Zingerman’s Mail Order
Cheese Waste Improvement Kata

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Company Background

Zingerman's Delicatessen was founded in 1982 by Ari Weinzweig and Paul Saginaw, who are still business partners to this day. The company experienced great success and became internationally known for selling high quality products over the next ten years. When the company plateaued, Mr. Weinzweig and Mr. Saginaw strove to find a way to continue to grow while maintaining the feel of a small business. Their solution was to create Zingerman's Community of Business (ZCoB), which consists of seven small businesses located in and around Ann Arbor, Michigan. One of those is Zingerman's Mail Order, where customers can have their favorite products shipped anywhere in the country at any time. The mail order business was started in the basement of the deli in 1994, and further expanded when the website used for Zingerman's deli began incorporating the mail order business as well.

Throughout this expansion, Zingerman's focused on maintaining an environment that encompassed a sense of community, belief in their people, and a passion for great food and customer service. One aspect of the mail order business that truly embodies that mindset is the cheese department. From the beginning, a priority of Zingerman's was to provide customers with full flavor cheeses that uphold the traditions of both cheese making and cutting. To this day, every type of cheese sold at Zingerman's is hand-cut, and Zingerman's Mail Order is the only company in the world that still hand-cuts cheese to order.

The Team, roles and responsibilities

This improvement kata team consisted of three University of Michigan (UM) students, who were the learners throughout the process. The onsite team at Zingerman's Mail order consisted of a product manager, who acted as the second coach, and two cheese mongers, that acted as both coaches and learners. Table 1 shows the team members and their respective roles and responsibilities.

Table 1. Team Roles and Responsibilities

Team Members	Roles	Responsibility
Lisa Roberts	Coach	To coach the UM Students and Operators during the course of the project
Tara Stow Diego Aliste	Operator/Coach/ Learner	During the project, helped come up with the experiments and conduct the experiments. After the project is complete, Tara and Diego will continue with the Improvement Kata and PDCA iterations with Lisa as the Coach.
UM Students	Learner	Understand the Improvement Kata and provide recommendations for experiments and Target Conditions. Responsible for keeping the Kata Board up-to-date. Practice the Coaching Kata and eventually become a Coach

Division of Labor

Both teams helped establish each target condition, and the UM students worked with the two cheese mongers to develop experiments for the onsite team to implement. The onsite team was responsible for documenting the results of the experiments, and the two teams worked together to analyze the results in order to develop each new experiment and target condition. Table 2 depicts the division of labor between the UM students and onsite team at ZMO throughout the project, and the full project charter is attached as Appendix I.

Table 2. Division of Labor

Activities	UM Students
Current state analysis and record	Lauren Gainor
Weekly visits to ZMO for observing and checking	Kelly Berry
PDCA routines	Katie Cappetta
Ensure storyboard is updated	
Project documentation	
PDCA coaching cycles with ZMO coach	

Activities	Onsite Team at ZMO
Record and track data from experiments	Diego Aliste
Coaching cycles with project team once a week	Tara Stow
Communication with project team	
Coaching cycles with project team	Lisa Roberts

Product Overview

From the beginning, a priority of Zingerman's was to provide customers with full flavor cheeses that uphold the traditions of both cheese making and cutting. To this day, every type of cheese sold at Zingerman's is hand-cut, and Zingerman's Mail Order is the only company in the world that still hand-cuts cheese to order. Although this distinguishes Zingerman's from other businesses and is in line with the overall priorities of the original founders, it does present some challenges. One of the biggest challenges is the relatively large amount of cheese waste that cannot be sold when hand-cutting the cheese.

One of the difficulties in hand-cutting cheese to order at preset increments is the variety in cheese shapes, densities, and textures, both between different types of cheese and different wheels of cheese of the same type. Also, because of the human factor involved and the difficulty in making precision cuts, there is a possibility for the cheese to be under the specified weight required. If this occurs, the cheese cannot be sold. Also any wedge of cheese outside the tolerance level of +10% must be recut which also results in cheese waste.

Parmesan Selection

The decision to focus only on reducing the amount of Parmesan cheese waste was made because Parmesan waste makes up approximately 25% of all of the cheese waste at Zingerman's Mail Order. Since this was a large portion of the overall waste, the thought was that the reduction in Parmesan waste would have a significant impact on the amount of overall cheese waste. In addition, by focusing on only one type of cheese, the variability in shapes, densities, and textures would be reduced. The total cheese waste for all cheeses for January 2016 was 66.21lbs, with Parmesan making up 26.55% of total cheese waste as seen in Figure 1. The portion of 49% was made up of a large variety of less popular cheeses.

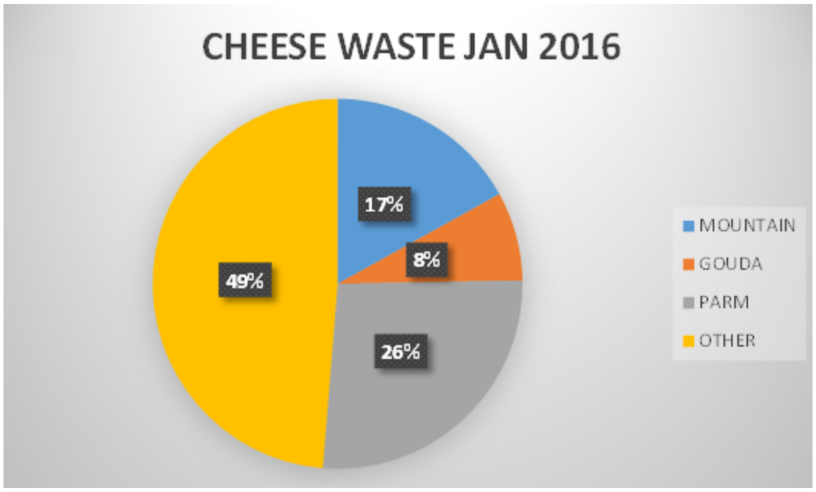


Figure 1. Cheese Waste Pie Chart

Company's Vision

Zingerman's Mail Order bottom lines: *Great Food! Great Service! Great Finance!*

Maintain continuous flow by feeding the stations downstream, not blocking the stations upstream, working at the correct pace as efficiently as possible while producing zero defects.

The mail order's guiding principles include:

1. Model and teach the philosophy, tools, and processes of Lean
2. Be a model of continuous improvement for the ZCoB
3. Always able to meet planned guest demand
4. Strive for zero in-process mistakes
5. Cultivate a culture of continuous improvement in order to solve problems and eliminate waste
6. Aid, assist, and cooperate with other departments to achieve in-process mistakes
7. Balance the needs of the department with the needs of the overall business
8. Do it the "right" way the first time, not the easy way.

Zingerman's Mail Order mission and guiding principles show they are fully committed to selling high-quality food with great service that exceeded customer's expectations.

Challenge

"Waste No Parm, Want no Harm"

The challenge was to reduce the cumulative Parmesan cheese waste due to miscuts, compared to Parmesan sold, from 5.60% to 2.80% by December 2016. One of the priorities throughout the improvement kata was to uphold the traditions of cutting cheese by using only non-electronic tools, and by focusing on maintaining a consistent cheese face (paste) to rind ratio for every customer.

Initial Current State

From January to April 2015, Parmesan sales made up approximately 10% of all cheeses sold. Of the 1699.7 lbs of Parmesan sold, 64.75 lbs of Parmesan cheese waste was recorded. This resulted in approximately 3.81% of waste for Parmesan sold for the January to April 2015 timeframe. The total cheese waste for all cheeses in January to April 2015 was 216.6 lbs, with Parmesan making up 29.89% of total cheese waste. Graphs showing the historical data are included as Appendix II. A cost analysis was done as well, revealing that the 64.75 lbs of Parmesan Cheese resulted in a lost profit of $1,159.23.

The initial current condition of Parmesan cheese waste was recorded in January 2016. Parmesan sales made up approximately 6.2% of all cheeses sold. Of the 314.2 lbs of Parmesan sold, there was 17.58 lbs of Parmesan cheese waste. This resulted in approximately 5.6% of waste for Parmesan sold in January. The benchmark used as the initial current state was the waste of 5.6% in January 2016 of the total Parmesan sold as seen below in Table 3. The data collected from February to April is shown in the tables contained in Appendix III.

Table 3. January Parmesan Waste and Parmesan Sold

JANUARY 2016

DATE	PARM WASTE (LBS)	PARM SOLD	%
JAN 3-9	9.16	122.2	7.50
JAN 10-16	3.91	57.5	6.80
JAN 17-23	2.45	83	2.95
JAN 24-30	2.06	51.5	4.00
TOTAL	**17.58**	**314.2**	**5.60**

Important Current State Observations at the Gemba

The work pattern for the cheese cutting process occurs entirely in the cheese room and includes setting the Parmesan wheel to be cut on the moveable cutting table, procuring the three tools needed for the three steps of opening the wheel, performing the three steps for opening the wheel at the table, and then moving the pieces to the stationary table. Once those pieces are needed for cutting, they are removed from the shelf, weighed, and then cut and bagged, but all of these steps occur at the stationary table in the cheese room.

The actual process of opening the wheel includes three separate processes: (1) scoring the rind; (2) placing wedges; and (3) wire cutting. The dryness and hardness of the particular wheel affects the time it takes to open the wheel. Initially, we measured the cycle time to cut the wheel in half, and found that it varies from 5 to 15 minutes. This time does not include cutting the wheel into quarters or into eighths. This time is also increased when a wire breaks, which takes approximately 1.05 minutes to replace. Since these times are difficult to measure, incredibly variable, and do not affect the amount of waste generated, we chose not to include the times for each step in our block diagram, and reducing the overall cycle time is not part of our challenge.

The computer system, Eve, generates the required amounts, sizes, and types of cheese per day based on the orders. Once a cheese monger begins their shift, they check their required cheese cuts for the day and grab the correct Kanban for the cheese specified. Next, they print the label and then cut the cheese to the Kanban weight. The tolerance for the cheese is +10%. However, if the cheese is cut below the specified amount, the cheese cannot be sold and is considered waste. After the cheese is cut to the specific Kanban weight, the cheese is bagged, placed in the tote, and placed on the pick line. It should be noted that the bagger is only part of the cheese cutting staff in times of high demand-for the majority of the year, there is only one operator cutting and bagging the cheese. The block diagram for the total cheese cutting process can be seen below in Figure 2.

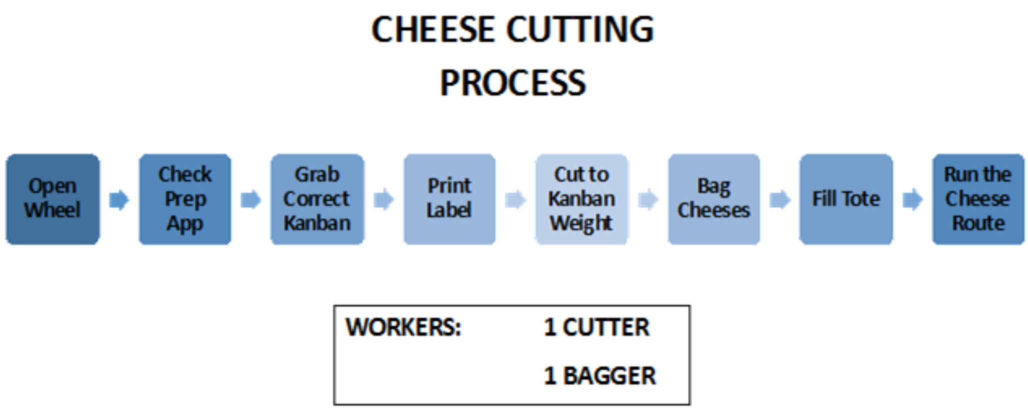


Figure 2. Cheese Cutting Process

The takt for cheese at ZMO is extremely variable, and changes not only daily but could change throughout the day. For this reason, takt was not included in the current condition analysis. Additionally, since there is usually only one operator cutting cheese, a work balance diagram is not necessary. For times of high demand, such as the end of the year, a work balance diagram might be necessary. One additional observation about the current state includes the significance that certain human factors have on the accuracy of cuts made. For example, if demand is unusually high, and the staff is not increased to account for that, the one cutter is under an additional amount of stress to meet takt, and can tend to rush and unintentionally create more waste.

Traditionally, the Parmesan wheel weighs between 75lbs and 85lbs. The Parmesan wheel is first broken into two halves. The next step is breaking down the wheel into fourths and then further into eighths.

Focus Process

Since a large amount of cheese waste is generated when hand-cutting cheese due to the human factors involved and the variability in texture, density, size, and shape of the cheese, the process of cutting Parmesan cheese to order was chosen as the focus process.

Hand cutting cheese involves several steps: opening the cheese wheel, dividing the whole wheel into smaller sections, and then measuring and cutting each individual piece to order. At ZMO, a wire is used to cut the cheese to prevent excess crumbling of the cheese, which cannot be sold and therefore would add to the amount of waste produced. Once the wheel is broken down into eighths, the eighths are then broken down into 1 pound, 2 pound, or 4 pound pieces, according to the demand for that day. This kata focused on standardizing the way these cuts were made, which was intended to remove some of the variability inherent to the overall value stream and ultimately reduce cheese waste.

Target Condition – First Target

The first target condition was to reduce the Parmesan cheese miscuts by 7.5% by controlling the variability inherent in breaking down the Parmesan wheel.

Achieve By Date: 31 Mar 2016

Outcome Metrics:

- Weight of cheese cuts
- Waste (in lbs) of cheese miscuts
- Waste (by volume) of cheese miscuts

Process Metrics:

- No additional operators
- Standard process to make cuts
- Maintain paste to rind ratio

Obstacles

There were various obstacles that prevented the group from achieving the target condition and were captured using the obstacle parking lot form:

- Texture/density of rind varies
- Thick, tough rind yields inconsistent cuts when breaking down the wheel
- Rind to paste ratio is difficult to maintain (and difficult to quantify)
- Parmesan cuts must be thicker to maintain integrity through shipping
- Variability of orders from day to day makes it difficult to plan cuts
- Human factors involved with hand cutting
- Variability in lead-time for orders
- Increase in cheese demand not necessarily reflected in takt (which determines staff) and causes cutters to rush cutting
- Variability of wire strength
- Crumbles of parmesan cannot be sold-every piece must be 0.5 lbs or larger
- No interaction with customer

PDCA Experiments

The following sections describe the various PDCA experiments conducted in order to reach the first target condition by focusing on specific obstacles to the target conditions. All the experiments have been recorded in the PDCA cycles form shown in Figure 3. A larger version can be found in Appendix IV.

PDCA CYCLES RECORD *(Each row = one experiment)*

Obstacle: Thick tough rind yields inconsistent cuts when breaking down the Parmesan wheel.
Process: Parmesan Wheel Cutting
Learner: UM Students **Coach:** Diego & Tara

Date, step & metric	What do you expect?	Do a Coaching Cycle	Conduct the Experiment	What happened	What we learned
29 Feb 2016 Use template to measure ½, ¼, and1/8 wheel portions Metric: Weight of portions & std dev	Using a template to break Down the Parm wheel will decrease the standard deviation of weights of wheel portions			standard deviation of weight of 1/8 increased from 0.5 lbs to 0.51 lbs	The data collection was not consistent & it was hard to determine which eighths correlated w/same wheel. Need better data collection
09 Mar 2016 Measuring the eighth with a ruler from the tip/nose & the outer edge to consistently cut at least a 4lb piece	Method to guarantee at least a 4 lb piece from each eighth wheel			All cuts were between 1.5"-2.0"from the tip and5.5"-6.0" from the edge. All but one cut were at or above 4lbs.	The variability of the weight determines which cut would be better. Need more data to determine a standardized cut.
16 Mar 2016 Continue to break down the cheese eighth wheel start measuring each cut from remaining wheel -after 4lb cut. Continue to collect data for 4lb cut	Collecting data for additional cuts will help determine a standardized cut/cuts.			5 cuts were above 4 lbs, & 4 cuts were below 4 lbs. When breaking down the second 4 lb piece, all cuts were above 4 lbs, but were "heavy" 4 lb pieces.	Inconsistencies in people & process yield different cuts – right handed vs. left handed use different measurements. Cuts were based on cutter's experience, not standard procedure.

PDCA CYCLES RECORD *(Each row = one experiment)*

Obstacle: Inconsistency in people and process yields inconsistent cuts.
Process: Parmesan Wheel Cutting
Learner: UM Students **Coach:** Diego & Tara

Date, step & metric	What do you expect?	Do a Coaching Cycle	Conduct the Experiment	What happened	What we learned
23 Mar 2016 Use standard procedure (flow chart) to break down eighth wheel into two 4lbs pieces. Continue recording data and measurements.	Data to determine whether standard measurements consistently yield two 4lb pieces.			The flow chart that was being used was incorrect from the information found during experimentation. (Used incorrect data for flow chart). Created cuts that were below The 4 lb weight.	Proper flow chart is needed to collect data.
30 Mar 2016 Use standard procedure (flow chart) to break down eighth wheel into two 4lbs pieces. Continue recording data and measurements.	Data to determine whether standard measurements consistently yields two 4lb pieces. Use to fine tune measurements on flow chart.			All cuts between 10 and 11 lbs were consistently above 4lbs. One piece that was below 10 lbs was less than 4lbs	A new section needs to be added for pieces below 10 lbs. New measurement 1.5" from the tip and 6.5" from the corner
06April 2016 Add section addressing pieces below 10 lbs using New measurements. For second cut, add section addressing pieces less than 6 lbs (cut 2lb piece)	Continue to collect data to determine whether standard measurements consistently yield results in accordance w/flow chart. Determine measurements for 2lb piece			All initial cuts were above 4 lbs. For <10lb pieces, they were "heavy". For <6 lbs (second cut), cutting a 2lb piece leaves very thin heavy pieces	For <6lb for the second cut, a different method needs to be developed.

Figure 3. PDCA Cycles

A coaching cycle was conducted at the end of each experiment cycle, and each time a different member of the team answered the 5 Kata questions.

First Experiment

Duration: Two weeks (24Feb to 09Mar)

The Obstacle being addressed – Thick tough rind yields inconsistent cuts when breaking down the Parmesan wheel.

What did we do? – Used a template to measure $\frac{1}{2}, \frac{1}{4}$, and $\frac{1}{8}$ wheel portions. The template used was defined as a ruler to measure the center of the wheel and use the dots on the side of the wheel as an indicator to cut. Used the ruler to score instead of scoring free-handed. The metric was the weight of the portions and the standard deviation. (See Figure 4)

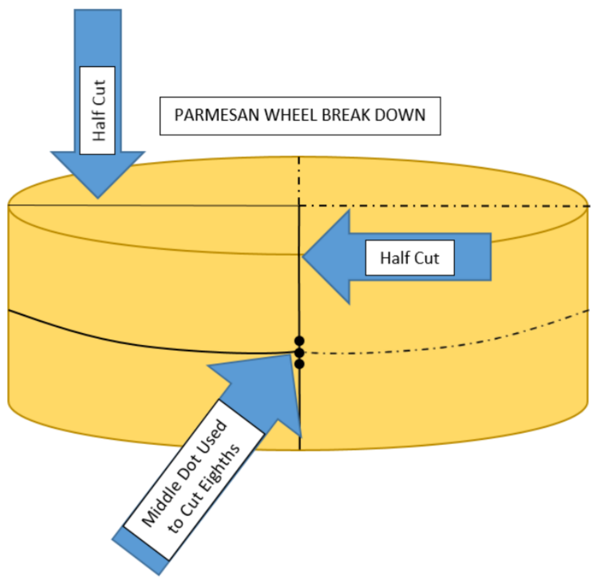


Figure 4. Breakdown of Cheese Wheel

What did we expect? – Using a template to break down the Parmesan wheel would decrease the standard deviation of the wheel portions.

What happened? – The standard deviation of the weights of the eighth wheel portions increased from 0.5 pounds to 0.51 pounds.

What did we learn? – Using a template did not affect the standard deviation of the weight of the wheel portions. Also, when determining the standard deviation of weight per wheel portion, it was important to accurately collect the data for a specific wheel and not combine all the data to allow the standard deviation of each wheel to be calculated. Better data collection was needed.

Second Experiment

Duration: One week (09Mar to 16Mar)

The Obstacle being addressed **–** Thick tough rind yields inconsistent cuts when breaking down the Parmesan wheel.

Actual Condition:

- Waste of cheese miscuts from 06Mar-12Mar (lbs) – 5.5
- Waste of cheese miscuts 06Mar-12Mar (%) – 10.28
- Cumulative waste (January to Present, %) – 37.47% (reduction)

What did we do? **–** Made cuts from the eighth of the Parmesan wheel using a ruler from the tip/nose and the outer edge to consistently cut at least a 4 pound piece. The cheese mongers would record the measurements used to make the cut and the weight of the cheese for each cut (Figure 5).

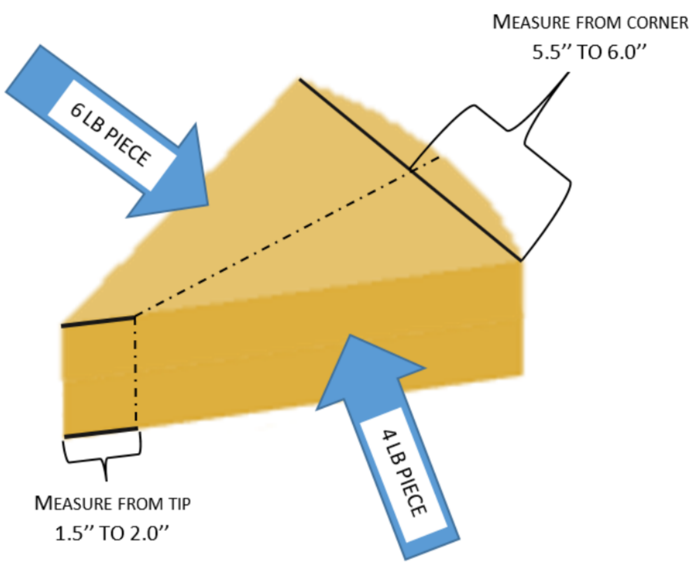


Figure 5. Diagram of Cheese Cutting Procedure

What did we expect? **–** A method to guarantee at least a 4 pound piece from each eighth wheel.

What happened? **–** All cuts were between 1.5"-2.0" from the tip and 5.5"-6.0" from the edge. All but one cut were at or above 4 pounds.

What did we learn? **–**Measuring the cuts was a valuable step toward reducing the waste. The variability of the weight of the eighth of the wheel determined which cut would be better. Having a common tool that is used every day (i.e. a Parmesan knife) would be useful for measuring rather than using a ruler. More data was needed to determine standardized cuts. Determined that 1.5 inches to 2 inches from the tip was the most consistent way to get at least a 4 pound piece, with a range of 5.5-6.0 inches from the left corner (depending on the weight of the eighth of the wheel)

Third Experiment

Duration: One week (16Mar – 23Mar)

The Obstacle being addressed – Thick tough rind yields inconsistent cuts when breaking down the Parmesan wheel.

Actual Condition:

- Waste of cheese miscuts from 13Mar-20Mar (lbs) – 5.23
- Waste of cheese miscuts 13Mar-20Mar (%) – 3.37
- Cumulative waste (January to Present, %) – 37.02% (reduction)

What did we do? – Continued to break down the cheese wheel eighths. Started measuring cuts from remaining wheel (after the 4lb piece was cut). Continued to collect data for the 4 pound cuts.

What did we expect? – Collecting data for the additional cuts would help determine a standardized cut/cuts.

What happened? – Five cuts were above 4 pounds and four cuts were below 4 pounds. When breaking down the second 4 pound piece, all cuts were above 4 pounds, but were "heavy" 4 pound pieces.

What did we learn? – Inconsistencies in people and processes yielded different cuts. Left-handed versus right-handed people used different measurement orientations. Cuts were based on cutter's experience and not a standard procedure. Measuring the cuts was a valuable step toward reducing the waste. Having a common tool that is used every day (i.e. Parmesan knife) would be useful for measuring rather than using a ruler.

Fourth Experiment

Duration: One week (23Mar – 30Mar)

The Obstacle being addressed – Inconsistencies in people and processes yields inconsistent cuts.

Actual Condition:

- Waste of cheese miscuts from 21Mar-27Mar (lbs) – 7.79
- Waste of cheese miscuts 21Mar-27Mar (%) – 4.36
- Cumulative waste (January to Present, %) – 35.48% (reduction)

What did we do? – Used standard procedure in the form of a flow chart (Figure 6) to break down eighth wheel into two 4 pound pieces.

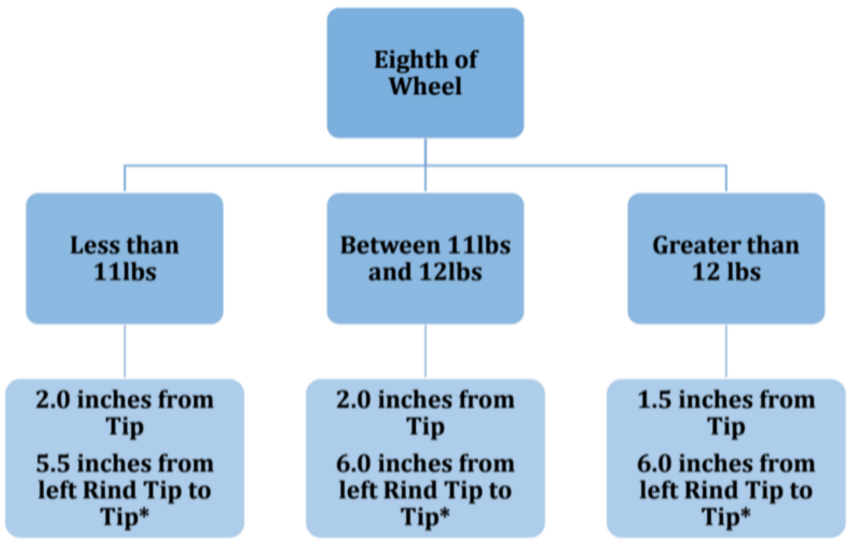


Figure 6. Initial Flow Chart

What did we expect? – To collect enough data to determine whether the procedure we created consistently yielded two four pound pieces.

What happened? – The flow chart was not yielding 4 lb pieces; it was actually creating more miscuts.

What did we learn? – The numbers on the flow chart were incorrectly recorded on the flow chart. When creating the flow chart, the numbers for > 12 pounds was recorded for <11 pounds and vice versa. More attention should be paid to details when developing the flow charts and double check to make sure the flow chart made sense intuitively.

Additionally, it is important to note that it was discovered that the correct way to graph the data to clearly see the percentage reduction had not been identified. To correct this, the cumulative waste as a percentage of volume sold, including from January, began being graphed. This graph showed the team that the first target condition was met during the third week of February, and had been maintained since. As a result, a new target condition was established.

New Target Condition – Second Target

Second Target Condition: Reduce the cumulative Parmesan cheese waste due to miscuts, compared to Parmesan sold, from 3.6% to 3.3%

Achieve By Date: 13 April 2016

Outcome Metrics:

- Weight of cheese after Cuts
- Waste (lbs) of Parmesan cheese miscuts
- Waste (% volume) of Parmesan cheese miscuts

Process Metrics:

- No Additional Operators
- Standardized Process to Make Cuts
- Maintain Paste to Rind Ratio

The reason such a small reduction (0.3%) was chosen was because as the overall cumulative percentage continued to decrease, larger reductions would be more and more difficult to achieve.

Obstacles

- Texture/density of rind varies
- Thick, tough rind yields inconsistent cuts when breaking down the wheel
- Rind to paste ratio is difficult to maintain (and difficult to quantify)
- Parmesan cuts must be thicker to maintain integrity through shipping
- Variability of orders from day to day makes it difficult to plan cuts
- Human factors involved with hand cutting
- Variability in lead-time for orders
- Increase in cheese demand not necessarily reflected in takt (which determines staff) and causes cutters to rush cutting
- Variability of wire strength
- Crumbles of parmesan cannot be sold-every piece must be 0.5 lbs or larger
- No interaction with customer

Fifth Experiment

Duration: One week (30Mar – 06Apr)

The Obstacle being addressed **–** Inconsistencies in people and processes yields inconsistent cuts.

Actual Condition:

- Waste of cheese miscuts from 28Mar-03Apr (lbs) – 8.44
- Waste of cheese miscuts 28Mar-03Apr (%) – 3.16
- Cumulative waste (January to Present, %) – 36.56% (reduction)

What did we do? – Revised the flow chart (shown below in Figure 7) to reflect the correct numbers and continued to use the standard process to break down the eighth of a wheel into two four pound pieces. Continued to record data and measurements.

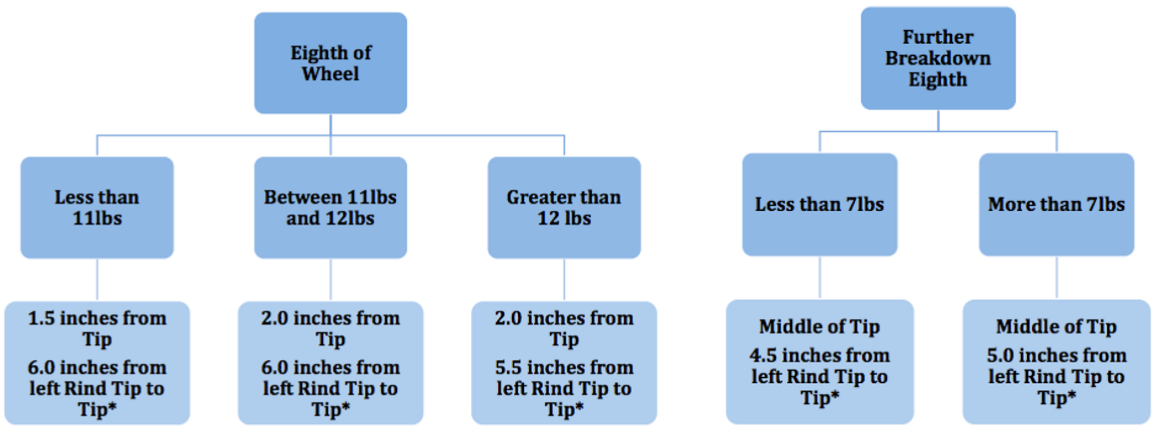


Figure 7. Updated Flow chart for Experiment 5

What did we expect? – The updated numbers would increase the number of four pound pieces cut, and that more data would be gathered to use to refine the measurements even further.

What happened? – All cuts that were between 10 and 11 pounds were consistently above 4 pounds. One piece that was below 10 pounds yielded a cut that was not above 4 pounds

What did we learn? – Learned that for smaller pieces (less than 10 pounds) had not been accounted for in the original flow chart; anew section needed to be added to the flow chart for pieces below 10 pounds. New measurement was 1.5” from the tip and 6.5” from the corner. Learned that cutter could use the knife commonly found in cheese room to make measurements as indicated on flow chart, which saved time by not having to use the ruler.

Sixth Experiment

Duration: One week (06Apr – 13Apr)

The Obstacle being addressed **–** Inconsistencies in people and processes yields inconsistent cuts.

Actual Condition:

- Waste of cheese miscuts from 04Apr-13Apr (lbs) – 3.66
- Waste of cheese miscuts 04Apr-13Apr (%) – 4.33
- Cumulative waste (January to Present, %) – 35.99% (reduction)

What did we do? **–** Added another section to the flow chart that addressed pieces below 10 pounds. Also added a section for a piece that was less than 6 pounds once the initial 4 pound piece was cut off that addressed trying to get a 2 pound piece cut off of that. Continued recording data for the initial 4 pound piece, and took measurements to find a way to consistently get a 2 pound piece from the piece that was less than 6 pounds (Figure 8).

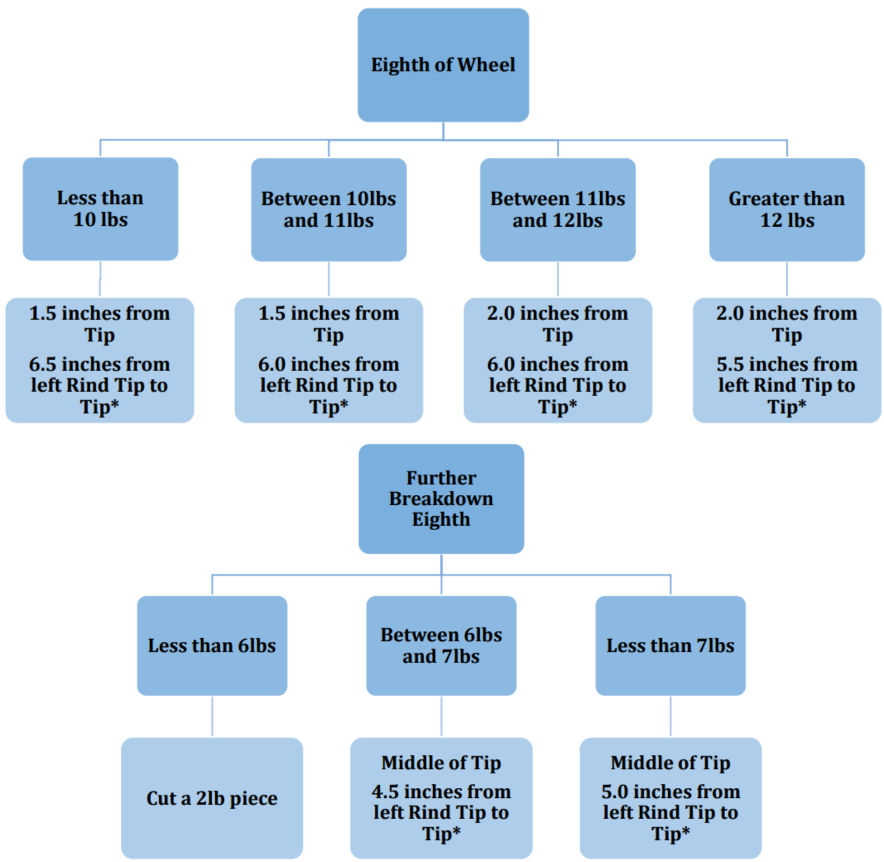


Figure 8. Flowchart including less than 10lb cuts

What did we expect? **–** To continue getting 4 pound pieces from the initial eighth of the wheel, and also to determine whether a 2 pound piece could consistently be cut off of the <6 pound piece.

What happened? **–** The demand for cheese was greatly reduced after the completion of the cheese sale, so it was difficult to collect enough data. The one piece that was cut off of a <10 pound piece was greater than 4 pounds, and a little bit heavy, which allowed for a smaller ½ pound piece to be cut off. Only one piece that was >2 pound was cut off of the <6 pound piece; the other pieces were less than 2 pounds.

What did we learn? **–** Trying to cut off a 2 pound pieces from the <6 pound piece yielded very long, skinny pieces that were not usually desirable due to the difficulty in shipping Parmesan cheese. A new method was needed for how to cut the <6 pound piece. Additionally, although a tool that could be used to measure the cheese instead of using the ruler would make the work easier, at that time using the ruler had become part of the standard work. However, during the holiday season, the difficulty in using the ruler due to the significant increase in demand was discussed.

End of Project and Next Steps

- The final storyboard is shown in Figure 9.

- ZMO Team plans to continue holding regular meetings to conduct coaching sessions and continue experimenting.

- The upcoming Holiday Season will be used to truly evaluate the flow chart by training newly hired personnel to follow it when cutting Parmesan. The team hopes that the flow chart will reduce the amount of training needed, which might allow two stations to be active in the cheese room-one for opening Parmesan wheels and prepping cheese, and another for cutting the cheese to order.

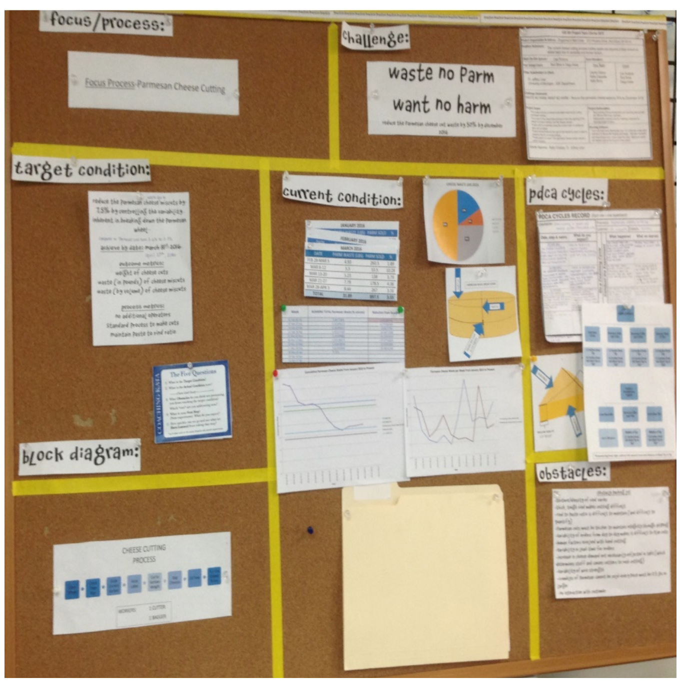


Figure 9. Final Storyboard

The KATA project highlights

1. Proper assessment of current condition regarding Parmesan cheese cutting process was critical to establishing first target condition.

2. Development of standardized method to cut Parmesan cheese to order that can be used to train new employees and ensure waste is minimized.

3. Data collection scheme created to monitor amount of waste from week to week and as a cumulative value throughout the year.

4. New perspective from outside observer helped to bring new approaches to an artisan craft.

Overall Results Summary

Comparison between start and end of the Kata Project

A comparison was made between February, March, and April 2015 and 2016 to show improvements made from the experiments conducted. These were converted into dollar figures. There was a decrease in percentage for amount of Parmesan waste in dollars versus amount of sold Parmesan in dollars of 0.55%. Between February and April of 2015, $33,244.00 was sold and a possible profit of $815.56 was lost. Between February and April of 2016, $37,127.00 was sold and a possible profit of $730.89 was lost. Although a small improvement, this still represented a positive impact of the experiments that were conducted over the two and a half month period.

The amount of Parmesan cheese waste compared to amount sold in January 2016 was used as the baseline on which to improve. Of the 314.2 lbs of Parmesan sold, there was 17.58 lbs of Parmesan cheese waste. This resulted in approximately 5.8% of waste for Parmesan sold in January.

At the start of the project, there was no standard way of breaking down Parmesan wheels or for cutting the individual half-pound, one-pound, two-pound, or four-pound pieces. Figure 10 shows how the cumulative percentage of waste has decreased over the course of the project as rapid experimentation was taking place. The tabular data shown in this graph is included as Appendix V, and a second graph showing the weekly Parmesan waste in both pounds and as a percentage by volume is attached as Appendix VI. The log used to record all of the data can be found in Appendix VII.

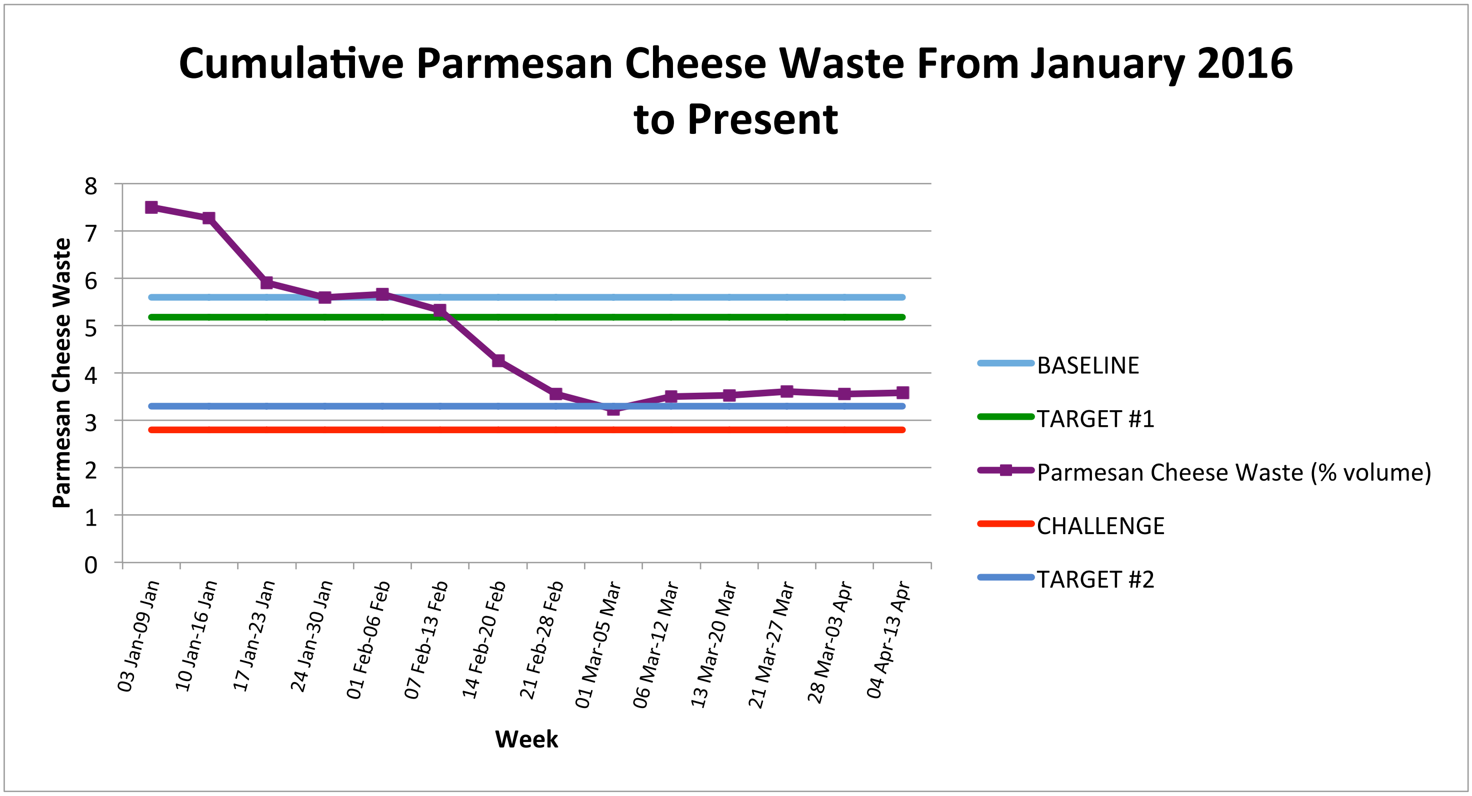


Figure 10. Run Chart Showing Decrease in Cumulative Cheese Waste from January 2016-April 2016

The first target condition, once finalized, was to reduce the Parmesan cheese waste by 7.5% by 31 March 2016. When data was first collected, it was not captured in a way that made the amount of waste reduction clear. Once the cumulative waste was calculated and documented in the run chart shown here at the end of February, the team discovered that target condition #1 had been met two weeks prior to that meeting.

The second target condition was to reduce the Parmesan cheese waste further, from 3.55% to 3.3%. A smaller reduction was chosen for the second target condition because the team realized that the smaller the cumulative waste became, the more difficult it would be to gain improvement. This target condition was met briefly the first week of March, but was not sustained, and is therefore still active.

The total cumulative amount of Parmesan cheese waste measured as a percentage of Parmesan cheese sold went from 5.66% on 01 February 2016, to 3.58% on 13 April 2016, which is a 36% reduction. The challenge was to reduce the Parmesan cheese waste by 50%, and the progress seen in this project indicated that the challenge is definitely achievable and may need to be re-evaluated at some point.

Figure 11 shows the final flow chart created for the cheese mongers to use while cutting the Parmesan pieces. A larger version can be seen in Appendix VIII. The measurements for each step were adapted throughout the process based on what was learned through the experiments. This flow chart process deviated from the way Parmesan was being cut previously, not only by using measurements, but also by resulting in a final piece that was much longer and skinnier than is usually desired due to the difficulties in shipping Parmesan. This is an issue that the ZMO team will address in the future to decide whether this change is simply different from the tradition they created at ZMO or if it negatively affects the business and customer satisfaction.

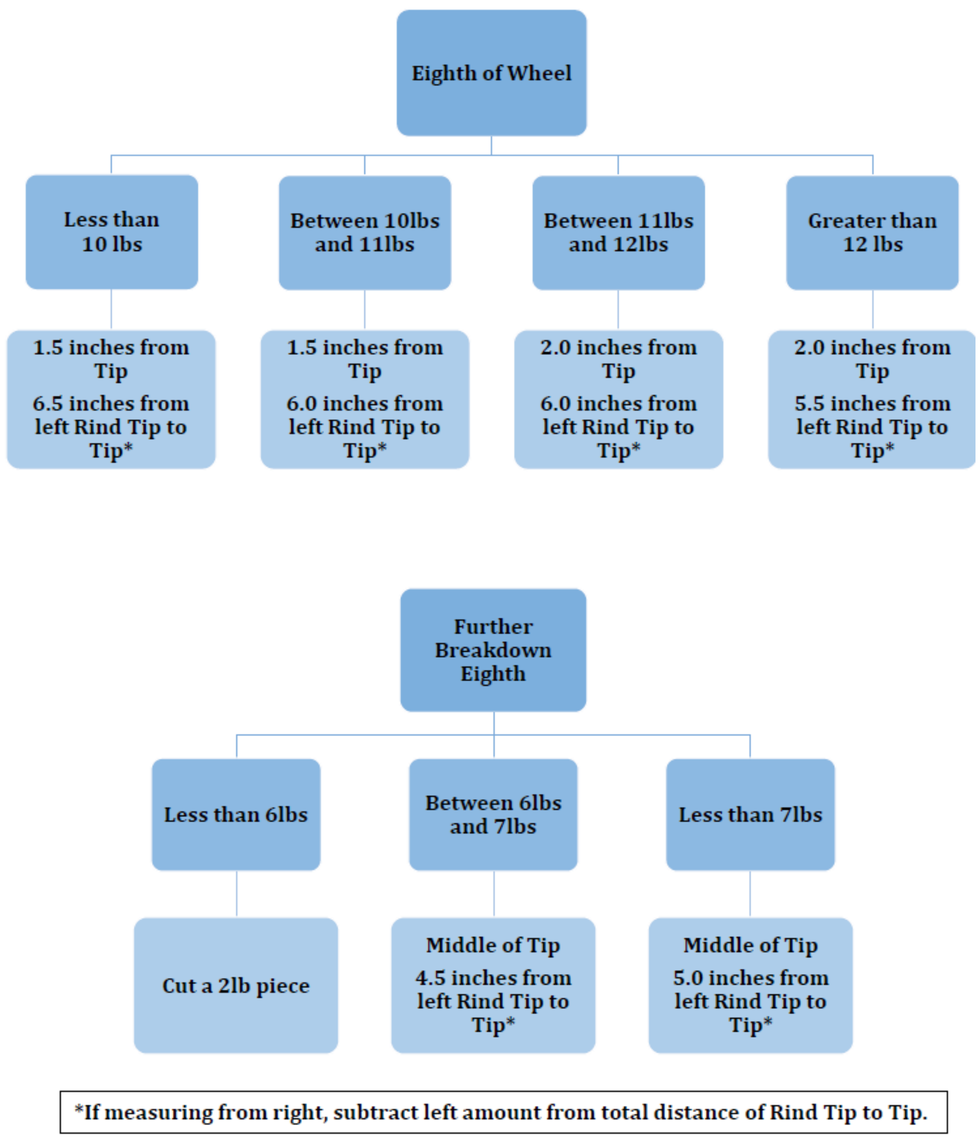


Figure 11. Parmesan Cutting Flow Chart

Before Kata experimentation, the cutting of the quarter wheels into eighth wheels was done simply by visualizing the halfway point and using judgment to decide where to cut. One of the earlier PDCA cycles determined that using the markings on the outside of the wheel, shown in

Figure 12, was a more accurate way to cut and resulted in more standardized eighth wheels in terms of weight.

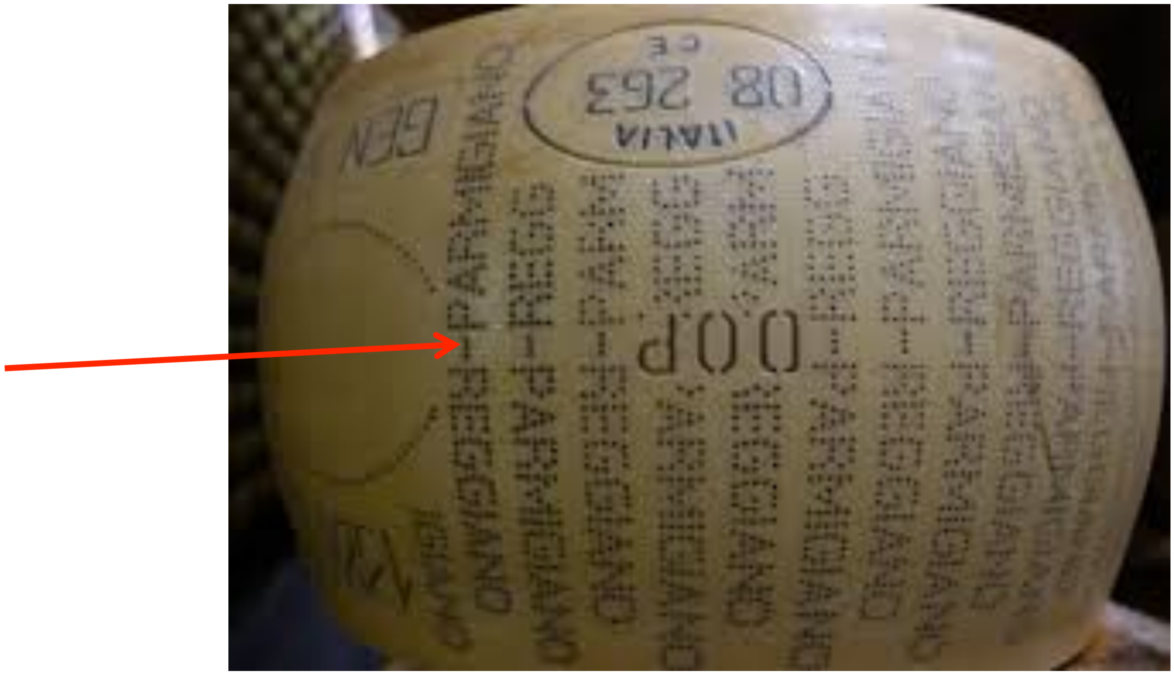


Figure 12. Picture of Parmesan Wheel Markings

Throughout the experiments, when the measurements used in the flow chart were being adjusted according to the results, a common idea was to identify an everyday cheese tool that could be used to measure rather than the ruler. Since addressing this issue in a PDCA cycle would have changed the direction of the experiments before the end goal of an accurate flow chart was complete, it was not examined during this project but it is on the list of future items for the ZMO team to work on.

Coaching Cycles

Continuous improvement consists of two aspects-the improvement kata and the coaching kata. Throughout this project, the coaching cycles provided a way for the teams to reflect on the previous week, whether that involved evaluating the current condition or discussing lessons learned from the last experiment. The team met every Wednesday morning to conduct a coaching cycle and determine what the next steps would be. By following the structure of the coaching questions every week, the team learned to answer the questions directly and concisely, focusing on critical information and using consistent metrics from week to week. At the start of the process, the target condition was not well defined, and the coaching cycles helped illuminate the fact that clear metrics had not yet been established. Additionally, when an experiment was successful and improvement was seen, the coaching cycles provided an opportunity for the team to reflect on the success and encourage each other to continue working towards the common goal. When an experiment failed, the team could analyze the results together and work to brainstorm ideas of what to try differently in the next PDCA cycle.

Lessons Learned

Target conditions are not specific to a single PDCA cycle-at first the team felt that the PDCA cycle should be designed to accomplish a new target condition every time, but they quickly learned that it might (and usually does) take several PDCA cycles.

A strong current condition is required to truly measure progress. Initially, the team started by measuring the standard deviation of the weights of the cheese that was being cut. As the target condition evolved, and feedback was received from the coaches, the team realized that the data needed to be captured differently because the standard deviation would have to be measured for every increment of cheese weight that could be sold. The team then tried tracking the waste in pounds and as a percent of the Parmesan sold from week to week, but due to the fluctuations in cheese demand, this still did not accurately reflect the total cheese waste. Finally, a cumulative run chart was created, shown in Figure 10 above that gave a clear indication of how the amount of Parmesan waste was changing.

In conjunction with the previous point, further experiments are often required to fully capture the current condition. In this case, experiments were conducted to simply collect data in order to be able to move forward.

Going to the gemba and observing the process is critical to understanding the current condition. For this project, the team initially wanted to reduce the time required for each step of opening the Parmesan wheel, but realized that the time was incredibly variable and difficult to capture. Additionally, the work flow diagram was difficult to create for this project because the entire process occurred in a small room with only one person. These realizations made it clear that every process is different and must be approached according to the circumstances specific to that process.

Sometimes using a standard operating procedure to perform a process can reveal things about the process that otherwise would not have been discovered. The standardized method might be too stringent or too vague for that particular process, actually making the task at hand more difficult.

It is difficult to try to standardize a process that consists of tradition and artisan skill. Cheese cutting is traditionally done by individuals who have learned the skill by trial and error; the majority of the cutting is done by judgment and historical experience. However, the team learned that there is a balance between preserving the tradition and standardizing the process.

At times it can be difficult for an employee who performs a task every day to be able to think outside the box and come up with new experiments to try. An outside perspective can be very beneficial in this regard, and may push the employees to step outside of their comfort zone to try new things.

Reflection-*Hansei*

This project has shown the importance of keeping an open mind toward change and a willingness to work toward continuous improvement. At times, this mentality can be very difficult because of the tendency to look for quick solutions and jump into problem solving before fully understanding the problem. The coaching sessions forced everyone on the team to take a step back and reflect on what had been done, what was learned, and what the next step might be.

The Toyota Kata methodology created an environment where the team was not afraid to present new ideas, regardless of how far-fetched or impossible they might seem, because there was always the understanding that no one knew whether the idea would work or not until the experiment was conducted. This project revealed the power behind this environment-No one was afraid to fail. In this modern world, where failure can mean the end of a career, creativity is stifled and the reasoning that "this is the way it has always been done" is an easy excuse to avoid improvement. Kata breaks down this wall and eliminates the fear of retribution, which allows for ideas that would have otherwise been shot down to be tried, and for continuous improvement to occur.

As outsiders to the ZMO traditions and culture, there was a challenge in getting the ZMO team members to embrace changing the way they do their job. During their previous experience with the Kata, they had been the ones creating all the experiments, which allowed them to stay in their comfort zone and continue using the same process they had always used. For this project, however, the UM team members brainstormed possibilities for the experiments and allowed the ZMO team to give feedback. Sometimes there was a bit of pushback from the ZMO team because the experiments created extra work for them or deviated from the way they were used to working. When this occurred, the UM team made sure to welcome the feedback and listen to their concerns, and by engaging in a civil discussion, eventually the entire Kata team would arrive on the same page. As the project got further along, there was a noticeable difference in the way the ZMO team embraced the new ideas and contributed their own opinions on ways to improve the process.

Culture and Leadership

The culture at ZMO is incredibly tangible, and it is easy to see and get caught up in the environment. The first Schein level of culture, artifacts, is obviously represented through the bright colors and positive sayings covering the walls; the standard operating procedures posted at every station make it clear that standards are important and expectations are high, which are embraced values that would fall into the second Schein level of culture. The ZMO mission statement is hung in practically every room, serving as a constant reminder of another espoused value, which is bringing joy to people through delicious food. The third Schein level of culture, basic underlying assumptions, is more difficult to see, but after working with the ZMO team, it was apparent that there is an inherent belief that everyone will take care of each other.

One of the challenges that can be encountered when employing the Kata methodology is having to get approval from upper levels of management prior to conducting experiments, or receiving pushback from managers who are resistant to change. At ZMO, however, this was never a problem. The leadership encouraged their employees to take time out of their day to work on continuous improvement, and gave positive feedback to those that succeeded in making even a small difference. Going forward, the ZMO team is incredibly fortunate to have the flexibility to continue this Kata improvement project, and they will be able to continue experimenting and improving their process long after the semester ends.

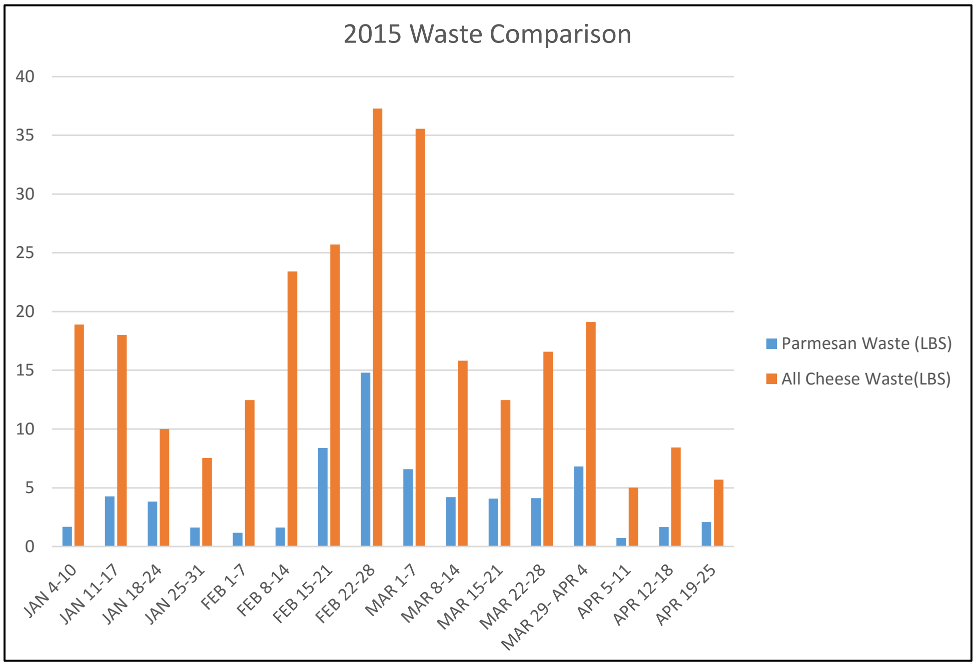
APPENDIX I – Project Charter

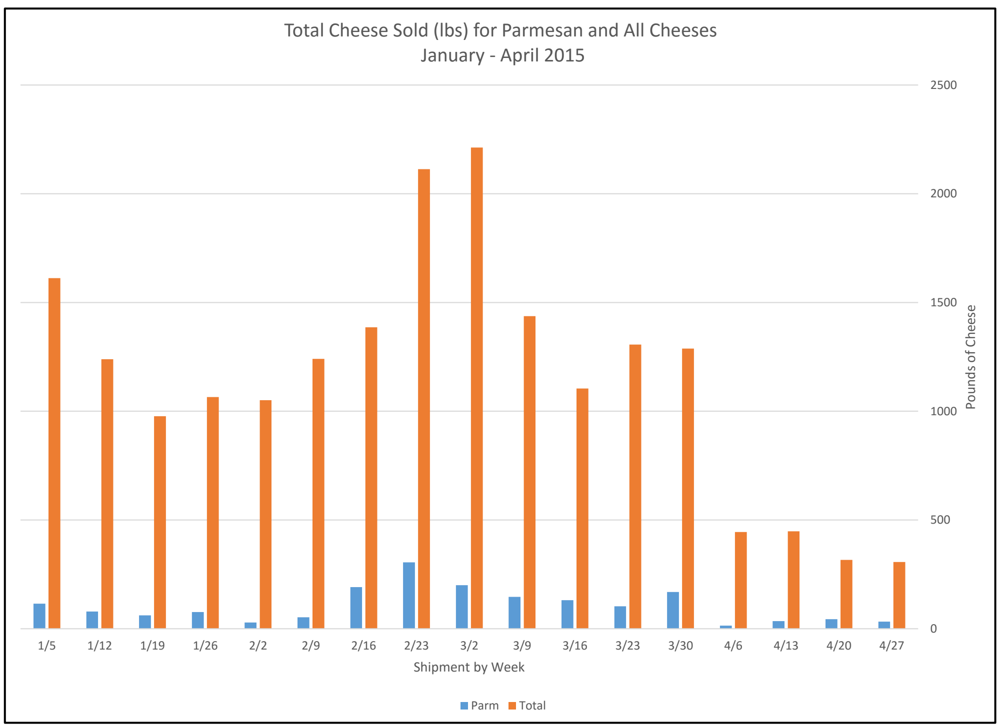
IOE 591 Project Team Charter 2015

<table>
<tr><td colspan="3">Project Organization & Address: Zingerman's Mail Order 610 Phoenix Drive, Ann Arbor, MI 48108</td></tr>
<tr><td colspan="3">Problem Statement:. The current cheese cutting process creates excess cheese waste and requires a large amount of added labor due to variability and human factors.</td></tr>
<tr><td>Client On-Site Sponsor: Lisa Roberts</td><td colspan="2">Team Members:</td></tr>
<tr><td>Your Group Coach: Tara Stow & Diego Aliste

Other Stakeholders in Client:
Dr. Jeffrey Liker
University of Michigan – IOE Department</td><td><u>Your Team</u>
Lauren Gainor
Katie Cappetta
Kelly Berry</td><td><u>Client</u>
Lisa Roberts
Tara Stow
Diego Aliste</td></tr>
<tr><td colspan="3">Challenge Statement:
WASTE NO PARM, WANT NO HARM – Reduce the parmesan cheese waste (including time to open wheel of parmesan) by 50%</td></tr>
<tr><td rowspan="2">Project Scope:
• The project activity is limited to the tasks required for cutting parmesan wheels.
• The scope of the observable process is from the opening of the wheel to product delivery into the cheese market.
• Project will be completed using the current staff; no additional labor will be added.
• Project will be limited to the use of non-electronic tools in order to preserve the art of cheese cutting.
• Project goal is to reach 5% parmesan cheese waste reduction within 8 weeks.</td><td colspan="2">Project Deliverables:
• New routines of improvement kata and coaching kata by both the UM and ZMO team members.
• Measureable progress towards challenge statement by reaching target condition</td></tr>
<tr><td colspan="2">Meeting Cadence:
Team will meet every Wednesday from 10-12 AM with onsite team members to discuss the findings and issues. UM team members will meet at least once a week apart from that. Milestone review will happen once at the midpoint of the project.</td></tr>
<tr><td colspan="3">Charter Approval: Betty Gratopp, Dr. Jeffrey Liker</td></tr>
</table>

APPENDIX II – Historical Data





APPENDIX III – Tables Showing Parmesan Waste in Pounds and Percent Volume (January-April 2016)

JANUARY 2016

DATE	PARM WASTE (LBS)	PARM SOLD	%
JAN 3-9	9.16	122.2	7.50
JAN 10-16	3.91	57.5	6.80
JAN 17-23	2.45	83	2.95
JAN 24-30	2.06	51.5	4.00
TOTAL	**17.58**	**314.2**	**5.60**

FEBRUARY 2016

DATE	PARM WASTE (LBS)	PARM SOLD	%
FEB 1-6	3.09	50.85	6.08
FEB 7-13	1.65	53.5	3.08
FEB 14-20	5.59	236	2.37
FEB 21-27	11.31	449.5	2.52
TOTAL	**21.64**	**789.85**	**2.74**

MARCH 2016

DATE	PARM WASTE (LBS)	PARM SOLD	%
FEB 28-MAR 5	4.93	260.5	1.89
MAR 6-12	5.5	53.5	10.28
MAR 13-20	5.23	138	3.79
MAR 21-27	7.79	178.5	4.36
MAR 28-APR 3	8.44	267	3.16
TOTAL	**31.89**	**897.5**	**3.55**

APRIL 2016

DATE	PARM WASTE (LBS)	PARM SOLD	%
APR 4-13	3.66	84.5	4.33
TOTAL	**3.66**	**84.5**	**4.33**

APPENDIX IV – PDCA Cycles

Target Condition: Reduce the Parmesan cheese miscuts by 7.5% by controlling the variability inherent in breaking down the Parmesan Wheel.

PDCA CYCLES RECORD *(Each row = one experiment)*

Obstacle: Thick tough rind yields inconsistent cuts when breaking down the Parmesan wheel.

Process: Parmesan Wheel Cutting

Learner: UM Students

Coach: Diego & Tara

Date, step & metric	What do you expect?	Do a Coaching Cycle	Conduct the Experiment	What happened	What we learned
29 Feb 2016 Use template to measure ½, ¼, and1/8 wheel portions Metric: Weight of portions & std dev	Using a template to break Down the Parm wheel will decrease the standard deviation of weights of wheel portions			standard deviation of weight of 1/8 increased from 0.5 lbs to 0.51 lbs	The data collection was not consistent & it was hard to determine which eighths correlated w/same wheel. Need better data collection
09 Mar 2016 Measuring the eighth with a ruler from the tip/nose & the outer edge to consistently cut at least a 4lb piece	Method to guarantee at least a 4 lb piece from each eighth wheel			All cuts were between 1.5”-2.0”from the tip and5.5”-6.0” from the edge. All but one cut were at or above 4lbs.	The variability of the weight determines which cut would be better. Need more data to determine a standardized cut.
16 Mar 2016 Continue to break down the cheese eighth wheel start measuring each cut from remaining wheel -after 4lb cut. Continue to collect data for 4lb cut	Collecting data for additional cuts will help determine a standardized cut/cuts.			5 cuts were above 4 lbs, & 4 cuts were below 4 lbs. When breaking down the second 4 lb piece, all cuts were above 4 lbs, but were “heavy” 4 lb pieces.	Inconsistencies in people & process yield different cuts – right handed vs. left handed use different measurements. Cuts were based on cutter’s experience, not standard procedure.

APPENDIX IV – PDCA Cycles

Target Condition: Reduce the cumulative Parmesan cheese waste due to miscuts compared to Parmesan sold from 3.6% to 3.3%

PDCA CYCLES RECORD *(Each row = one experiment)*

Obstacle: Inconsistency in people and process yields inconsistent cuts.

Process: Parmesan Wheel Cutting

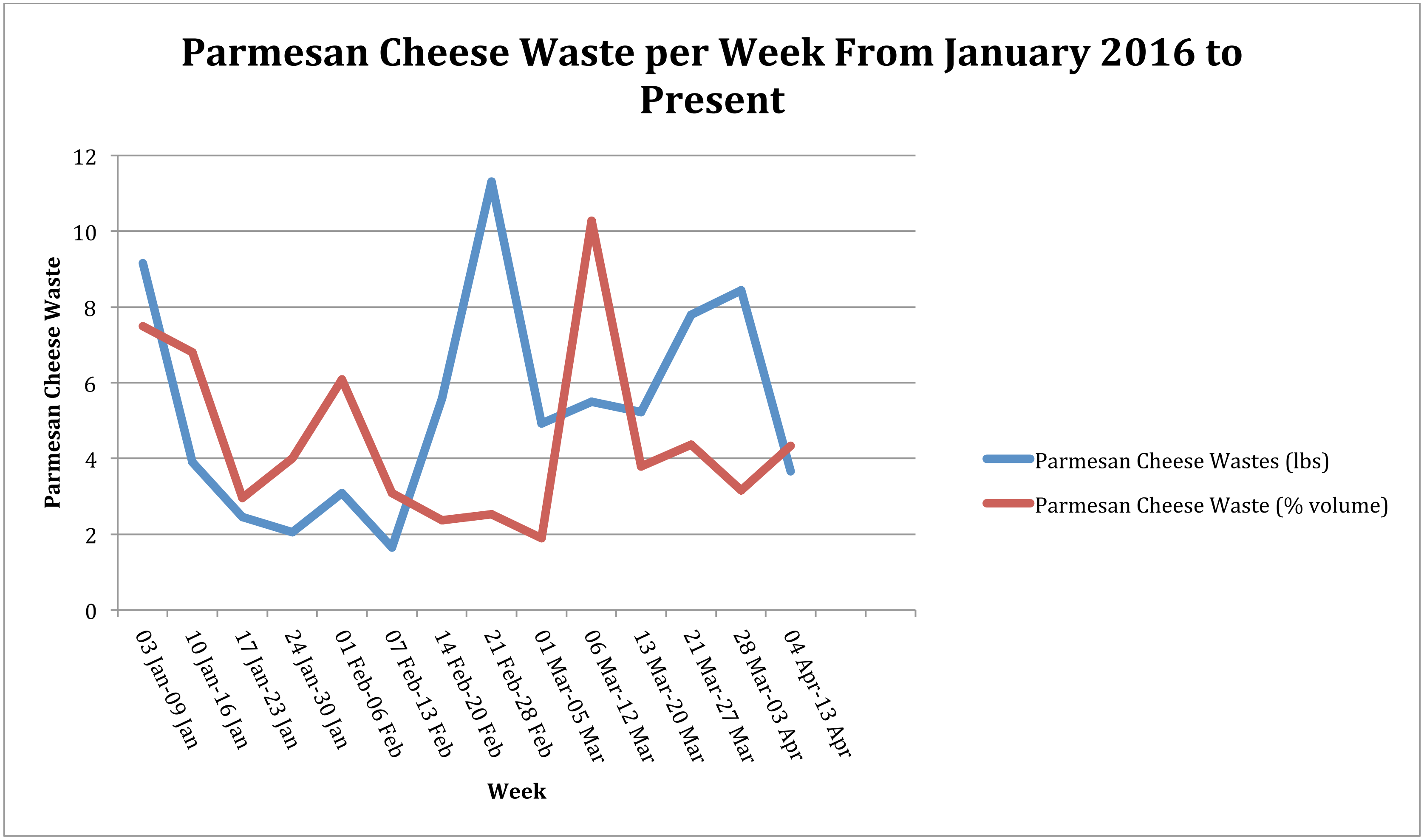
Learner: UM Students **Coach:** Diego & Tara

Date, step & metric	What do you expect?	Do a Coaching Cycle / Conduct the Experiment	What happened	What we learned
23 Mar 2016 Use standard procedure (flow chart) to break down eighth wheel into two 4lbs pieces. Continue recording data and measurements.	Data to determine whether standard measurements consistently yield two 4lb pieces.		The flow chart that was being used was incorrect from the information found during experimentation. (Used incorrect data for flow chart). Created cuts that were below The 4 lb weight.	Proper flow chart is needed to collect data.
30 Mar 2016 Use standard procedure (flow chart) to break down eighth wheel into two 4lbs pieces. Continue recording data and measurements.	Data to determine whether standard measurements consistently yields two 4lb pieces. Use to fine tune measurements on flow chart.		All cuts between 10 and 11 lbs were consistently above 4lbs. One piece that was below 10 lbs was less than 4lbs	A new section needs to be added for pieces below 10 lbs. New measurement 1.5" from the tip and 6.5" from the corner
06April 2016 Add section addressing pieces below 10 lbs using New measurements. For second cut, add section addressing pieces less than 6 lbs (cut 2lb piece)	Continue to collect data to determine whether standard measurements consistently yield results in accordance w/flow chart. Determine measurements for 2lb piece		All initial cuts were above 4 lbs. For <10lb pieces, they were "heavy". For <6 lbs (second cut), cutting a 2lb piece leaves very thin heavy pieces	For <6lb for the second cut, a different method needs to be developed.

APPENDIX V – Cumulative Waste Percentage Data

Week	RUNNING TOTAL Parmesan Waste (% volume)	Reduction From Baseline
01 Feb-06 Feb	5.66223805	1.111393743
07 Feb-13 Feb	5.332696213	-4.773281909
14 Feb-20 Feb	4.263998167	-23.8571756
21 Feb-28 Feb	3.552375345	-36.56472598
01 Mar-05 Mar	3.235498882	-42.22323424
06 Mar-12 Mar	3.501286979	-37.47701824
13 Mar-20 Mar	3.526878956	-37.02001864
21 Mar-28 Mar	3.613040846	-35.48141346
29 Mar-03 Apr	3.552746621	-36.55809605
04 Apr-13 Apr	3.584286091	-35.99489123

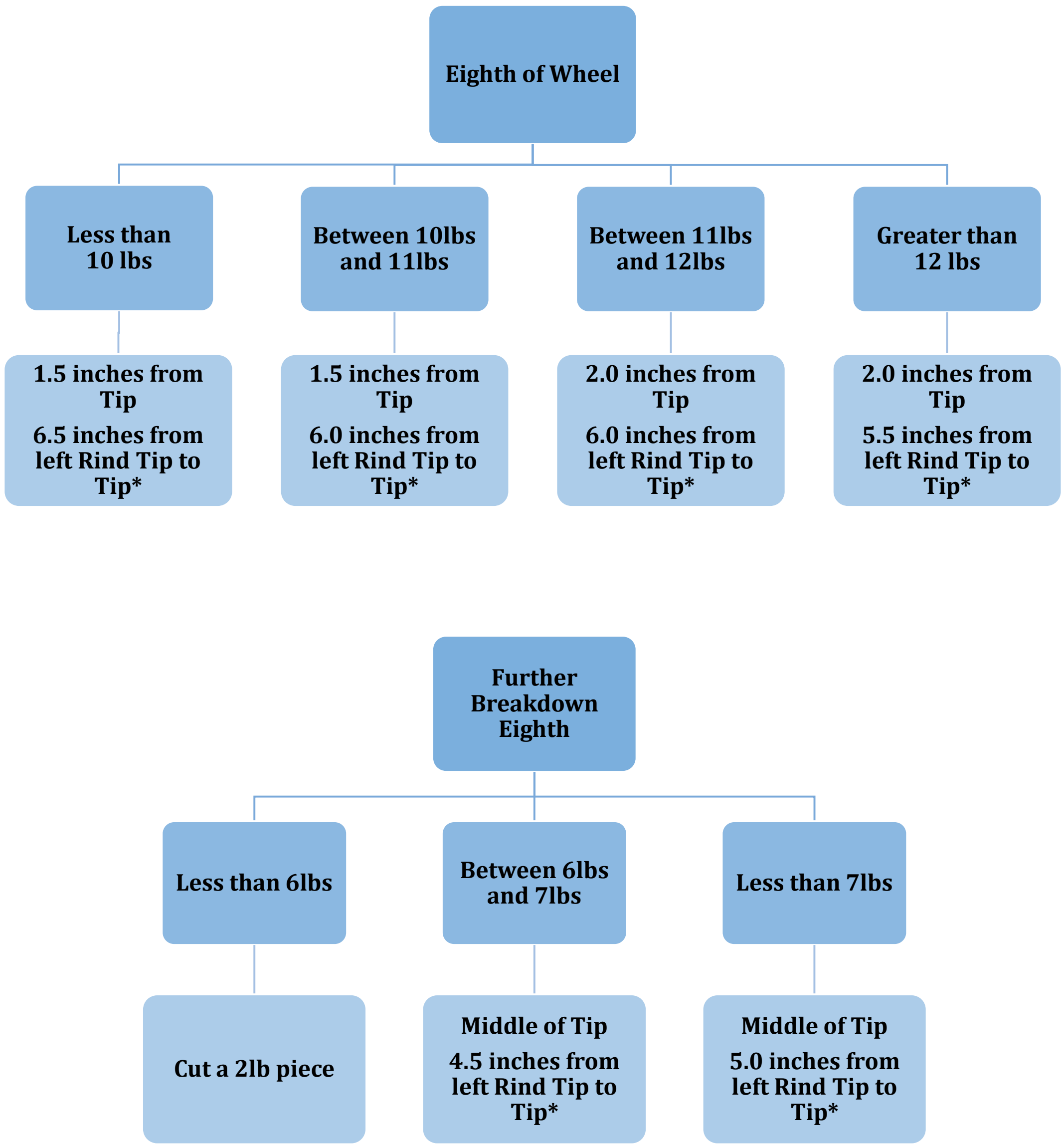
APPENDIX VI – Graph Showing Parmesan Waste in Pounds and Percent Volume
(January-April 2016)



APPENDIX VII – Cheese Waste Log

January						METRICS			
	Date	Waste (lbs)	Waste (% volume)	PARM SOLD	RUNNING TOTAL (% volume)	BASELINE	TARGET #1	TARGET #2	CHALLENGE
Week 1	03 Jan-09 Jan	9.16	7.5	122.2	7.495908347	5.6	5.18	3.3	2.8
Week 2	10 Jan-16 Jan	3.91	6.8	57.5	7.273233166	5.6	5.18	3.3	2.8
Week 3	17 Jan-23 Jan	2.45	2.95	83	5.907879711	5.6	5.18	3.3	2.8
Week 4	24 Jan-30 Jan	2.06	4	51.5	5.595162317	5.6	5.18	3.3	2.8
	TOTAL	17.58	5.595162317	314.2					
February									
	Date	Waste (lbs)	Waste (% volume)						
Week 1	01 Feb-06 Feb	3.09	6.08	50.85	5.66223805	5.6	5.18	3.3	2.8
Week 2	07 Feb-13 Feb	1.65	3.08	53.5	5.332696213	5.6	5.18	3.3	2.8
Week 3	14 Feb-20 Feb	5.59	2.37	236	4.263998167	5.6	5.18	3.3	2.8
Week 4	21 Feb-28 Feb	11.31	2.52	449.5	3.552375345	5.6	5.18	3.3	2.8
	TOTAL	21.64	2.739760714	789.85					
March									
	Date	Waste (lbs)	Waste (% volume)						
Week 1	01 Mar-05 Mar	4.93	1.89	260.5	3.235498882	5.6	5.18	3.3	2.8
Week 2	06 Mar-12 Mar	5.5	10.28	53.5	3.501286979	5.6	5.18	3.3	2.8
Week 3	13 Mar-20 Mar	5.23	3.79	138	3.526878956	5.6	5.18	3.3	2.8
Week 4	21 Mar-27 Mar	7.79	4.364145658	178.5	3.613040846	5.6	5.18	3.3	2.8
Week 5	28 Mar-03 Apr	8.44	3.161048689	267	3.552746621	5.6	5.18	3.3	2.8
	TOTAL	31.89	3.553203343	897.5					
April									
	Date	Waste (lbs)	Waste (% volume)						
Week 1	04 Apr-13 Apr	3.66	4.331360947	84.5	3.584286091	5.6	5.18	3.3	2.8

APPENDIX VIII – Flow Chart (Final Version)



***If measuring from right, subtract left amount from total distance of Rind Tip to Tip.**