Summary of Thesis

Enhancing Data Visualisation for Nuclear Power Plants – A Quality-Based Approach for Vattenfall's Forsmark Facility

In today's data-driven world, the ability to visualize complex information effectively is critical, especially in high-stakes environments like nuclear power plants, where the interpretation of data can directly impact operational safety and efficiency. As the energy industry increasingly relies on precise data for decision-making, the need for robust tools that can translate raw data into clear, actionable insights has never been more pressing. Vattenfall AB, one of Europe's leading energy companies, manages Forsmark Nuclear Power Plant, which plays a crucial role in Sweden's energy production. At Forsmark, temperature and radiation levels are continuously monitored to ensure the safety and functionality of the plant. However, the existing methods for visualizing this data are often inefficient and lack standardization, leading to delays in analysis and potential risks in decision-making.

This thesis, "Enhancing Data Visualisation for Nuclear Power Plants – A Quality-Based Approach for Vattenfall's Forsmark Facility," addresses these challenges by investigating how quality management principles can be applied to develop a visualization tool tailored for the unique needs of a nuclear power plant. By integrating advanced data visualization techniques with quality management frameworks, the study aims to create a tool that enhances both the accessibility and clarity of critical operational data. This work is particularly important because it not only improves the day-to-day efficiency of the plant's operations but also contributes to the broader goal of ensuring safety in nuclear energy production. The development of such a tool represents a significant advancement in the field of quality management and its application in complex, safety-critical environments.

The primary contribution of this thesis lies in demonstrating how quality management tools such as the Kano model, Quality Function Deployment (QFD), and Statistical Process Control (SPC) can be adapted to the development of a specialized data visualization tool for the Forsmark Nuclear Power Plant. The tool developed through this research improves the accessibility and understanding of temperature and radiation data, thereby enhancing decision-making processes within the plant.

The study illustrates the broad applicability of quality management methodologies in new contexts, showing that with careful adaptation, these tools can effectively address specific industrial challenges. By focusing on continuous improvement and effective visualization, the research offers valuable insights into how data can be more effectively communicated within complex, safety-sensitive environments. This contribution is not

only significant for Vattenfall but also has broader implications for the energy sector, where similar approaches could be applied to other facilities facing similar challenges.

The research methodology employed in this thesis is primarily qualitative, involving close integration with the visualization team at Forsmark. The study began with a comprehensive literature review to identify relevant theories and practices in quality management and data visualization. This was followed by a case study approach that included observations, interviews, and discussions with key stakeholders at the Forsmark facility to gather detailed insights into their specific needs and challenges.

The collected data was then structured and analyzed using the Kano model, which helped categorize end user needs into must-be, one-dimensional, and attractive qualities. These needs were further translated into actionable development steps through the QFD house of quality, ensuring that the final visualization tool was aligned with the users' requirements. The tool was developed using Microsoft Power BI and incorporated principles of effective visualization and SPC to ensure the accuracy and usability of the data presented.

The methodology also involved iterative validation with stakeholders to refine the tool and ensure it met the necessary safety and reliability standards. This approach allowed the research to remain focused on practical outcomes while adhering to the theoretical frameworks of quality management, ultimately leading to the successful development of a visualization tool that could significantly enhance the data analysis capabilities at Forsmark.