Enhancing Management Visibility Through a Visual Booking System for Shared Laboratory Resources

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Abstract

This project focuses on improving the management of shared laboratory resources in Lab 1701 at a biopharmaceutical manufacturing site through the implementation of a visual scheduling and booking system. The objective was to increase management visibility, reduce administrative burden, and improve coordination for the use of the Recipe Development Unit (RDU) and sample management activities. Lean methodology, including Voice of the Customer analysis and Value Stream Mapping, was applied to evaluate the current process and design a future-state supported by visual management and standardized work. Administrative processing time was reduced by approximately 60%. However, statistical analysis (a = 0.05) indicated that additional data collection is required to confirm long-term process improvement.

Introduction

In regulated biopharmaceutical laboratory environments, management visibility of ongoing operational activities is essential to support informed decision-making, ensure compliance with standard operating procedures, and optimize the allocation of shared resources. Within the Process Development Department of a biopharmaceutical company located in Juncos, Puerto Rico, Laboratory 1701 supports two critical activities: utilization of the Recipe Development Unit (RDU) for process optimization and image collection, and sample management inspections conducted in dedicated inspection booths. Although these activities can be performed simultaneously, both rely on shared laboratory space and coordination with the laboratory owner, creating a strong need for effective scheduling and oversight.

Problem Statement

The existing manual scheduling process is labor-intensive, highly dependent on individual availability, and susceptible to delays, scheduling conflicts, and communication errors. The lack of standardized work and real-time visibility limits management's ability to effectively monitor laboratory usage, anticipate resource conflicts, and maintain operational control. From a Lean perspective, the current process introduces several forms of waste, including waiting due to unclear equipment availability, over-processing through repeated communication exchanges, and excess motion associated with manual scheduling efforts. These inefficiencies increase administrative burden and reduce process predictability for laboratory users who depend on timely access to shared laboratory resources, ultimately creating the need for improved coordination, transparency, and management visibility within Laboratory 1701 operations.

The objective of this proposal is to design and implement a visual booking and tracking system using Smartsheet for RDU equipment usage and sample management activities that align with Lean principles by improving management visibility, establishing standardized work, reducing identified waste, and supporting proactive, data-driven decision-making. The proposed system will function as an organizational and management tool that enhances efficiency, accountability, and overall laboratory performance

Background

Laboratory 1701 houses the Recipe Development Unit (RDU), an off-line equipment that supports recipe development and process optimization activities. Due to its complexity and high operational cost, the RDU requires specialized training to operate and includes a Human Machine Interface (HMI) system that allows operators to log in and maintain a record of equipment usage. In addition to RDU utilization, the laboratory also supports sample management activities conducted within designated inspection booths designed to facilitate defect detection in syringes and vial samples under controlled lighting conditions.

Access to Laboratory 1701 is currently managed through a manual booking process in which laboratory users must contact the Senior Manager responsible for the laboratory to request time for equipment utilization or sample management activities. Scheduling information is recorded manually in a personal working calendar, requiring continuous coordination between laboratory users and the laboratory owner.

Methodology

This project follows a Lean-based methodology to improve scheduling and coordination of shared laboratory resources in Lab 1701. The steps below outline the structured approach used to evaluate the current process, design a visual booking system, and assess its impact on administrative efficiency and management visibility.

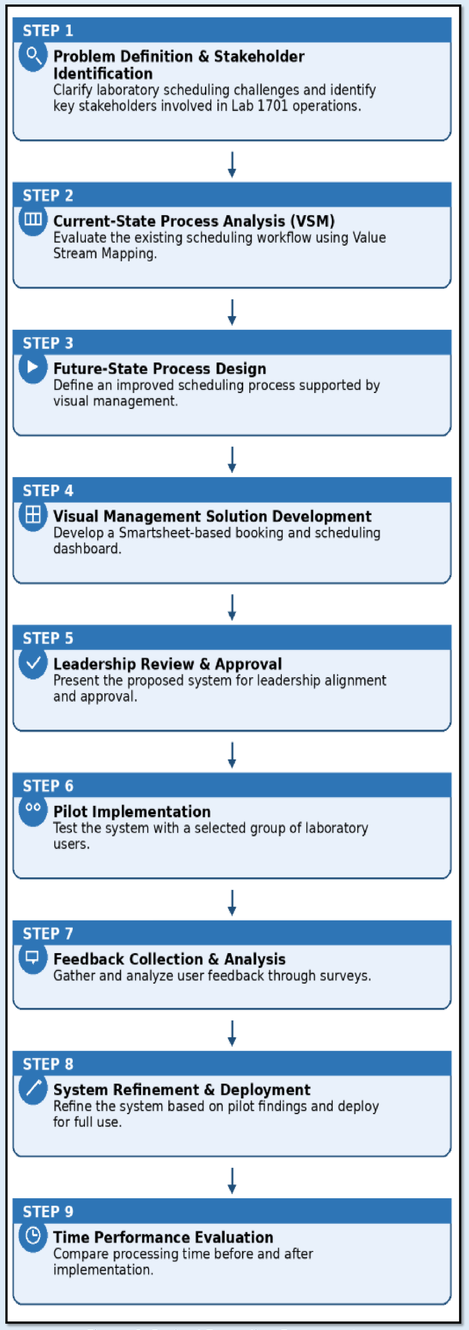

Figure 1. Project Execution Framework

Results and Discussion

This section summarizes the results obtained from the methodology. To better understand the workflow and establish a clear baseline of the current state, a Value Stream Map was developed (Figure 2). This map provided a comprehensive visualization of the existing process, including key activities and information flow. Based on this analysis, a future state Value Stream Map was then created to define the desired process performance, improve information flow, and enhance coordination prior to the development of the proposed tools.

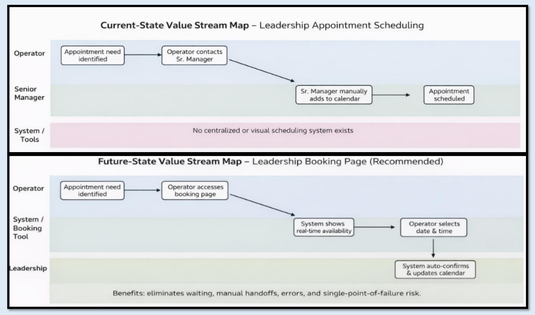

Figure 2. Current State Value Stream Map vs. Future State Value Stream Map

Following the definition of the future state process, a visual booking and scheduling dashboard was developed to support execution of the future state. The dashboard includes a clearly defined purpose, visibility of training requirements, a centralized calendar displaying availability, and direct links to supporting resources such as Standard Operating Procedures, training materials, and contact information (Figure 3).

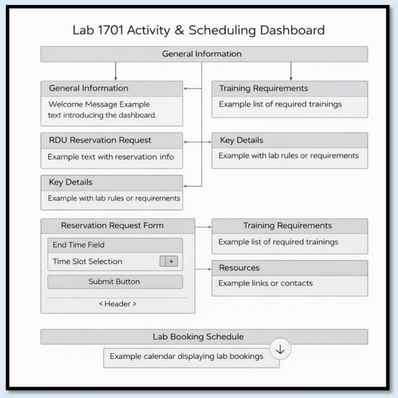

Figure 3. Visual Mockup of the Smartsheet Dashboard's Structure and Layout

Following the dashboard development, a pilot implementation was conducted with 40 laboratory users to evaluate changes in scheduling experience. Surveys completed before and after implementation showed that dissatisfaction with the existing process decreased from 70% to 15%, while 85% of participants reported satisfaction with the visual booking system, indicating improved clarity and planning of laboratory activities (Figure 4).

Table 1. Survey Percentage Results Before and After Implementation

Survey Phase	Satisfaction Level	Percentage of Participants	Number of Participants
Before Implementation	Not completely satisfied	70%	28
Before Implementation	Generally satisfied	30%	12
After Implementation	Satisfied	85%	34
After Implementation	Neutral	15%	6

A time-performance analysis was conducted to evaluate process efficiency. For this step, administrative processing times were measured using timestamp data from actual booking requests, both before and after the booking tool's implementation. For this analysis, processing time will be defined as the interval between receiving the initial request and receiving final approval (Figure 4).

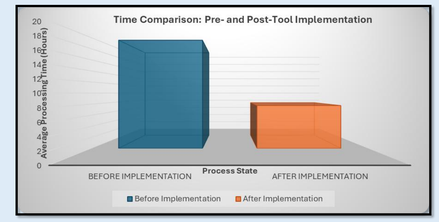

Figure 4. Time Comparison: Pre and Post Tool Implementation

Figure 4 shows a comparison of the average processing times: before implementation requests took about 19.6 hours on average, whereas after, the time decreased to approximately 7.7 hours, an estimated 60% reduction.

Statistical Validation

In order to statistically validate the effectiveness of the new scheduling process, mean and variance hypothesis tests were performed to compare administrative processing times before and after implementation. Although a reduction in processing time was observed, the results were not statistically significant at a = 0.05 due to the limited sample size and process variability. Therefore, additional data collection is required to confirm the long-term impact of the improvement.

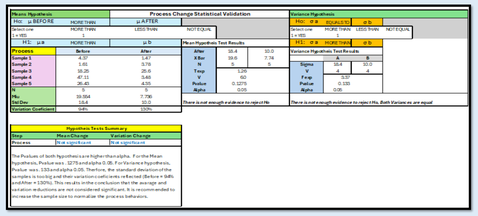

Figure 4. Process Change Statistical Validation

Conclusions

The implementation of a Lean-based visual scheduling system improved coordination and management visibility of shared laboratory activities in Lab 1701. Standardizing the booking process reduced reliance on manual communication and decreased administrative processing time. Survey results also indicated improved user satisfaction. However, statistical analysis showed that additional data collection is required to confirm long-term process improvement due to the limited sample size.

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