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By

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Contribution to the development of new maintenance strategies integrated to control charts for a production process under service levels, operational, and quality constraints

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ABSTRACT

The current production industry is characterising by significant progress: a massive increase in high technology, the emergence of exigent customers, competitive markets, varied product quality, and random demands required the collaborations of the inter-related aspects of production. The production, maintenance, and quality are the most critical aspects of the industrial system. We are interested in optimising maintenance that plays a critical role in customer satisfaction, sustainability, and the development of companies. Our study is centred on developing production and maintenance integrated into a control chart of quality policy. We propose new integrated maintenance strategies with an in-depth analysis of the continuous production process reliability improvements and treated under customer requirements (Service, quality, and cost) constraints. The integration and optimal coordination of these factors of production is not easy and represent a challenge for industrial companies, and are more challenging with multi-assignable causes of production process variation. To address this problem, this research work employed the use of a control chart tool in combination with the AFNOR principles known as Rule of seven as involved in quality management. To monitor, analyses and direct appropriate maintenance actions for continuous system reliability improvements along the different multiple process scenarios as decision levels. We use the interactions between the production process and product quality for strategies of maintenance which reduce the failure of the production system by improving process reliability and reducing the no conformal products. The study Significantly focused on quality, quality tools, and their applications in production and maintenance control. The technique we used to optimise the maintenance and quality control of an integrated production system is a control chart tool based on statistical measurement and analysis of quality parameters. We model different production problems and develop a control policy for randomly failing production systems that must satisfy customer requirements dynamically throughout the finite production horizon. We introduced a mathematical model to minimise the total costs of production, inventory, maintenance, and quality control. The optimisation of the maintenance strategy was integrated into a control chart tool information. Based on the production rate variation and its impact on machine degradation the number of maintenance, times, and intervals needed for prudent decision-making is determined by the developed algorithm. In this context, this research presents the derivation for different cases of all the probabilities for the process to be in or out of control, the average run lengths, and the restoration cycle durations. Based on the degradation factor, new failure rate equations are formulated, and then the average failure rate for each case, we formulated different maintenance cost optimisation models. The proposed approach is useful for precise calculation and minimisation of the total maintenance cost. Which optimises total production cost considering all possible production process statuses due to multiple causes. Our work contributes to the emergence of quality management and performance improvement techniques that will contribute to the development of production companies.

Keywords: Production, Maintenance, Quality, Statistical Process control (SPC) chart, Improved Statistical Process control chart (ISPC), AFNOR Principles, Total production cost optimisation.