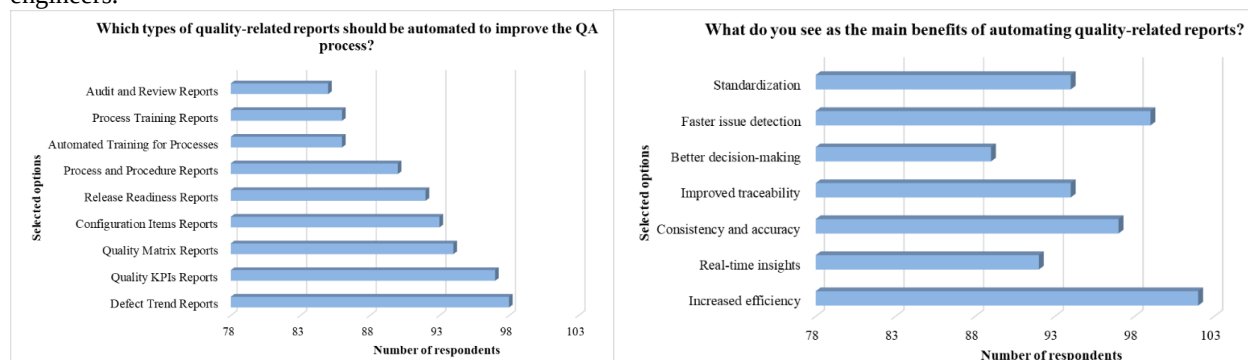


Figure 7: Question 6 (Q6)
Source: Author's own contribution

Figure 7 shows the types of quality reports that should be automated to enhance the QA process. Analysis shows a strong preference among QA engineers for automating those reports that directly support monitoring, improvement, and decision-making in the QA process.

Figure 8 shows the distribution of responses regarding the perceived benefits of automating quality reports. Analysis shows that the most frequently selected benefit was increased efficiency, indicating that eliminating manual data collection is often viewed as a crucial factor in reducing time.

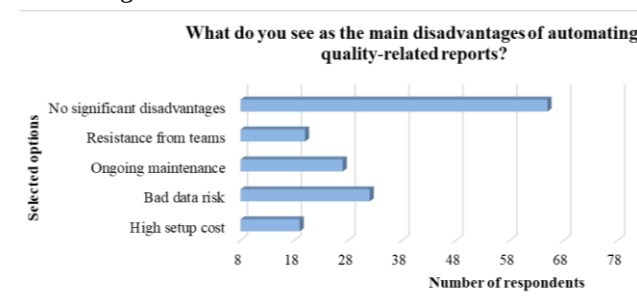


Figure 8: Question 7 (Q7)
Source: Author's own contribution

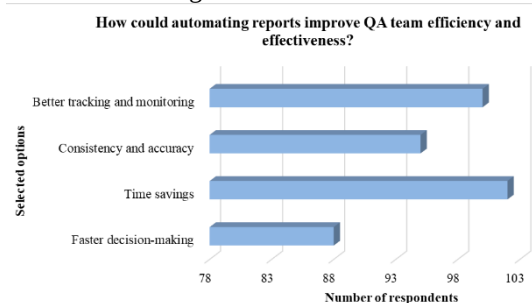


Figure 9: Question 8 (Q8)
Source: Author's own contribution

Figure 9 shows the main disadvantages of automating quality reports. Analysis shows that the most commonly selected response was **no** significant disadvantages, showing that the majority of respondents believe the value of automation clearly outweighs its limitations. Approximately 30% of respondents pointed to the risk of bad data as a critical issue, showing that automation is only as reliable as the data it processes.

Figure 10 shows the distribution of responses regarding the perceived impact of automating quality-related reports on team efficiency and effectiveness. Analysis shows that the most commonly identified benefit was time savings which allows teams to focus on analysis instead of data collection.

Figure 10: Question 9 (Q9)
Source: Author's own contribution

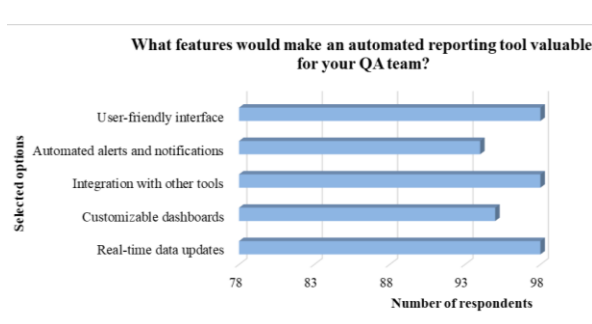
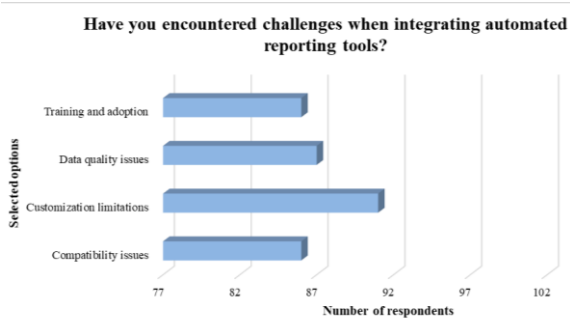


Figure 11: Question 10 (Q10)
Source: Author's own contribution

Figure 11 shows the main challenges faced when integrating automated reporting tools. Although the survey was distributed to 108 respondents, only 107 provided valid answers to this question. Analysis shows that the most frequently reported challenge was customization limitations, showing that standard automation tools often require substantial configuration to align with team specific workflows.

Figure 12 shows the features considered most valuable in automated quality reporting tools. Analysis shows that a significant proportion of respondents emphasized the importance of real-time data updates, integration with other tools, and a user-friendly interface.

Figure 12: Question 11 (Q11)
Source: Author's own contribution

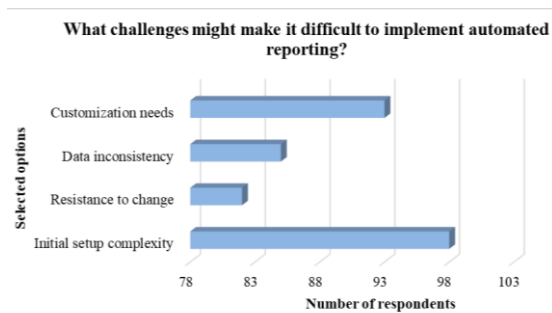


Figure 13: Question 12 (Q12)
Source: Author's own contribution

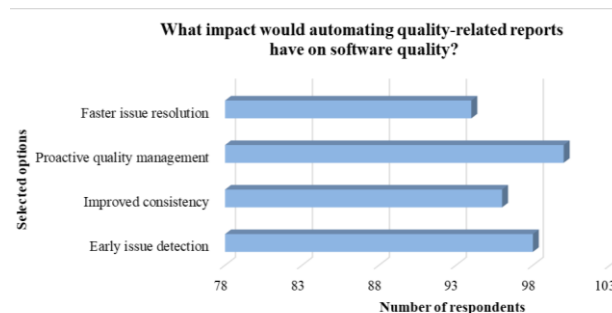


Figure 14: Question 13 (Q13)
Source: Author's own contribution

Figure 13 shows the potential challenges that may hinder the implementation of automated quality reporting tools. Analysis highlights concerns about the technical and time-intensive nature of configuring automation systems. Closely following were customization needs and data inconsistency, which point to difficulties in aligning tools with specific QA workflows and ensuring reliable inputs.

Figure 14 shows the perceived impact of automating quality-related reports on software quality. Analysis shows that the most frequently selected benefit was proactive quality management, highlighting that automation is seen as a tool to shift QA efforts from reactive problem-solving to preventive strategies.

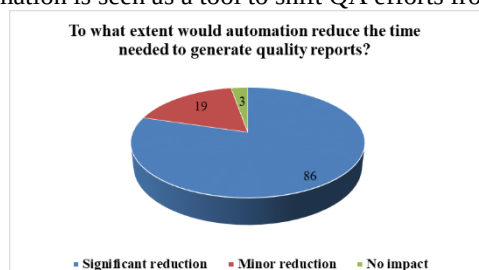


Figure 15: Question 14 (Q14)
Source: Author's own contribution

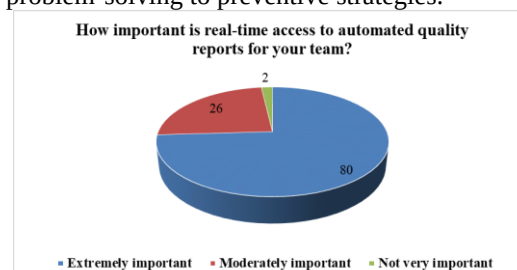


Figure 16: Question 15 (Q15)
Source: Author's own contribution

Figure 15 shows the expected impact of automation on the time required to generate quality reports. Analysis shows that majority of respondents believe that automation would lead to a significant reduction in the time needed to generate quality reports. This dominant perception highlights the potential of automation to streamline QA processes, enabling faster data access and more efficient reporting workflows. Only 2,8% reported no impact, showing that most QA engineers recognize clear benefits for automating.

Figure 16 shows the perceived importance of real-time access. Analysis shows a strong consensus among QA engineers on the value of real-time access, this highlights the critical role that immediate data availability plays in modern QA processes, allowing rapid decision-making and efficient problem resolution.

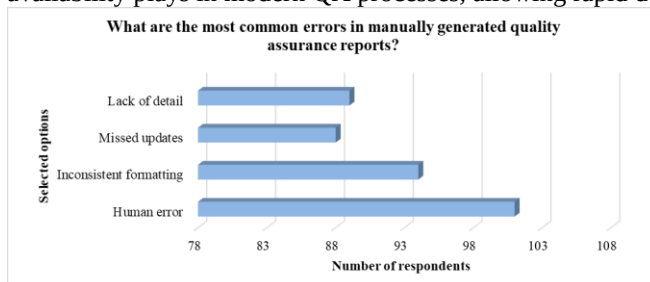


Figure 17: Question 16 (Q16)
Source: Author's own contribution

Figure 17 shows the distribution of responses regarding the most common errors observed in manually generated reports. Analysis shows the most selected was human error, such as mistakes in data calculation or interpretation. This highlights the vulnerability of manual reporting processes to inconsistencies stemming from human input.

Conclusion

This study was designed to explore the perspectives of QA engineers on manual versus automated quality reporting, with a focus on two main independent variables: experience in the QA field and entry path into QA.

The study provides new information about how QA engineers view automation and explains practical ways to improve efficiency, consistency, and quality.

Although it was initially hypothesized that factors such as experience and entry path were expected to affect attitudes, the results were consistent across all respondents. Challenges associated with manual reporting were consistently reported across all levels of experience. The second independent variable, how respondents began their careers in QA, was considered as a contextual factor that might influence preferences or perceptions, especially regarding reporting practices or tool functionalities. Descriptive interpretation based on visual data highlights challenges in manual reporting, including human error, inconsistency and time consuming. The results show that experience and entry path had limited influence, supporting the general idea that QA engineers see automation as useful for everyone. Manual reporting continues to pose critical obstacles, especially due to delays, inconsistency, and susceptibility to human error. Real time reporting capabilities are considered essential, indicating that speed and accessibility of data are central to modern QA expectations. These conclusions highlight the scientific importance and original contribution of this research on automation in QA. The results indicate that experience and entry path had little impact on opinions, showing that QA engineers support automation regardless of their background. All five hypotheses have been addressed: H1, H2, and H5 are fully supported, confirming that automation improves efficiency, effectiveness, and software quality. H3 and H4 are partly confirmed, showing that manual reporting causes challenges and obstacles may limit automation.

Limitations of the study include the small number of respondents (only 108) and the difficulty of gathering enough responses from QA teams, as many quality engineers are busy with their daily work. In the next phases of future research, the collected data will be examined through statistical analysis to identify patterns, correlations, and potential relationships between key variables. The analysis will examine how professional experience and entry path influence perceptions of automation. This quantitative study will complement the descriptive results and help understand what supports or limits automation in QA.

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