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Research paper

Evaluation of the Production Capacity: Soup Mixing, Sub Manufacturing Production Department ABC Company

Sarah Khate C. Montederamos

University of Perpetual Help Molino Campus, College of Engineering
Corresponding author E mail: sarahkhate@gmail.com

Abstract

In the fast pace of today, the consumer market continues to search for easy, fast and satisfying meals, and cup noodles is one of them. The ABC Company is an industry that pioneers in creating these said to go meals and what makes the noodles taste great, it is the flavoring where as in the industry termed soup mix. Made at the sub-manufacturing department of the plant, the soup mixing section is an area for continuous improvement. This study aimed to evaluate the production capacity of the said section. It was discovered via TMS that 40% of the production capacity was not utilized. Operation Standard Time was established at 1 hour and 30 minutes. Thus the best course of action is to change the former 3 batch quota per shift to a 4-5 batches per shift, removing batch if there would be a change flavor in schedule. With the current year plan the operations direct labor cost would save 25% for a 4 batch per shift quota and 40% savings for a 5 batch per shift quota. Other recommendations such as improving PPE used by laborers, reevaluating operation procedures, lining drums with limit lines and automating the process was also suggested. Overall, many aspects of the section could be improved and suggestions stated could be done in the discretion of the company.

Keywords: *Manufacturing, Production Capacity, Production Systems, Standard Time , Time and Motion Study*

1. Introduction

Eating while on the go is quite a trend in the market today, most especially affordable and easy to prepare meals that are both satisfying and tasty. Cup Noodles or Instant noodles are one of those staple quick and easy meals that I am talking about. Available in a variety of packaging, in pouch, paper cups, polystyrene or polypropylene cups, one could enjoy this hot and savory meal any time of the day.[1]
The ABC Company is a leading brand in the snack food and beverage industry, catering to a vast variety of customers both local and international. Mass producing a wide array of flavors from beef, chicken to seafood enables the company to suite the market of all age and race. Its commitment to bringing not only delicious food but also efficient systems and high-quality service make the company a powerful presence not only in the Philippines but worldwide. Keeping in line with the JG Summit's Vision "to make life better, not only for Filipinos, but for the rest of the world".
What are noodles without those little packets of flavor included in every cup. Those packets are the one that gives life and color to the noodles that everyone eats. In line with that this study centralizes on the Soup Mixing Section, in the Sub manufacturing production of the company. Focusing on improving the overall productivity of the section.
With the use of Time and motion study analysis the researcher aimed to identify and establish the standard time of the operation as proof to the possible increase of quota output per shift. Currently the soup section aims to accomplish 3 batches per shift. During the months of July to August 2018
the maximum capacity per machine is only 360kg thus per shift
quota of 3 batches per machine totals to approximately 2117kg-2160kg at a 98% minimum efficiency.
Through the series of observations, the researcher aims to evaluate the reasons for only establishing a 3 batch quota and thereafter prove that the increase in batches per shift is beneficial to both the company and the employees. Procedure for Paper Submission
Scope and Limitation
This study covers only the soup mixing process of the sub-manufacturing production department of the ABC Company located at Main Dr, Dasmariñas, First Cavite Industrial Estate, Cavite. Data gathered only covered the span of April 24-25, and the month of July 2018. Limiting that each batch is at a maximum weight of 360kg with current quota of 6 batches per shift, functioning at 3 shifts per day. This study aims only to establish the standard time of the operation in order to support and prove the ability to increase in overall output per shift of the process.

2. Statement of the Problem

With the use of Time and Motion Study Analysis it was determined that 40% of the maximum production capacity per shift is not being utilized in the soup mixing process of the sub-manufacturing section.

2.1. Objectives

Generally, the study aims to prove the maximum production capacity of the soup mixing process
Specifically, the study aims accomplish the following
a. Determine standard time for each soup batch
b. Recommend alternative courses of action that would result to the utilization of the maximum production capacity
c. Provide possible time schedule to maximize process productivity

3. Presentation and Evaluation Of Data

3.1. Time and Motion Study

Table I: Summary of Time and Motion Study Analysis

	Dumping of RM	Mixing	Dumping of FM	Checking	Storage
AVE OT	18.1467	15.832	21.664	8.473	3.524
Rating	100.25	100	102.95	94.45	105
AVE NT	18.831	15.832	19.516	7.603	3.600
No. of Observations	20	20	20	20	20
Standard Time	26.522	15.832	27.488	10.709	5.071

Total Standard Time: 85.62

Base on the summary table I it was established that the standard time of the entire mixing process was 1 hour and 25 minutes. Given that Personal and Fatigue Allowance (PFA) is 29% and Performance Rating is based on the Westing house scale on effort, consistency, skills and conditions. Dumping of raw materials is 26.5 minutes, Mixing time is 15.8 minutes, Dumping of Finish Mix is 27.4 minutes, Checking of finish mix weight is 10.7 minutes and Storage is 5 minutes.

3.2. Manual Sifting

Table II: Table on Manual Sifting Time

SKU	Time	Minute Conversion
MCH	7:47.88	7.798
MCH	7:03.69	7.0615
CYB Export	6:43.54	6.726
CYB	6:16 .31	6.272
CYB	8:25.06	8.418
MLB	6:51.60	6.86
MSB	7:36.08	7.601
CNH	8:55	8.916
CNH	8:55.23	8.9205
CHS	8:38.46	8.641
CHS	8:27.09	8.4515
Average Time		**7.788 Minutes**

Given in table II, the researcher had timed the manual sifting procedure during the dumping of the raw materials. Data shows that a raw average of 7 minutes and 47.28 seconds is spent by the helpers manually sifting raw materials through the screen. Timing was done with the parameters that timer would start when both helpers are sifting and is paused if one or both of the helpers are dumping any raw material.

3.3. Analysis of Quota

Table III: Summary on Total Planned Quota

Total Nissin	Total Kg	Total Batches at 360
635,009	255,144.14	708.73

Source: Nissin planned quota for the month of August

TABLE III Quota indicates that for the month of August the limit of 6 batches of 360 per shift would not be sufficient to meet the plan. It was computed that the given quota would require 5 weeks and 5 days to complete given that per batch is only 360kg at a maximum.

3.4. Operations Flow Chart

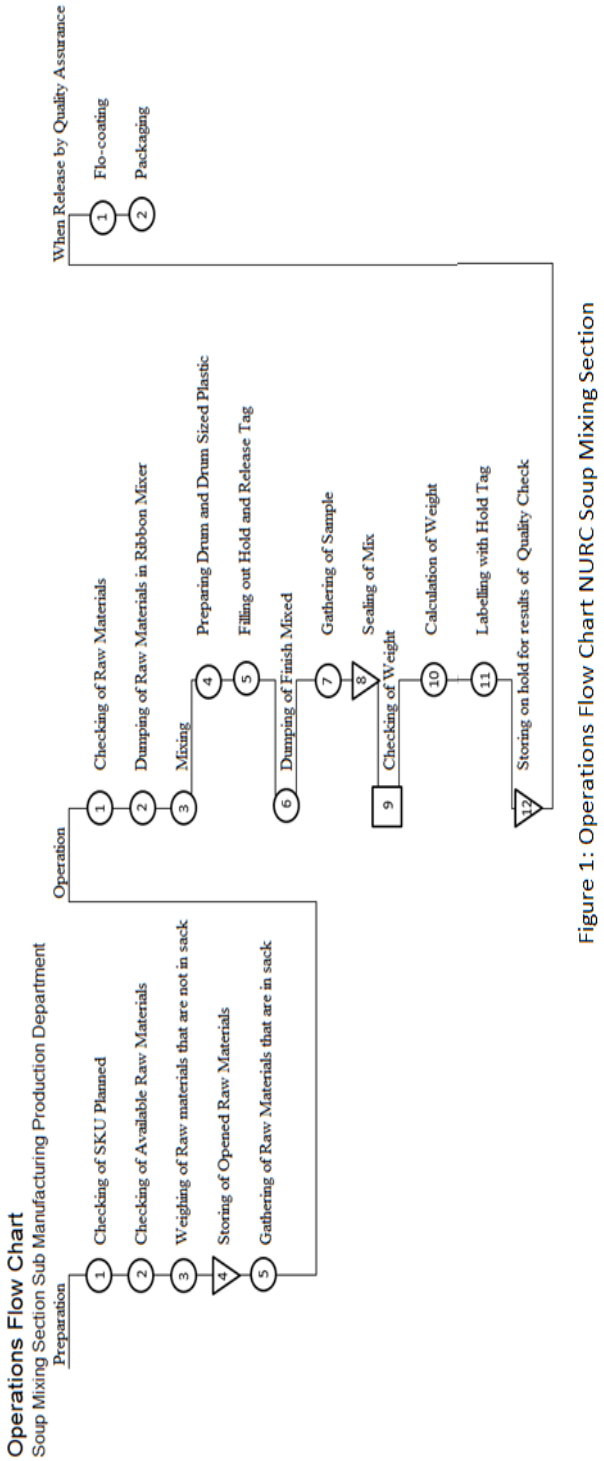

Figure 1: Operations Flow Chart NURC Soup Mixing Section

Fig. 1: designates the current sequence of operations in the soup mixing section. Staring from the Preparation of Raw Materials toward the actual processing or mixing of the soup batch and ending with the storage of the soup batch in the holding area. Operations after the mixing of the soup batch may be flow coating or packaging depending on the SKU involved.

3.5. Multiple Activity Chart

Multiple activity checking was done and observation shows the time and the activities done by the helpers on Ribbon Mixer 1 during the 600 - 1400 shift on July 10, 2018. It has displayed that a total of 1 hour and 10 minutes idle time, 1 hour change flavor and 3 batches done. While time and the activities done by the helpers on Ribbon Mixer 2 during the 600 - 1400 shift on July 10, 2018, displayed a total of 1 hour 50 Minutes idle time, 1 hour change flavor and 3 batches done.

3.6. Ishikawa Analysis

Ishikawa diagram done by the researcher displays probable causes of why the 40% of the production capacity is left unutilized. Most probable cause is pointed and displayed which are the lack of standards and lack of raw materials causes delays the entire process.

4. Recommended Courses of Action

4.1. Redesign Schedule and increase number of batches per shift.

Table IV: 6:00am – 2:00pm Shift Possible Schedule

Batch 1 6:00 – 7:30	Break 10:30 – 11:00
Batch 2 7:30 – 9:00	Batch 4 11:00 – 12:30
Batch 3 9:00 – 10:30	Batch 5 12:30 – 02:00

Change Shift : 1:30 – 2:00
Change flavor allowance Remove 1 batch
Maximum Capacity: 5 batches
Minimum Capacity: 4 Batches
Change Shift time would also be allotted for the preparation of all materials needed by the next batch.

Table V: 6:00am – 6:00pm Shift Possible Schedule

Batch 1 6:00 – 7:30	Break 10:30 – 11:00	Batch 6 2:00 – 3:30
Batch 2 7:30 – 9:00	Batch 4 11:00 – 12:30	Break 3:30-3:45
Batch 3 9:00 – 10:30	Batch 5 12:30 – 02:00	Batch 7 4:00 – 5:30

Change Shift : 5:30 – 6:00
Change flavor allowance Remove 1 batch
Maximum Capacity : 7 batches
Minimum Capacity : 6 batches
Change Shift time would also be allotted for the preparation of all materials needed by the next batch.

4.2. Improve Storage Drums

Fig 5: Sample Lining of the Storage Drum

Fig 5 indicates Lined storage drums to reduce the instance of Overweight during checking of Finish Mix.

4.3. Re-evaluate Standard Operating Procedures

Given would be the suggested SOP for the soup mixing section
Suggested SOP for the Soup Mixing Process
Preparation of All Raw Materials:

- All Raw materials should be prepared ahead of the shift.
- Inventory in the staging area should be sufficient and no bulk materials should be lacking
- All excess raw materials should be prepared and properly labeled as complete and checked
- Checking of both bulk and excess raw materials would be done prior to the shift by the regular operator
- All raw materials (excess and bulk) would be lined up in the mixing area according to its sequence during change shift time

Mixing Process

- During dumping of all RM, regular operator should be monitoring the sequence of raw materials
  - Ribbon mixers are then properly sealed before starting the machine

- Drums and drum size plastics are then prepared by one helper in the dumping area
- The other helper would then be cleaning packaging materials at the mixing area.

Dumping of Finish Mix
- Hold Tags are accomplish by one helper while waiting for the mixer to stop
- Drums should be lined by the drum size plastic bags
- Drums should not be filled beyond the indicated line to reduce overweight during checking
- Finish Mix should be checked first before sealing to reduce waste of tape.

Checking of Finish Mix
- A sample is then taken, properly labeled and tagged to be release to the Quality Assurance Department
- Checking of weight per drum is done and checked drum is then sealed and labeled with a hold tag

Storage
- Ask assigned helper the location where to store the drums
- Drums are then place on storage area
- Ensure that drums are sealed and labelled properly

4.4. Automate Ribbon Mixer Sifter and install machine cover

Automating the sifter in the ribbon mixer would aid in minimizing risk of particulate inhalation and human contact with the soup mix. Minimization of human contact would ensure sanitation of the mix and almost completely remove the risk of spoilage due to human error. Installing a machine cover would improve environmental conditions of the area. It would encapsulate the raw materials so that minimal dust particulates would be present in the air. Overall it is the researcher's view that automating this process would reduce the standard time and possibly reduce the number of helpers needed in the area.

4.5. Train Helpers according to NIOSH Lifting standards and Improvement of workers PPE

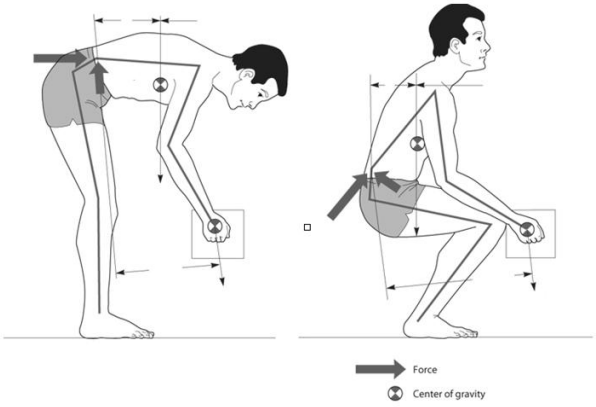

Fig 6: Proper Lifting Guide

Table VII: Sample Demand Plan year 2018 for Nissin Mini Creamy Seafood

Agreed Demand Plan CY18	January	February	March	April	May	June	July	August	September	October	November	December
Cases	23,287	25,929	25,929	24,451	25,243	30,412	33,646	38,400	38,566	38,324	42,403	38,220
Kg	15,000.50	16,702.73	16,702.73	15,750.53	16,260.54	19,590.00	21,673.73	24,735.98	24,842.94	24,686.79	27,314.32	24,619.99
Batches	41.67	46.40	46.40	43.75	45.17	54.42	60.20	68.71	69.01	68.57	75.87	68.39
Shift @ 3	6.94	7.73	7.73	7.29	7.53	9.07	10.03	11.45	11.50	11.43	12.65	11.40
Shift @ 4	5.21	5.80	5.80	5.47	5.65	6.80	7.53	8.59	8.63	8.57	9.48	8.55
Shift @ 5	4.17	4.64	4.64	4.38	4.52	5.44	6.02	6.87	6.90	6.86	7.59	6.84

1 case = 48 Cups
1 flavor pack = 12.2 g

Source: Nissin Demand plan for 2018: Year Plan 2

Table VIII: Cost Benefit Computation for Batch increase to 4 Batches per Shift

Per Shift Computation:
NISSIN MINI CREAMY SEAFOOD 45gx48 = 12.2g
1 Batch = 360 kg
Contractual Personnel Rate/Hour = 60.58 php
No. of Personnel = 5 per shift
Personnel ₱ 302.90

Actual Cost	January	February	March	April	May	June	July	August	September	October	November	December	
Personnel	₱ 2,103.54	₱ 2,342.25	₱ 2,342.25	₱ 2,208.72	₱ 2,280.24	₱ 2,747.14	₱ 3,039.34	₱ 3,468.76	₱ 3,483.76	₱ 3,461.86	₱ 3,830.33	₱ 3,452.50	Grand Total ₱ 34,760.69
Future Cost @ 4 Batches	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**	
Personnel	₱ 1,577.66	₱ 1,756.69	₱ 1,756.69	₱ 1,656.54	₱ 1,710.18	₱ 2,060.35	₱ 2,279.50	₱ 2,601.57	₱ 2,612.82	₱ 2,596.40	₱ 2,872.75	₱ 2,589.37	Grand Total ₱ 26,070.52
Total Savings	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**	
Personnel	₱ 525.89	₱ 585.56	₱ 585.56	₱ 552.18	₱ 570.06	₱ 686.78	₱ 759.83	₱ 867.19	₱ 870.94	₱ 865.47	₱ 957.58	₱ 863.12	Grand Total Savings ₱ 8,690.17
											Percentage %		25.00

Source: NURC CBA Form revised 2018

CBA Form revised 2018

Table IX: Cost Benefit Computation for Batch increase to 5 Batches per shift

Mini Creamy Seafood

Per Shift Computation:
NISSIN MINI CREAMY SEAFOOD 45gx48 = 12.2g
1 Batch = 360 kg
Contractual Personnel Rate/Hour = 60.58 php
No. of Personnel = 5 per shift
Personnel ₱ 302.90

Actual Cost	January	February	March	April	May	June	July	August	September	October	November	December	
Personnel	₱ 2,103.54	₱ 2,342.25	₱ 2,342.25	₱ 2,208.72	₱ 2,280.24	₱ 2,747.14	₱ 3,039.34	₱ 3,468.76	₱ 3,483.76	₱ 3,461.86	₱ 3,830.33	₱ 3,452.50	Grand Total ₱ 34,760.69
Future Cost @ 5 Batches	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**	
Personnel	₱ 1,262.13	₱ 1,405.35	₱ 1,405.35	₱ 1,325.23	₱ 1,368.14	₱ 1,648.28	₱ 1,823.60	₱ 2,081.26	₱ 2,090.26	₱ 2,077.12	₱ 2,298.20	₱ 2,071.50	Grand Total ₱ 20,856.41
Total Savings	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**	
Personnel	₱ 841.42	₱ 936.90	₱ 936.90	₱ 883.49	₱ 912.10	₱ 1,098.85	₱ 1,215.74	₱ 1,387.51	₱ 1,393.51	₱ 1,384.75	₱ 1,532.13	₱ 1,381.00	Grand Total Savings ₱ 13,904.28
											Percentage %		40.00

Source: NURC CBA Form revised 2018

Demand plan for 2018: Year Plan 2

CBA Form revised 2018

Fig 6: display the force and center of gravity of a person when lighting objects. It is always proper to lift with your legs not with your back most especially when the object is heavy.[2]. For the list of suggested PPE refer to Appendix Annex B Table VI.

5. Financial Cost Benefit Analysis

Table VII displays the ABC Company Demand plan for Mini Creamy Seafood year 2018. Along with it is the computation for case conversion to kg and to batches per shift. Computation is done by the formula below.

$$Total\ Kg = \frac{Cases\ x\ pack\ per\ Case\ x\ 1.1\ Allowance\ x\ grams\ per\ pack}{1000\ kg} \quad [1]$$

$$Total\ Batches = \frac{Total\ Kg}{360kg} \quad [2]$$

5.1. Cost Reduction Analysis at 4 Batches

Table VIII displays Cost Reduction Percentage savings for increasing batches from 3 to 4 per shift. Computation Displays that there would be a *25% labor cost reduction* using Php 60.58 / hour contractual personnel rate.

5.2. Cost Reduction at 5 Batches

Table IX displays Cost Reduction Percentage savings for increasing batches from 3 to 5 per shift. Computation Displays that there would be a *40% labor cost reduction* using Php 60.58 / hour contractual personnel rate.

6. Tangible and Intangible Cost Benefit Analysis

Cost of the Redesign Schedule and increase number of batches per shift are (1) Increase in employee workload, (2) possible complaint from current helpers and (3) redesign of plan for output and raw materials needed. On the other hand, tangible benefits includes (1) Increase in daily yield, from approximately 6480kg per day with 3 shift to 8640kg per day with 3 shifts and (2) a possible decrease in days of work from 7days a week to 6 days a week thus decreasing labor cost. Intangible benefits would include (1) Increase in employee productivity. (2) Reduction of 3rd party helper idle time and (3) decrease in the tendency of over break for 3rd part helpers.

Improving the storage drum designs costs are the (1) labor of individually lining the drums and (2) 3rd party helper reorientation. While foreseen tangible benefits include (1) reduce in waste of tape when drums are overweight and (2) Minimize the risk of spilling the soup batch. Intangible benefits are foreseen as a (1) reduction in time since there won't be a need to look for a scooper to transfer excess and removing the tape seal when reopening sealed drum size bag.

Re-evaluation of the standard operating procedures (SOP) costs are (1) time to be spent with employee retraining and re-orientation and (2) Re approval of guidelines by the head office. While tangible benefits include (1) Reduction or unexpected delay due to lack of prepared Raw materials since preparation and checking is done prior to shift. Intangible benefits include (1) Increase in Regular Employee Productivity and (2) Increase in regular employee's pride in his work since he would be hands on with both monitoring and checking of raw materials.

Costs of automating the ribbon mixer sifter and installation of machine cover includes (1) additional Investment cost for the company, (2) time needed for evaluation of proper machine to be install, (3) Possible downtime during machine installation, (4) regular employee and 3rd Party helper training on how to use new machine, (5) close monitoring for the first few months when the machine is installed and (6) re-evaluation of Operation guidelines

Additional PPE for machine vibration is needed. However, with all that cost foreseen by the researcher, tangible benefits include (1)

improvement of the work environment: minimization of dust particles from raw materials in the air. (2) Reduction of approximately 7 minutes and 47.28 seconds in total batch cycle time since workers would no longer need to manually sift the raw materials. (3) Possible increase of 5/6 batches per shift from current 3 batches due to reduction of cycle time. (4) Possible decrease of needed 3rd party helpers from 5 to 4. 2 helpers in preparation of raw materials and 2 for the ribbon mixers. Moreover, intangible benefits include (1) Eliminate direct human contact with the raw materials thus minimizing the risk of food contamination. (2) Increase in worker safety from both health hazard of particulate inhalation and the physical risk of not having a cover for the machine. (3) Reduction in 3rd part laborers' fatigue due to the environmental condition and manual labor needed. (4) Overall increase in operation productivity.

For Train Helpers according to NIOSH Lifting standards and improvement of worker's PPE costs include (1) Time and cost of training the helpers and regular Employees and (2) Additional cost of purchasing proper PPE. Tangible benefits include (1) Reduce the risk of dropping and wasting raw materials due to wrong lifting especially when raw material is already open. (2) Reduce the risk of MSD due to improper lifting of sacks (3) Reduction high tendency in acquiring respiratory diseases due to continuous inhalation of raw material particulates. Intangible benefits include (1) Increase in worker productivity due to reduction of fatigue caused to environmental situation and (2) Increase in overall work place safety. Additional PPE include (1) Eye protection / Goggles: This would aid in protecting the helpers from eye irritation due to the raw materials that they handle [4]. (2) Proper face mask : Face mask like the N95 or N99 mask would filter out most if not all the raw material particulate in the air [5][6]. (3) Elbow height tight fitting gloves: this would Protect the skin of the helpers from allergens present come raw materials[8]. (4) Plastic like overalls: design of the apron should be revise due to that current one used by the helpers is insufficient when it comes to protecting them from the raw materials they are handling. Plastic overalls could be used in place of aprons to fully cover their clothes and body. [7]

7. Conclusion

Base on the study done by the researcher it is concluded that the standard time for the soup mixing process is 1 hour and 30 minutes. The best course of action to maximize production capacity is to increase batches done per shift to a maximum of 5 and a minimum of 4, given that all preparation, both excess and bulk raw materials, is done prior to the shift. Moreover, regular operators should be in close monitoring whenever raw materials are dump into the mixer to ensure that the sequence is proper and quality of the mix would not be compromised. Lastly when budget and company permits it is still best to automate the process for its overall improvement.

8. Recommendations

The researcher gives the following recommendations;

- Implement most if not all the Alternative course of Action
- Further study and observations should be done to polish all the improvements to be implemented
- Additional IE tools and techniques could be used to further improve the process
- Evaluation of Mechanical Engineer should be done for automation design
- Evaluate the soup mixing process via ergonomic approach
- Study the standard time per SKU to test the difference, if there is any, between times of various SKU.

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