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Navigating Automotive Software Quality: A Comprehensive Study on Quality definition, Organizational factors, and ASPICE

(Thesis submitted for the degree of Executive Doctorate in Business Administration)

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ABSTRACT

The automotive industry is currently experiencing significant technological advancements and upgrades, leading to a substantial increase in the complexity and importance of automotive software. This is primarily due to the fact that most of the innovations in automotive electronics and services are implemented through software. Consequently, vehicle software quality has emerged as a critical factor, as the very definition of a vehicle is now intertwined with its software capabilities.

Over the past few decades, the industry has established several methodologies and models, such as Six Sigma, CMMI (Capability Maturity Model Integration), and ASPICE (Automotive Software Process Improvement and Capacity Determination), to guide software process improvement and ensure high-quality software development in the automotive sector. However, the software quality challenges faced today are distinct from those encountered when these traditional models were initially introduced. The absence of specific considerations for managing the complexities associated with Intelligent Connected Vehicles (ICV) software quality indicates that these traditional models are insufficient in effectively addressing ICV software quality management.

To bridge this gap, this study adopts a comprehensive and professional approach by conducting in-depth interviews with professionals from the quality sectors of China's automotive manufacturers, software suppliers, and quality management experts. The research findings presented in the study highlight important aspects related to automotive software quality. Firstly, the author defines a comprehensive set of metrics for defining quality in automotive software, with functionality, security, reliability, easiness of use, and regulatory compliance identified as the most important metrics. Secondly, the study identifies organizational factors that influence software quality. Communication and roles & responsibility were found to be the most frequently mentioned challenges, while factors such as organizational structure, training & learning, team size, and organizational culture were moderately cited. On the other hand, KPI (Key Performance Indicator) setting and organizational distribution were less commonly discussed by the interviewees. Lastly, the study addresses the challenges faced during the

implementation of Automotive SPICE (ASPICE) and proposes solutions to overcome them. Three frequently occurring challenges were identified: traceability, network security, and data security. These challenges can be addressed through detailed supplements to the existing ASPICE process reference model, providing practitioners with guidance when facing these specific challenges. Overall, the study's findings contribute to a better understanding of automotive software quality by providing a comprehensive definition, identifying significant organizational factors, and proposing specific solutions to effectively manage associated difficulties.

The findings of this study are expected to make significant contributions to the development of a comprehensive and professional quality management system and framework for effectively managing automotive software quality in the automotive industry. By addressing the specific challenges related to ICV software quality and considering the organizational factors that influence its management, this study aims to enhance the overall software development process and ensure the delivery of high-quality software solutions in the automotive sector, ultimately benefiting both the organizations involved and the end-users of Intelligent Connected Vehicles.

Key Words: Quality management, intelligent connected vehicle, software defined vehicle, automotive software, automotive software quality definition, organizational factors, software process improvement, ASPICE

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