

DEFINE STAGE

EXECUTIVE SUMMARY

The present industries are facing the problem of intensive competition. In this competition the main aim is to attract customers by providing products at a low cost with best quality. This kind of practice helps to build up company credibility in the market thus attracting more customers in the coming years. Quality is a critical factor from a customer's point of view. The project implements the DMAIC process and this report identifies the problems in the process – Define stage

IDENTIFYING THE PROBLEM

From the prioritization matrix, it is clear that the priority should be given to the customer satisfaction objective. The objective is not merely satisfying the customers but attracting new customers and convert them to returning customers. Therefore, we decided to interview 200 customers to identify the concerns of the customers.

From the analysis we observed that –

- 40 percent of people visit the coffee shop during the office hours in the morning.
- The most ordered drink is the espresso
- The quality of the product served are satisfactory
- One of the main concerns expressed was the extended serve time
- Many drive-thru customers experienced problems with incorrect orders
- One of the major concerns included parking lot problems and cleanliness
- Most people preferred Starbucks as an alternative option; hence, that is set as a benchmark for SigmaBrew

Now we decided to interview the employees of SigmaBrew. Three employees of SigmaBrew were interviewed. This helped us understand the responsibilities of the employees and to understand the standard work involved with the coffee shop. From the gathered data we developed a Swim lane flowchart for the espresso preparation process. Figure 1 elucidates a Swim lane flow chart; we can say that this is the most time consuming process than other available drinks in the shop.

The reasons being lengthy process with multiple steps and handoffs. The defects identified were the number of handoffs between builder and counter.

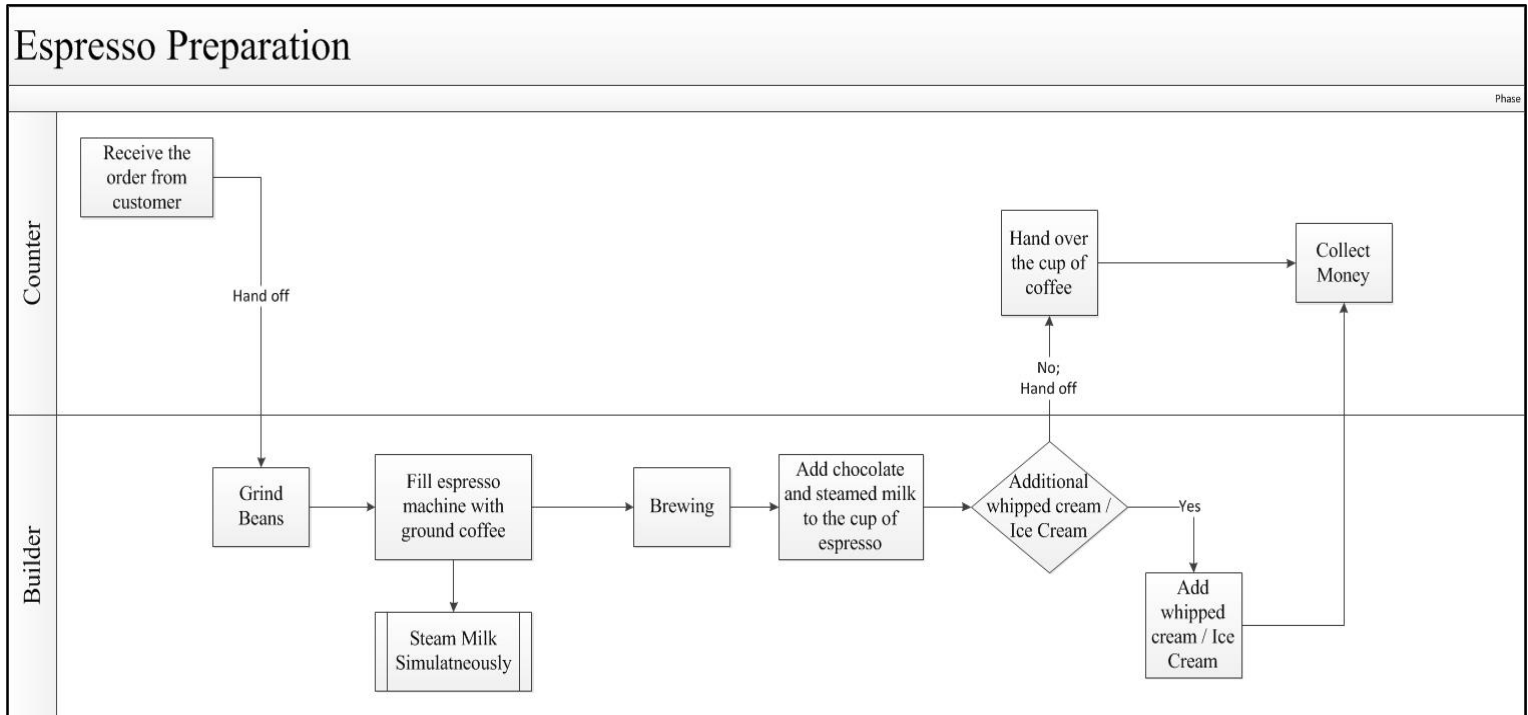


Figure 1: Process Flow Diagram

The data collected from the audit reports and the customer complaints file, we further confirmed that there was a definite problem with parking and cleanliness over the years.

A SIPOC (Suppliers Input Process Output Customer) has been developed from the data gathered from the employees and the customers. Figure 2 shows a SIPOC that analyses possible defects in a particular process. In this case we have again chosen the espresso preparation process as it is considered one of the most time consuming processes and the most preferred drink by the customers. The defects identified from the SIPOC are incorrect orders, long serve time and the inability to serve hot coffee.

SIPOC				
PROCESS: Espresso Preparation				
CUSTOMER	OUTPUTS	PROCESS	INPUTS	SUPPLIERS
List the primary customers (internal and external) for the process	List the key products, services or outcomes of the process	List the key steps in the process	List the key information, materials, parts, supplies, etc. required for the process	List the key suppliers of the inputs - both internal and external
		Grind coffee beans		
Consumers	The outcome of the process is a hot espresso based drink. This can be cappuccino, mocha, latte or machiatto.	Fill espresso machine with ground coffee		Water supplier
		steam milk	raw materials - coffee beans, milk, water, power, coffee maker and espresso machine	Milk supplier
		Add chocolate and steamed milk to the cup of espresso	materials - steamed milk, ground coffee, chocolate syrup, whipped cream and ice cream	Espresso machine provider
		Add whipped cream or ice-cream depending on the customer's request		
		What are the controllable process parameters?		
		Temperature of brewing		
List the secondary customers (residual) for the process	List the key defects or undesirable outcomes of the process	temperature of steaming milk		
		Size of the order (reg/large)		
SigmaBrew Employees				
	Incorrect orders			
	Coffee being cold	What are the uncontrollable process parameters?		
	Long serve time	rate of incoming customers		
		variation in orders		

Figure 2: SIPOC

FUTURE PLAN

In the measure stage, we intend to measure and evaluate the current level performance of the process. This can be performed by utilizing the available measure tools.

MEASURE STAGE

From the define stage, it has been identified that the preparation of special drinks especially espresso is the most time consuming process and that most of the customers were dissatisfied due to the delay. In the measure stage a detailed analysis is done in order to determine the KPIV's and the KPOV's.

Value stream mapping or the flow chart is used to plot the exact process that takes place in Sigma Brew Company. From the value stream mapping, non-value added time and the value added time is determined. Most of the drive-thru customers complain about wrong order; so, when the customers return we have to remake the orders. Therefore, when a detailed analysis of remake orders was performed, it was shocked to see that most of the remake orders were special drinks.

After identifying the KPIV's and the KPOV's, a cause and effect matrix is prepared in order to determine the relationship between Key Process Input Variables and Key Process Output Variables. A meeting has been conducted in order to determine a cause and effect matrix. As per the team rating, it has been found that new complex drinks, time of delay, and poor work flow mainly affects the service time.

In order to generate cycle time data, the team members started watching security tapes from the store. When Gauge R&R is performed based on the security tapes, it has been found that around 43% of measured time range was taken up by the measurement error i.e., due to repeatability and reproducibility. This is greater than 30% and is unacceptable.

A survey is conducted in order to measure the number of customers and the time taken to serve the drink. From the survey, it was clear that most the customers arrive in the morning from 6-9 AM and the service time on an average for the morning hours was around 6 min. After 9 AM, there was a drastic decrease in number of customers.

SCORECARD

	Cost in Dollars	Time in Days	Avg. Serve Time Sec.	Serving Sigma Level	ROI%
Define	32475	33.25	330	1.258	72
Measure	19000	19	298	2.398	568
Analyze	750	0.5	298	2.398	0
Improve	0	0	0	0	0
Control	0	0	0	0	0
Total:	52225	52.75	298	2.398	229



From the scorecard, the Return on Investment for the project is 229% and we spend 51475\$ for the project until measure phase. Project health is around 75% and the average serve time has been reduced from 330 seconds to 298 sec.

ANALYZE PHASE

For the next phase, it is easier to determine the causes with the help of cause and effect diagram. The cause and effect diagram gives a better picture of the causes that lead to defects in the process. From the Fish-bone diagram, the causes identified are

- Less number of employees
- Defects occur when making complicated drinks
- Due to space constraint, more time is spend on searching things

In next phase, we would benchmark the product performance and try to obtain enough data responsible for wastes and non-value adding process.

ANALYZE STAGE

The fish bone diagram in Define stage highlighted three major causes:

- Less number of employees
- Defects occur when making complicated drinks
- Due to space constraint, more time is spend on searching things

As we go in the analyze stage we look towards analyzing these major causes and thus data is collected to help strengthen the root causes discovered and to narrow down the problem to a level from where maximum customer satisfaction can be achieved.

The first thing focused in analyze stage is the various wastes and one of the parameters used to identify them is the non-value added time for a process. On analyzing the motion of the builders it came to fact that 4 hours and 11 minutes is the time which is wasted in motion by three builders in one single day which does not add any value to the customer service thus it needs to be one of the priority targets for improvement stage. Also rework percentage for the one store including every product sold came out to be 16.23%. This was further analyzed to know which among all the products have the highest rework percentage and data was collected across different SigmaBrew locations for a period of 30 days.

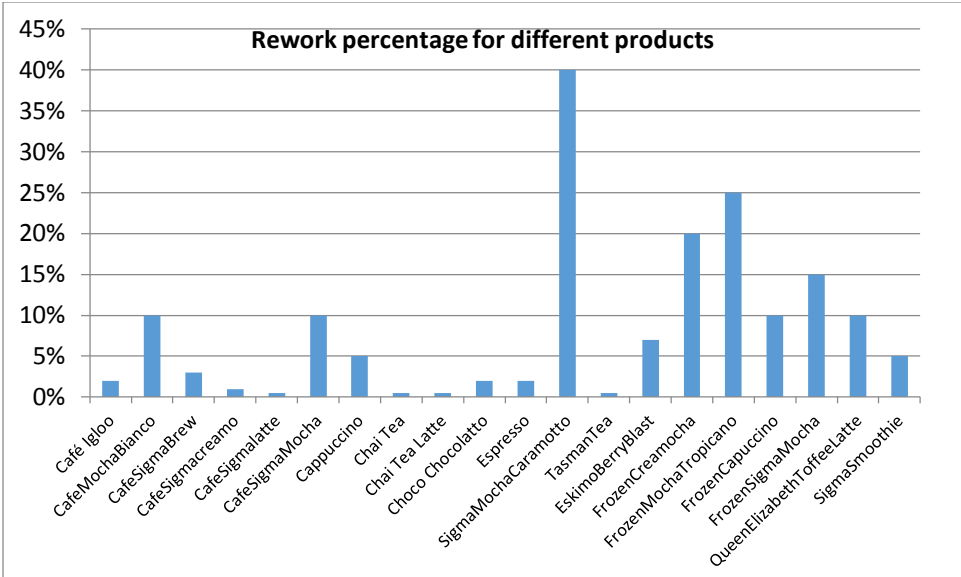


Figure 3: Rework percentage by products

The rework percentage shows that SigmaMochaCaramotto has the highest rework percentage of 40% among all products and is followed by FrozenCreamMocha and FrozenMochaTropicano thus focusing on these three alone can bring the rework percentage by significant level. Thus in improve stage we will be following the principle of focusing on 20% problems to make 80% improvement and thus this analysis of narrowing down the problem will be great help.

The total product time for all products is collected and then subsequently distributed among value added and non-value added time to focus on the products which have least product value added ratio.

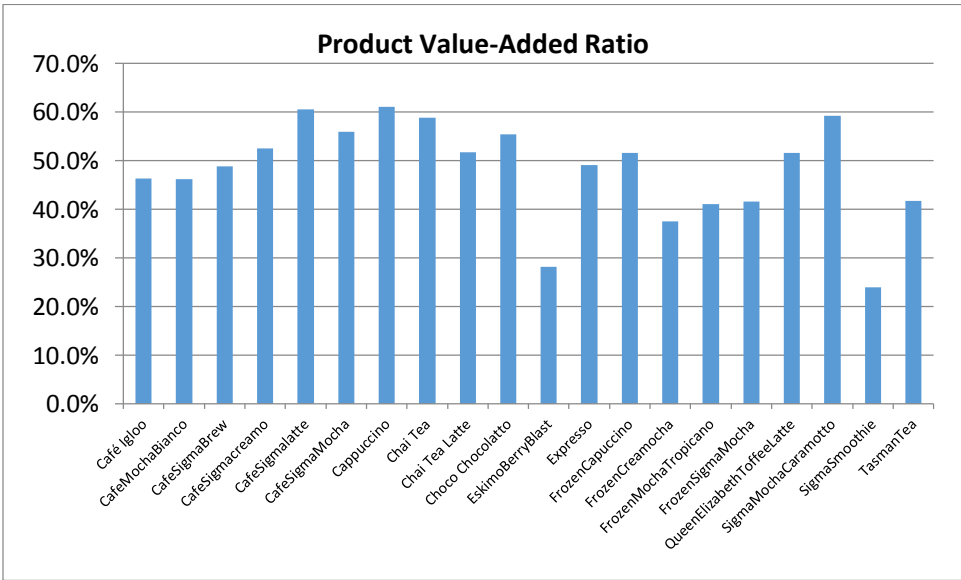


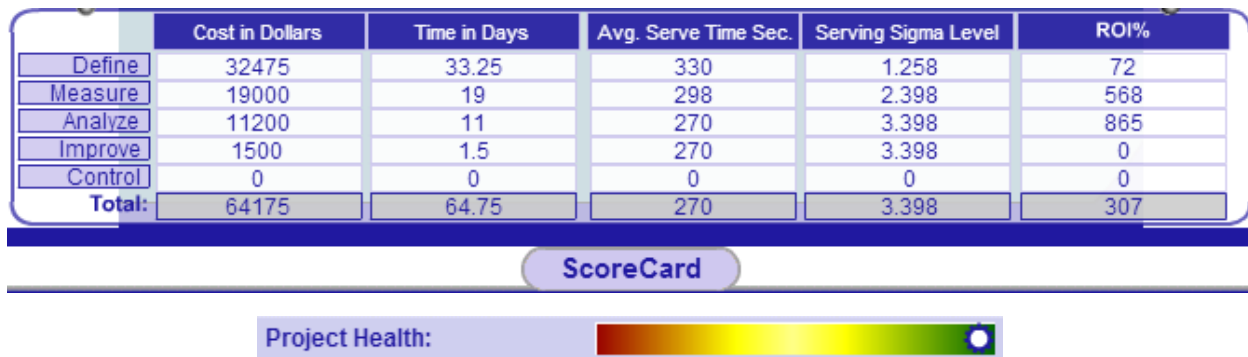
Figure 3: Value – Added Ratio

The above graph shows that the three products which has least product value added time are the ones which have highest rate of rework thus rework in these three products is one of the major wastes.

Another major problem identified during the define phase was less number of employees thus data is collected which reflects the number of employees, waiting queue for the customers and average service time. This helped in reflecting the manpower scheduling so that can be waiting queue for customers is short and also the average service time is reduced which will ultimately help increase business by improving customer satisfaction. Analyzing data it is observed that 2 drive up workers with 3 building workers and 2 walk up workers can keep the average service time to less than 7 minutes consistently in the busiest time of the day which is from 6 am to 9 am. Also the scheduling does not need to be same throughout the 7 days and even during the day as the customer arrival data shows a trend about the timings at which the customer frequency to arrive at the store is maximum. The busiest time of the day is between 7-8 am and the frequency slows down considerably after 1 pm thus scheduling of workers can be managed accordingly. Also the frequency of customers visiting is least on Sunday morning and Thursday comes out to be the busiest day in terms of customers visiting the coffee shop.

To look at the equipment side of the waste due to waiting it came to knowledge that espresso machine is used about 82 times on average in 5 different stores between the busy timings of 6 am to 9 am and the builder has to wait 48 times with average non value adding time of 110 seconds. There is only 1 espresso machine in every shop which is resulting in waste of time and leading to longer queues and longer service time to the customers of about 2 minutes for 1/3rd of the products served in busiest time of the day.

The scorecard and project health after the analyze stage is as below:



From the scorecard, the Return on Investment for the project is 307% and total spending for the project is \$64175. Project health is around 95% and the average serve time has been reduced from 298 seconds to 270 seconds.

The analyze stage has helped to narrow down the problems considerably and has paved way for the areas to focus during the improvement stage.

IMPROVE STAGE

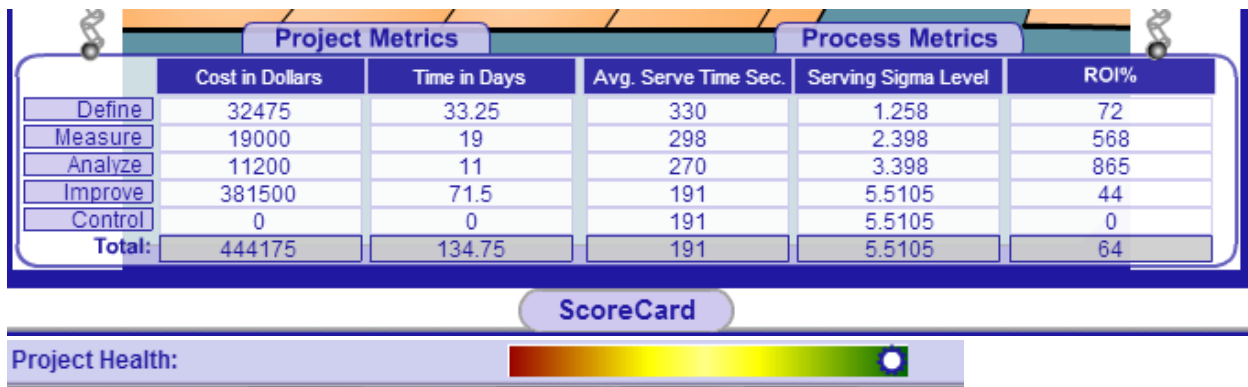
In the improve phase, we have brainstormed ideas regarding the reduction of service time. From the brain storming, it is found that excessive service time is due to implementation of wasteful activities like: writing order on cup, loading grinder, and too many hand-offs between counter and builder. In order to decrease service time, a new espresso machine is installed. By implementing this solution, the average service time has reduced by 20% of the initial time.

In the define phase, it has been said that espresso preparation is the most tedious and most time consuming process due to the hand-offs between counter and the builder; moreover, large number of people come to store during morning hours. By appointing one or more people at the counter during the rush hour reduces the service time by a great extent.

A pilot was conducted to verify if the before mean and the after mean was statistically significant. Since, N was less than 100 (N=91) and the distribution was normal we used a 2-sample t-test. From the hypothesis test ($H_0: \mu_1 - \mu_2 = 0$; $H_A: \mu_1 - \mu_2 > 0$); we reject the null hypothesis as the p-value (0.002) is lesser than $\alpha = 0.05$. This confirms our conclusions about that the before mean and after mean is statistically significant.

Another problem identified in the define stage is that defects occur for both drive-thru and walk-up customers. Measures are taken to reduce the frequency of the defects. This reduces the service time indeed. In FMEA analysis, it was found that RPN score is high for frequency of defects. By repeating the order, errors can be easily detected before the product is made. Therefore, occurrence value decreases and in turn RPN score decreases.

By installing an espresso machine, reducing remakes, and reducing walk time, a mean of 4.23 minutes and a standard deviation of 1.37 is achieved within a small sample size. By considering the above factors, a defect rate of 0.3% is estimated which gives Sigma Level of 4.2.



By successfully implementing the above solutions, from the score card - the average service time has been drastically reduced from 270 sec to 191 seconds and the serving Sigma Level has increased from 3.39 to 5.51 and the project health is almost 98%.

CONTROL PHASE

For the next phase, we would like to document the improve process and find the process capability of the new process. If the output is not desirable, then we would redesign the process.

CONTROL STAGE

In the Control Phase, we had to design controls to keep the improved process consistent. The service time that was achieved in the improve stage had to be controlled and kept unfluctuating.

In order to design the right controls, we decided to go about with control plan B. The Control plan B document outlines ongoing responsibilities for data collection, charting and analysis, and reaction plan. This control plan would help the team acquire the 5W2H (Where, Why, Who, When, What, How, and How much) information.

To keep the goal on going, we decided to document the Standardize work and distribute it to all the work stations in order to ensure standard work procedures. This Standard document consists of Operation Takt Time, Work Elements, Work procedure and Sequences as these are the important elements of standardized work.

Furthermore, to achieve an improved irreversible process and to keep the cost low, we decided and initially purchased the process capability tool for small sample data. Since, this was a small sample data we could not draw any meaningful conclusions about the capability. We then purchased the tool to determine the capability of several Sigma Brew stores. This gave us better results as the sample data was higher than the previous one. The DPMO decreased and the sigma level increased indicating significant improvement in the capability. Choosing a larger sample data would result in better results but using the resources to understand the behavior of the process is suffice and cost efficient.

Finally, the team purchased the Execution plan B to schedule a project handoff meeting with the process owners to review final process capability, confirm ongoing responsibilities for process management, and agree for the project closure. We chose the execution plan B as it confirms whether the project requirements have been met indicating the target values and the achieved values. This determines the quality of work achieved using the DMAIC process.

So, from the control stage we can conclude that our process capability meets the required standards and the Standardize work is documented. We will see to it that the standardize work is followed by every employee in order attain minimum service time and to achieve required process capability. The project reached a six sigma level of 6.398; this is practically not achievable in a real life scenario.

FINAL SCORECARD

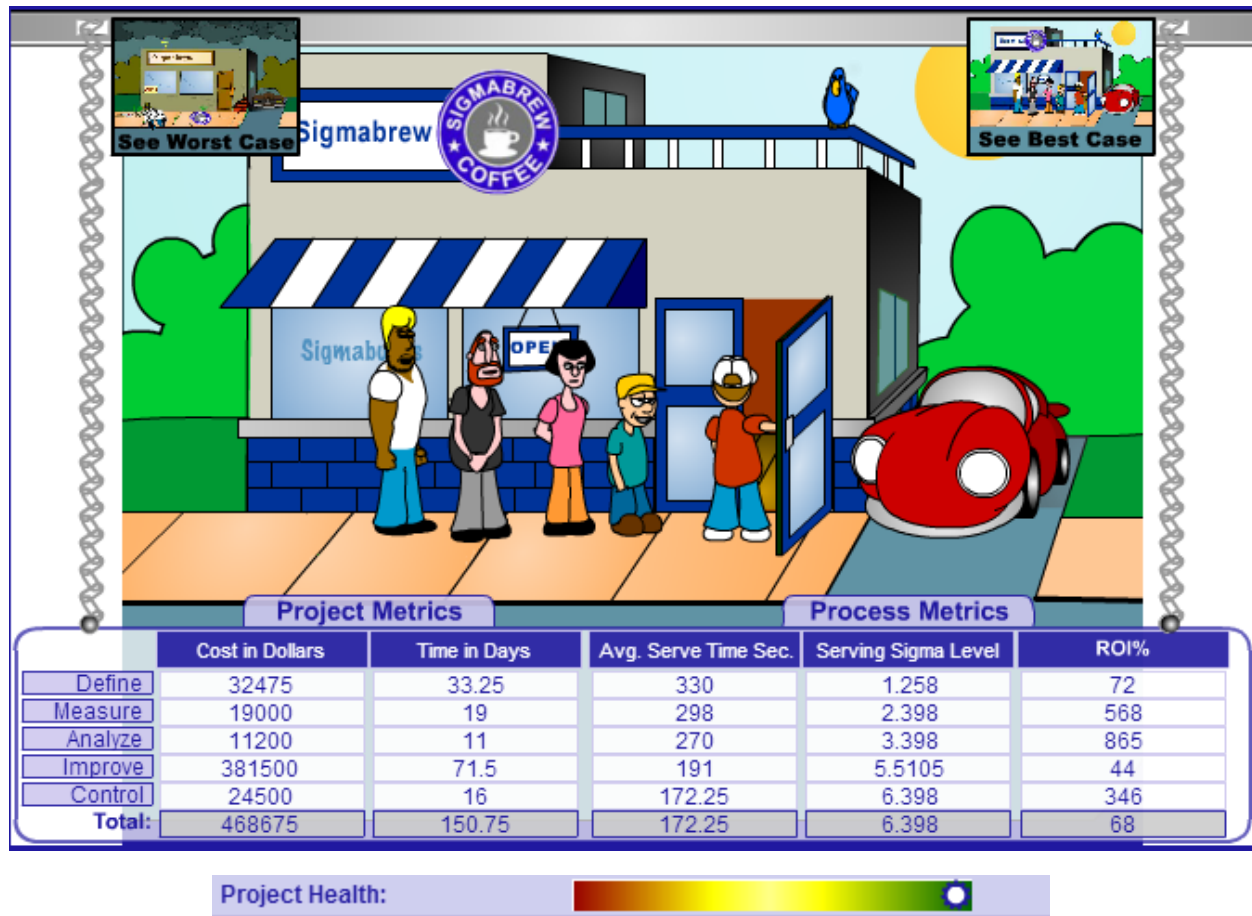


Figure 4: Final Scorecard and Project Health

From the above score card, we can conclude that the average service time has been significantly reduced from 330 seconds to 172.25 seconds and serving Sigma Level of 6.398 with an ROI of 68 %. The project was successfully completed in 151 days. A colossal improvement is observed in the improve stage where the service time was reduced by almost 30% from the analyze stage. The serving time was further reduced to 172.25 seconds at the end of the control phase.

The team achieved really good ROIs in the measure and the analyze stage as the team was efficient in choosing the right tools for data collection and identifying the causes in the measure and analyze stage respectively. The ROI was considerably less in the improve stage as money was invested in rectifying the problems and successfully decreasing the average service time for walk-in and drive-thru customers. This in the long run would increase customer satisfaction and would pay for itself. Figure 4 illustrates the best case scenario and the project health when the project has been completed. The project health is approximately 99%.

TEAM PERFORMANCE ANALYSIS AND FUTURE PROJECTS

In the define stage of the DMAIC process the major problem identified was the long service time to serve the espresso drink. The team spent \$32,475 in order to identify the problem in 33.25 days. The ROI achieved was 72% which is acceptable as money has to be invested in defining the problem. In the measure stage the KPIV's and KPOV's were identified and it was found that the delay in the process was due to new complex drinks, time of delay and poor work flow. The team spent \$19,000 and 19 days for the measure stage. The ROI was 568% indicating a very significant improvement in the process as the average service time was decreased to 298 seconds. In the analyze phase of the DMAIC process, three major causes were identified – inadequate number of employees, preparation of complicated drinks, and space constraint. The team was successful in using the right tools in identifying the right causes that affected the process. The service sigma level achieved was 3.39. Later, in the improve stage; the defects were rectified by making changes in the process. The team implemented an additional espresso machine and also recruited a new employee to decrease the hand-offs in the process. The total amount spent in this phase was \$381,500. The total time spent for implementing the changes was 72 days. The average service time was drastically reduced to 191 seconds and a sigma level of 5.51 is achieved. The team was successful in drastically reducing the service time. The ROI achieved was 44%, which is comparatively less as a lot of money was invested in improving the process by reducing the service time. In the control stage the team worked on standardizing the process and making it irreversible. The total amount invested in the project came to be \$468,675 and was completed in 151 days. The average service time was reduced to 172 seconds achieving an overall ROI achieved of 68%. The team was successful in achieving the goal of reducing the service time of walk-in and drive-thru customers. Therefore, in the future projects, the team would perform in the similar fashion; gradually improving the process by attaining high level of customer satisfaction while using the resources wisely.