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Evaluation and Optimization of Processes Through the Implementation of New Machines and Technologies at Concelac Company

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Evaluation and Optimization of Processes through the Implementation of New Machines and Technologies at Concelac Company

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***Abstract*—In Peru, many cheese plants continue to operate with traditional techniques, despite current technological advances. This contrast between the artisanal and the industrial reflects an opportunity for modernization in the sector. In this context, Concelac showed deficiencies in its production processes, specifically in the volumetric molding, pressing, draining and packaging stages. This study focused on the evaluation and optimization of these processes through the implementation of new technologies. Methodological tools such as Process Analysis Diagrams (PAD), Process Operations Diagrams (POD), Flow Diagrams and Ishikawa Diagrams were used to identify critical areas and bottlenecks. The time and cost analysis of the existing machines led to the proposal of three new technologies: one for volumetric molding, one for pressing and draining, and one for packaging. The implementation of these machines allowed significant reductions in operating times: 91.15% in volumetric molding, 92.08% in pressing and draining, and 88.34% in packaging. Mold filling uniformity and cheese quality were also improved. The investment analysis recommended prioritizing the acquisition of the pressing and draining machine, followed by the volumetric molding machine, and finally the packaging machine. These improvements achieved a significant optimization of production, positioning Concelac for greater efficiency and competitiveness in the market.**

Keywords—volumetric molding, pressing and draining, automated packaging and process optimization.

I. INTRODUCTION

In 2024, the Ministry of Agrarian Development and Irrigation (MIDAGRI) established Peruvian Cheese Day to promote the consumption of the 50 varieties of cheese produced in Peru [1], recognizing the importance of this sector in the national economy. It is estimated that there are approximately 6500 cheese plants in the country, mostly medium-sized and with artisanal processes, with fresh cheese accounting for 65% of national production [2]. Despite being in the fourth industrial revolution, many producers continue to use artisanal methods due to the lack of technological innovation. Automation could reduce the number of workers needed, optimize the use of resources, speed up production, improve energy sustainability and reduce harmful emissions [3][4].The present research analyzed the company Concelac and its production of fresh cheese, with the aim of modernizing and optimizing its processes through automation focused on industry 4.0. Automation of the whey removal, molding, pressing, packaging and labeling stages was suggested, which are currently performed manually, generating inefficiencies, high labor costs, variability in product quality and production delays. The implementation of advanced automation technologies will enable Concelac to optimize its production line, reduce operating times, and minimize human error.

Cheese production based on Industry 4.0 addresses the technical challenges of artisanal processes through virtual simulations and digital tools, improving efficiency and operability [5][6]. However, some sectors in Peru face problems with fungi that deteriorate the product, affecting the quality perceived by consumers in terms of smell and taste. These problems could be mitigated with better control of the pasteurization process through temperature sensors, which allow monitoring and adjustment of thermal parameters in real time to ensure the elimination of contaminants [7][8].

In addition, the cheese industry has developed Industry 4.0-based applications to evaluate raw materials and manage suppliers using data science techniques. These tools make it possible to ensure high-quality products in terms of attention, quantity and deliveries. The integration of these systems facilitates efficient supply chain management and optimizes product performance [9].

In Industry 4.0, the need for horizontal, vertical, and end-to-end integrations is emphasized to standardize and streamline manufacturing processes [10]. Pressing process automation includes data management and analysis to create a digitized database using artificial intelligence. This allows real-time monitoring of press parameters and product quality control, accompanied by methods that reduce operating times and estimate necessary maintenance to reduce operating costs [11][12].

The implementation of advanced machinery and devices in cheese production allows improving production processes, increasing productivity and saving raw materials. This approach focuses on a green and digital transformation, through real-time

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