



Improved Food Production Operations: Advancements in Facility Layout, Job Scheduling and Data Management

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Introduction

The Arkansas Food Innovation Center (AFIC) is a facility within the University of Arkansas Division of Agriculture that rents space to local food entrepreneurs for commercial production of their products. The AFIC provides equipment, machinery, and technical advice, as well as offers assistance with food testing and regulatory documents. The facility was established in 2013 on a trial basis to offer food entrepreneurs in Northwest Arkansas a place to create value-added processed products and reduce excess crop waste. Services are currently being provided to around 20 different producers, such as JR's Kombucha, Pink House Alchemy, and KYA Chocolates.



Project Objectives

Operations within the facility are currently handled by the AFIC manager, Mr. John Swenson. As the production within the facility increases, Mr. Swenson desires to improve efficiencies within the facility by automating some of his administrative duties and evaluate the facility layout. After research and stakeholder analysis, we narrowed our project down to three objectives:

- 1) Increase the utilization of equipment and space
- 2) Implement a data management system to allow for a more organized data collection
- 3) Design and create a decision support tool to help automate producer scheduling

The completion of these objectives would assist with the tedious tasks that Mr. Swenson and the AFIC interns deal with on a daily basis. With less time spent on non-value added activities, Mr. Swenson is able to spend more time focused on the thing that really matters: helping the producers.

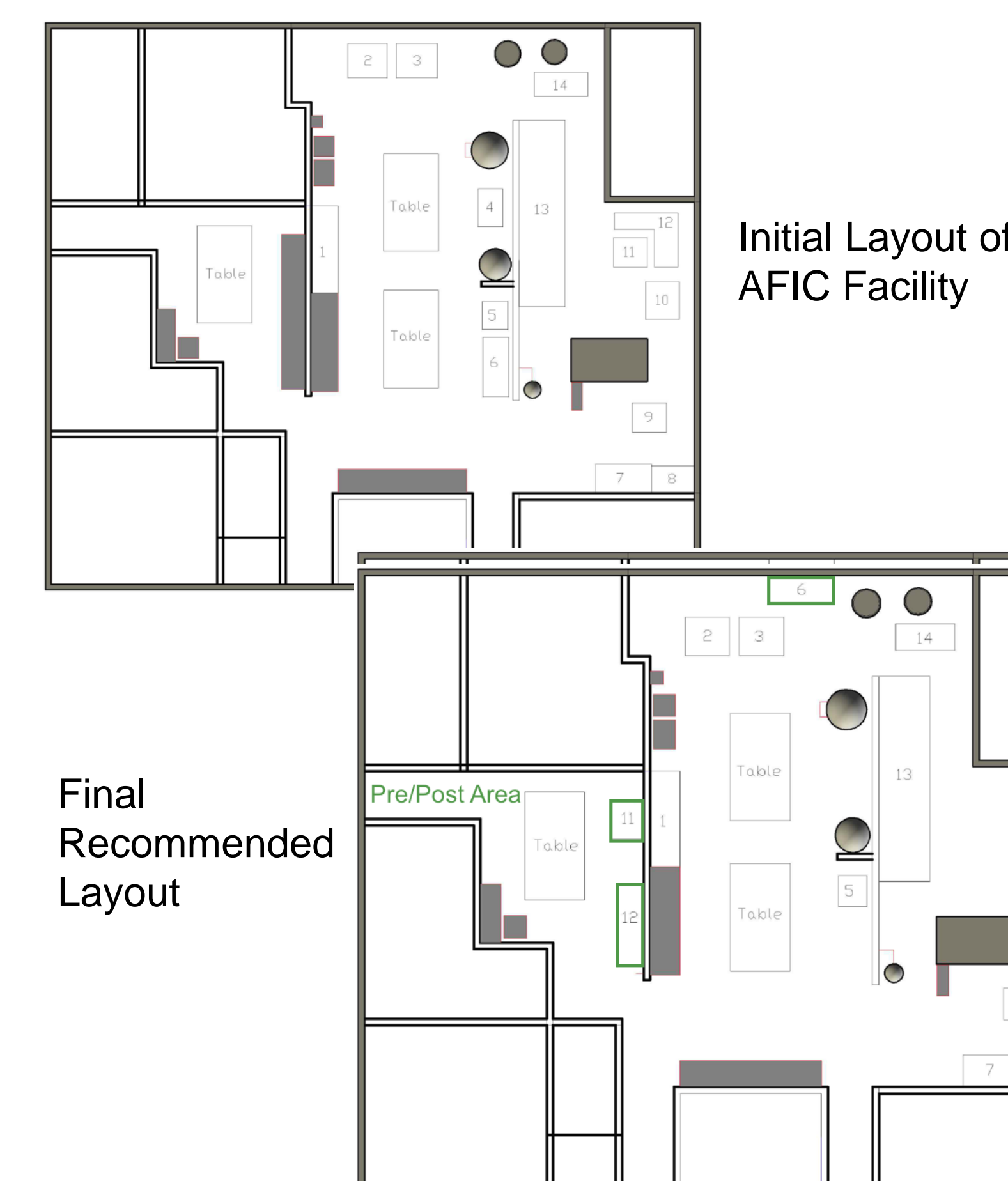


ARKANSAS FOOD INNOVATION CENTER

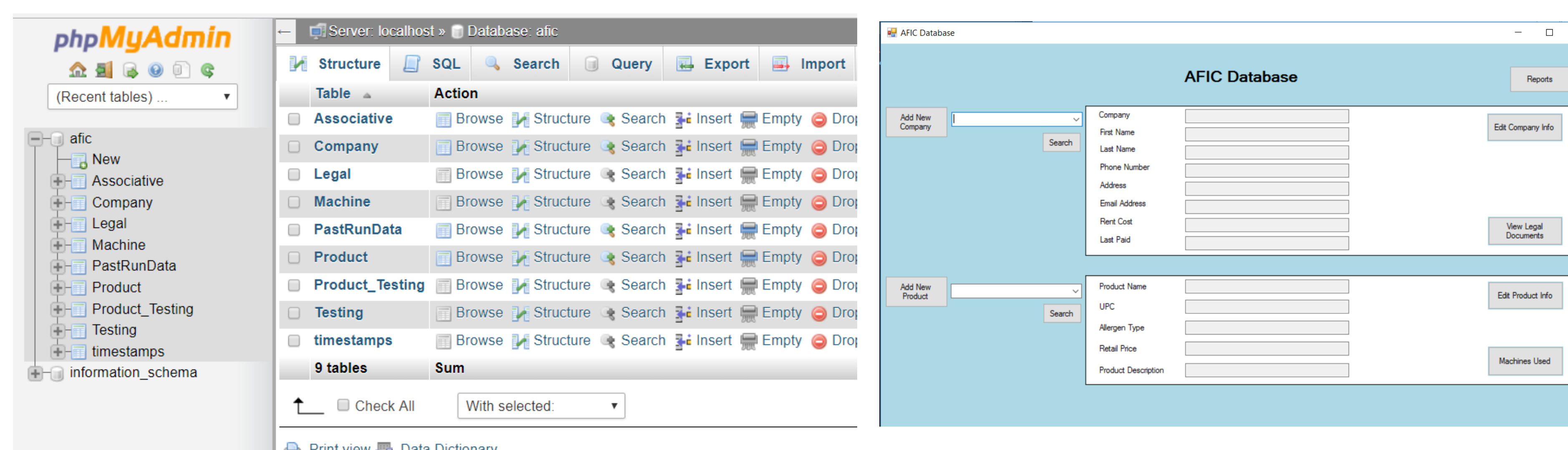


Facility Layout

The current facility layout was determined solely by the various constraints of each machine, like steam and electricity requirements. To increase layout efficiency, we determined that we wanted to minimize the distance producers traveled during their production process. Many improvement methods were considered, but the Pairwise Exchange method appeared to best suit our needs. The only data that was provided was the chronological order in which machines are used in a process. From this, we created a flow-between matrix that was multiplied with a distance matrix to determine different layout's distance-based efficiency scores. Ultimately, our final layout creates a "pre/post" production area (consisting of machines that are frequently used before or after the bulk part of a production process) and improves the distance-based efficiency by 2%.



Database



Currently, the AFIC uses a set of disorganized Excel files to keep track of company contact information, product data, rent scheduling, and regulatory documents. These files have spelling mistakes and missing/outdated information that cause the documents to be unreliable for analysis of information. Our industry partner expressed interest in a new data management solution, so we proposed building a database. By standardizing the data entered, not only would spelling mistakes decrease, but the scheduling tool would have a reliable and consistent place to gather information. To create the database, a combination of MySQL Workbench, phpMyAdmin, and Visual Studio was used. The data in the database is currently stored on an Industrial Engineering server, which is only accessible through the University of Arkansas internet. To bypass this issue, a virtual machine that can read into the University of Arkansas servers was created through a remote desktop connection file. With the virtual machine, all files related to the database can be saved to the machine and be accessed anywhere that has internet.

Scheduling Tool

Currently when a producer wants to be scheduled at the AFIC, the producer sends the AFIC manager an email with a date. The manager then schedules the producer based on the current schedule and the producer's needs with knowledge stored in the manager's head. To reduce the reliance on the AFIC manager and ease the scheduling process, a scheduling tool was created. The scheduling tool is comprised of four functions. The *Add Producer* function takes a producer's availability and production process and based on a heuristic, schedules a producer in a time that is less likely to be needed by another producer. The *Remove Producer* function allows for a user to remove a producer from the schedule. The *Display Schedule* allows for a user to display a week's schedule. Finally, the *Clear Schedule* allows for a user to remove a week's data and open scheduling up for a new week. The scheduling tool is connected to the database to retrieve information about the producers' processes and visits.

Conclusion

To accomplish the three objectives, three deliverables were provided to our industry partner:

- 1) A new layout of the AFIC's production floor was proposed to better utilize the space in the facility
- 2) A database using MySQL Workbench, phpMyAdmin, and Visual Studio was designed as a new data management solution for the AFIC's data
- 3) A scheduling decision support tool was created to help automate producer scheduling

These deliverables not only accomplish the stated objectives, but can also provide the backbone to future changes at the AFIC.