MINIMIZING PRODUCT GIVE AWAY IN ALL PACKING PROCESSES AT HEMAS MANUFACTURING

By

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DECLERATION

The project work described in this thesis was carried out at the Production Department of Hemas Manufacturing (Pvt) Ltd under the supervision of Dr. Ruwan Pathirana and Dr. C.P. Udawatte.

A report on this has not been submitted to any other university for another degree.

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AFFECTIONATELY DEDICATED TO

MY PARENTS

AND

TEACHERS

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Abstract

"Product Give Away" is defined as the amount which is packed more than the declared amount of a product. From the company's point of view, it adds a value to the cost of production reduces the competitive edge and reduces profit margins. At present, product specifications of Hemas Manufacturing demand minimum net content of a product to be always equal to declared net content making "Product Give Away".

This project work is launched to establish new specification limits to minimize the Product Give Away for all prepackages produced by the Hemas manufacturing, according to the regulations of Measurement Units, Standards and Services Act no 35 of 1995 and at the same time assuring all processes are capable of adhering to the set legal limits.

Raw material cost of Give Away products was 6.95 million rupees and the cost of packaging materials required to pack the Product Give Away was 12.6 million rupees per year (November 2007- November 2008). Therefore to get a more realistic figure, the cost of packaging material, retail margin and distributor margins were deducted to calculate the saving from "Product Give Away" which is 50.7 million rupees as per list price per annum. 4M analysis and YY analysis were done in order to identify the root causes for the "Product Give Away" loss. Samples of products were collected randomly and frequently from the online production lines and weighed and recorded to analyze the current loss and current process capabilities, then new specification limits for all products were determined after a statistical analysis. Then new weight control and monitoring charts can be prepared by determined specification limits for all packaging processes and thereby loss due to "Product Give Away" was reduced which contributes to the company profit margins.

As a further development, applying a suitable automation option, which have ability to capture weights on-line in the production process and display captured weights in a graph consisting of mean, Upper Control Limit (USL) and Lower Control Limit (LSL). Display window would be controlled by a Product ID card which is driven by a bar code scanning for the In-Process control records.

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List of Abbreviation

ARCA	Apollo Root Cause Analysis
Cpk	Process capability index
CPU	Upper Control Point
CPL	Lower Control Point
etc.	etcetera
D	Declared Nominal Net Content
FMCG	Fast Moving Consumer Goods
FTA	Fault Tree Analysis
g	Gram
k	Correction Factor
ml	milliliter
No	Number
RCA	Root cause analysis
s	Standard deviation
T	Tolerable Deficiency
LSL	Lower Specification Limit
USL	Upper Specification Limit
X	Mean of net content

CHAPTER 01

INTRODUCTION

1.1 Introduction

Hemas group is to passionately deliver products and services thus enriching the lives of customers and creating superior value to their stakeholders. Hemas Group is a publicly listed company with a focus on five key sectors FMCG, Healthcare, Transportation, Leisure and Strategic Investments. Hemas Personal care brands include the entire spectrum of grooming products for both babies and adults in hair care, skin care, toiletries, fragrances and oral care.

Department of Measurement Units, Standards and Services in Sri Lanka was established in 1997 under the Measurement Units Standards and Services Act No 35 of 1995. The Department is the successor to the weight and measures division, which was, established in 1952 under the weight and measure ordinance no 37 of 1946. The department is entrusted with the implementation of the act, upgrading necessary laws and promulgating regulations while safeguarding the interest and protecting the rights of the consumer as well as the manufacturer. The Minister of Commerce and Consumer Affairs under section 60 (2) (i) of Measurement Units, Standards & Services Act, No. 35 of 1995 of the parliament of the Democratic Socialist Republic of Sri Lanka, has made regulations to verify the net content of packaged goods where the net content is declared in units of mass, volume, length, width, thickness, area number.

According to the previous Measurement Units, Standards and Services act weight of every product should be equal or more than its declared weight. This minimum weight system look after the interest of the consumer, it added lot of pressure on the manufacturer who had a machine which always shown a deviation. Especially for small scale manufacturer who has the minimum machine capability have to pack more than declared quantity to meet the law. This leads to specifying mean weight or volume should always higher than its declared weight or volume and it is a big disadvantage for the manufacturer. Therefore a new system was introduced in the above mentioned act considering the manufacturer's interest while protecting the consumer.

By ensuring that declared weight is delivered to the manufacturer every batch should have their mean meeting the declared weight or Nett content the new system was introduced. As a result of this manufacturer had the benefit of saving on product give away, but Company like Hemas, specifications still continue to be comply with previous minimum weight legislation can make a fairly big saving in a very competitive business environment and have a better chance of dealing with their competitors.

When a product is packed more than the legal requirement, that amount is defined as "Product Give Away". This amount is not appreciated by the consumer as he or she does not know that excess amount is given to the consumer. From the company's point of view it adds to the cost of production, reduces the competitive edge and reduces profit margins.

This project work is launched to establish new governing law in order to minimize the Product Give Away by controlling the process capability and the line capability for all prepackages producing by the Hemas manufacturing. Total saving for the company will be 50.7 million per year as per the list price reducing the "Product Give Away". That is final result will be a huge gain of cost benefit for the company.

1.2 Objectives

1.2.1. Overall Objective:

To minimize "Product Give Away" by controlling process capability and controlling line capability and adhering to the regulations of Measurement Units, Standards and Services Act no 35 of 1995.

1.2.2. Specific Objectives:

- Studying the regulations of Measurement Units, Standards and Services Act No 35 of 1995.
- Analyzing current loss, current practice.
- Brain-storming the legal requirements.
- Analyzing the current machine capability against the legal requirement
- Setting lower control limit and upper control limit.
- Reduce the Product Give Away by controlling process capability and line capability against the legal standards.

CHAPTER 02

LITERATURE REVIEW

2.1 Product Give Away

The term "Product Give Away" is defined as the amount which is packed more than the declared amount of a product. From the company's point of view it adds a value to the cost of production reduces the competitive edge and reduces profit margins.

In marketing, a product is anything that can be offered to a market that might satisfy customers' need. In retailing, products are called merchandise. In manufacturing, products are purchased as raw materials and sold as finished goods. In a manufacturing process of any product, waste can be aroused in any form and any method. There are different types of waste such as contaminated solids, core loss, customer returns, damage, draining, dust, effluent, evaporation, hidden losses, over fill, packaging, process loss, stock loss, etc. Any waste can take the opportunity to cut waste and increase profits by using a waste minimization practice. "Product Give Away" is a type of waste as it takes the opportunity to cut waste and increase the profit margin.

2.2 Legal Requirement

The regulations of the act, Measurement Units, Standards and Service Act No. 35 of 1995 shall be used in verification of the net content of pre-packaged goods where the net content is declared in units of mass, volume, length, width, thickness, area or number. These regulations contain statistical tests, sampling plans, average tare procedures and test procedures. (Measurement Units, Standards and Service Act No. 35 of 1995)

Importance of a Legal Requirement is to protect the consumer and at the same time to be fair by the manufacturer because of no machine can produce the exact declared weight or volume all the time which is leads to a deviation from standard.

Legal limits were set for the allowable Deviation from standard (specified target) and this was described as Tolerable Deficiency.

Table 2.1 Tolerable Deficiency (T) for Mass and Volume

Declared (Nominal) Net Content, [D] In g or ml	% Tolerable Deficiency [T], From [D]	Tolerable Deficiency [T], In g or ml
0-50	9.0 %	-
50-100	-	4.5
100-200	4.5 %	-
200-300	-	9
300-500	3.0 %	-
500-1000	-	15
1000-10,000	1.5 %	-
10,000 – 15,000	-	150

These Tolerable Deficiencies were indicated in the regulations of the act, Measurement Units, Standards and Service Act No. 35 of 1995.

Following example indicates that how a product can have the allowable deficiency.

Table 2.2 Example for Tolerable Deficiency of a product

Declared Nominal Quantity In g/ml	%Tolerable Deficiency [T], From [D]	Tolerable Deficiency [T], In g/ml	Example		
			Declared Net Content [D] Of product	Tolerable Deficiency [T]	
				-	+
0-50	9.00%	-	7 ml Sachet	6.37ml	7.63 ml
50-100	-	4.5	70g Tube	65.5 g	74.5 g
100-200	4.50%	-	125ml Bottle	119.375 ml	130.625 ml
200-300	-	9	250ml Bottle	241 g	259 g
300-500	3.00%	-	400 g Bottle	388 g	412 g
500-1000	-	15	500g Pack	485 g	515 g
1000-10,000	1.50%	-	1 kg Pack	985 g	1015 g
10,000–15,000	-	150	3 kg Pack	2955 g	3045 g

2.2.1 Acceptance Criteria of the Legal Requirement

A lot shall be declared as conforming to the nominal net content if the following three conditions are satisfied, else the inspection lot shall be rejected. (Measurement Units, Standards and Service Act No. 35 of 1995)

1. The number of prepackages having count less than or equal to the corresponding acceptance number given in column 3 of Table 2.3

Table 2.3 Number of Nonconforming packages permitted

LOT SIZE (N)	SAMPLE SIZE	**Number of Nonconforming packages permitted***	Sample Correction Factor, k *(Students t, 0.99)*
150-4000	32	**2**	0.485
More than 4000	80	**5**	0.295

*Number of packages of values between (D-T) and (D-2T)

Where T – Tolerable Deficiency, D – Declared net content

For an example 7ml sachet can have 2 packets between 6.37ml [(D-T) = (7-0.63) ml] and 5.74ml [(D-2T) = (7-2x0.63) ml] out of 32 samples from lot size of 150-4000.

Tolerable deficiency is described in Table 2.2

2. The number of prepackages having net content less than D-2T is zero

Table 2.4 Example for the second condition

Product	D (g)	Sample size	T	D-T	D-2T	Maximum packages possible between (D-T) and (D-2T)	**Less than D-2T**
Product A	40 g	80	9% (3.6g)	36.4 g	32.8 g	(betw.36.4-32.8g) 5	**0**
Product B	300 ml	80	9 (9ml)	291 ml	282 ml	(betw,291-82ml) 5	**0**

2. **Expression (X + ks) is greater than or equal to D,**

   That is $[(X + ks) \geq D]$

(Where s - standard deviation, X – Mean of net content and k – correction factor)

Example:

Where D = 40g , s = 2.3 and k = 0.295 and sample size = 80

$(X + ks) \geq D$

$X \geq D - ks$

$X \geq 40 - 0.295 \times 2.3$

$X \geq 39.3215$

$X_{min} = 39.3215g$

This value is less than the declared net content.

In this example, the standard deviation is too high and the third condition is to be fair the manufacturers who have machines with high deviations when filling products.

If these three conditions can satisfy the lot shall be accepted otherwise a lot shall be rejected. (Measurement Units, Standards and Service Act No. 35 of 1995)

2.2 Waste Minimization

Waste minimization is the process and the policy of reducing the amount of waste produced by a person or a society. It is part of the wider aim of **waste reduction** which is often described as a component of the waste hierarchy.

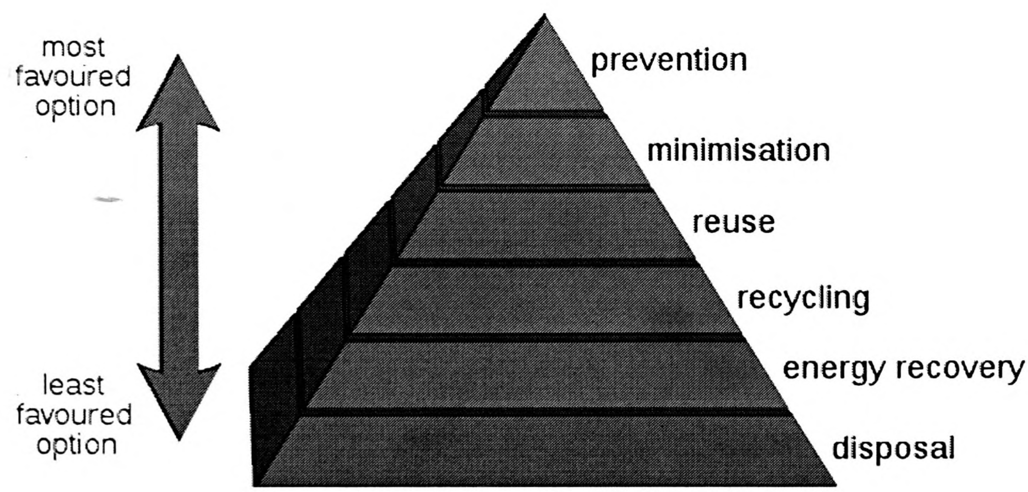


Figure 2.1 Waste Hierarchy

In the waste hierarchy, the most effective policies and processes are at the top. Waste minimization is also strongly related to efforts to minimize resource and energy use. For the same commercial output, usually the fewer materials are used, the less waste is produced. Waste minimization usually requires knowledge of the production process, cradle-to-grave analysis (the tracking of materials from their extraction to their return to earth) and detailed knowledge of the composition of the waste.

2.2.1 Waste Minimization Processes

Resource optimization

Minimizing the amount of waste produced by organizations or individuals goes hand-in-hand with optimizing their use of raw materials. For example, a dressmaker may arrange pattern pieces on a length of fabric in a particular way to enable the garment to be cut out from the smallest area of fabric.

Reuse of scrap material

The introduction of techniques or processes that enable production scrap to be immediately re-incorporated at the beginning of the manufacturing line so that they do not become a waste product. Many industries routinely do this; for example, paper mills return any damaged rolls to the beginning of the production line, and in the manufacture of plastic items, off-cuts and scrap are re-incorporated into new products.

Improved quality control and process monitoring

Taking steps to ensure that the number of reject batches is kept to a minimum. This is achieved by increasing the frequency of inspection and the number of points of inspection. For example, installing automated continuous monitoring equipment can help to identify production problems at an early stage.

Waste exchanges

Where the waste product of one process becomes the raw material for a second process. Waste exchanges represent another way of reducing waste disposal volumes for waste that cannot be eliminated.

Ship to point of use

Making deliveries of incoming raw materials or components direct to the point where they are assembled or used in the manufacturing process can minimize handling and the use of protective wrappings or enclosures.

Properly implemented waste minimization process

Usually Increase profitability, lowers production costs, enhances productivity, provide a rapid return of any capital or operating investments required, increase product yield, leads to more efficient use of energy and raw materials, results in improved product quality, increases staff motivation, etc.(Buffa , Sarin 1987)

2.3 Root cause analysis

Root cause analysis **(RCA)** is a class of problem solving methods aimed at identifying the root causes of problems or events. The practice of RCA is predicated on the belief that problems are best solved by attempting to correct or eliminate root causes, as opposed to merely addressing the immediately obvious symptoms. By directing corrective measures at root causes, it is hoped that the likelihood of problem recurrence will be minimized. However, it is recognized that complete prevention of recurrence by a single intervention is not always possible. Thus, RCA is often considered to be an iterative process, and is frequently viewed as a tool of continuous improvement.

Root cause analysis is not a single, sharply defined methodology; there are many different tools, processes, and philosophies of RCA in existence. However, most of these can be classed into five, very-broadly defined "schools" that are named here by their basic fields of origin: safety-based, production-based, process-based, failure-based, and systems-based. (Krajewski, Ritzman 2006)

- Safety-based RCA descends from the fields of accident analysis and occupational safety and health.
- Production-based RCA has its origins in the field of quality control for industrial manufacturing.

- Process-based RCA is basically a follow-on to production-based RCA, but with a scope that has been expanded to include business processes.
- Failure-based RCA is rooted in the practice of failure analysis as employed in engineering and maintenance.
- Systems-based RCA has emerged as an amalgamation of the preceding schools, along with ideas taken from fields such as change management, risk management, and systems analysis.

Despite the seeming disparity in purpose and definition among the various schools of root cause analysis, there are some general principles that could be considered as universal. Similarly, it is possible to define a general process for performing RCA. (Krajewski, Ritzman 2006)

2.3.1 General process for performing and documenting an RCA-based Corrective Action

Notice that RCA (in steps 3, 4 and 5) forms the most critical part of successful corrective action, because it directs the corrective action at the root of the problem. That is to say, it is effective solutions we seek, not root causes. Root causes are secondary to the goal of prevention, and are only revealed after we decide which solutions to implement.

1. Define the problem.
2. Gather data/evidence.
3. Ask why and identify the causal relationships associated with the defined problem.
4. Identify which causes if removed or changed will prevent recurrence.
5. Identify effective solutions that prevent recurrence, are within your control, meet your goals and objectives and do not cause other problems.
6. Implement the recommendations.
7. Observe the recommended solutions to ensure effectiveness.

2.3.2 Basic elements of root cause

- Materials
  - Defective raw material
  - Wrong type for job
  - Lack of raw material
- Machine/Equipment
  - Incorrect tool selection
  - Poor maintenance or design
  - Poor equipment or tool placement
  - Defective equipment or tool
- Environment
  - Orderly workplace
  - Job design or layout of work
  - Surfaces poorly maintained
  - Physical demands of the task
  - Forces of nature
- Management
  - No or poor management involvement
  - Inattention to task
  - Task hazards not guarded properly
  - Other (horseplay, inattention....)
  - Stress demands
  - Lack of Process
- Methods
  - No or poor procedures
  - Practices are not the same as written procedures
  - Poor communication
- Management system
  - Training or education lacking
  - Poor employee involvement
  - Poor recognition of hazard
  - Previously identified hazards were not eliminated

    (Krajewski, Ritzman 2006)

2.3.3 5 Whys Analysis (YY Analysis)

The **5 Whys** is a question-asking method used to explore the cause/effect relationships underlying a particular problem. Ultimately, the goal of applying the 5 Whys method is to determine a root cause of a defect or problem.

Example

The following example demonstrates the basic process:

My car will not start. (The problem)

1. Why? - The battery is dead. (first why)
2. Why? - The alternator is not functioning. (second why)
3. Why? - The alternator belt has broken. (third why)
4. Why? - The alternator belt was well beyond its useful service life and has never been replaced. (fourth why)
5. Why? - I have not been maintaining my car according to the recommended service schedule. (fifth why is the root cause)

The questioning for this example could be taken further to a sixth, seventh, or even greater level. This would be legitimate, as the "five" in 5 Whys is not gospel; rather, it is postulated that five iterations of asking why is generally sufficient to get to a root cause. The real key is to encourage the troubleshooter to avoid assumptions and logic traps and instead to trace the chain of causality in direct increments from the effect through any layers of abstraction to a root cause that still has some connection to the original problem. (Buffa, Sarin, 1987)

2.3.4 Ishikawa Diagram (Fishbone Diagram)

Ishikawa diagram, in fishbone shape, showing factors of men, machines, milieu (workplace), materials, methods, measurement, all affecting the overall problem. Smaller arrows connect the sub-causes to major causes.

The **Ishikawa diagram** (or fishbone diagram or also cause-and-effect diagram) shows the causes of a certain event. A common use of the Ishikawa diagram is in product design, to identify potential factors causing an overall effect

Causes

Causes in the diagram are often based on a certain set of causes, such as the 6 M's, 8 P's or 4 S's, described below. Cause-and-effect diagrams can reveal key relationships among various variables, and the possible causes provide additional insight into process behaviour.

Causes in a typical diagram are normally grouped into categories, the main ones of which are:

The 6 M's

Machine, Method, Materials, Maintenance, Man and Mother Nature (Environment) (recommended for the manufacturing industry).

A more modern selection of categories used in manufacturing includes Equipment, Process, People, Materials, Environment, and Management.

The 8 P's

Price, Promotion, People, Processes, Place/Plant, Policies, Procedures, and Product (or Service) (recommended for the administration and service industries).

The 4 S's

Surroundings, Suppliers, Systems, Skills (recommended for the service industry).

Causes should be derived from brainstorming sessions. Then causes should be sorted through affinity-grouping to collect similar ideas together. These groups should then be labeled as categories of the fishbone. They will typically be one of the traditional categories mentioned above but may be something unique to your application of this tool. Causes should be specific, measurable, and controllable. (Buffa, Sarin, 1987)

2.4 Process capability

The ability to produce products or provide services that meet specifications defined by the customer's needs. Capability analysis reveals how well the manufacturing process meets these specifications, and provides insight into how to improve the process and sustain manufacturers' improvements.

Before assessing processing capability, you must ensure your process is stable. An unstable process is unpredictable. If the process is stable, manufacturer can predict future performance and improve its capability.

The capability of a process should be constantly measured and analyzed. Capability analysis can help you answer following questions:Is the process meeting customer specifications?, How will the process perform in the future?, Are improvements needed in the process? And Have you sustained these improvements, or has the process regressed to its previous unimproved state?

Analyze process capability with capability indices such as Cp, Pp, Cpk, and Ppk.
(Buffa, Sarin, 1987)

2.4.1 Capability Indices (Cpk, CPU, and CPL)

Measures of potential process capability, calculated with data from the subgroups in the study. They measure the distance between the process average and the specification limits, compared to the process spread.

- CPL measures how close the process mean is running to the lower specification limit
- CPU measures how close the process mean is running to the upper specification limit
- Cpk equals the lesser of CPU and CPL.

If Cpk, CPU, and CPL are equal, the process is centered at the exact midpoint of the specification limits. Compare the values to benchmarks to determine whether to improve your process; many industries use benchmark values of 1.33. (Gupta, Kapoor, 2002)

Cp and Pp

Capability indices that measure whether a process is capable of meeting specifications by calculating a ratio between the specification spread and the process spread. In general, the higher Cp and Pp values, the more capable process. To calculate Cp and Pp, you must know both the upper and lower specification limits.

Cp indices recognize the fact that samples represent rational subgroups, which indicate how the process would perform if the shift and drift between subgroups could be eliminated. Therefore, it calculates process spread using within-subgroup variation.

Pp, on the other hand, ignores subgroups and considers the overall variation of the entire process. This overall variation accounts for the shift and drift that can occur between subgroups; therefore, it is useful in measuring capability over time. If the Pp value differs greatly from the Cp value, which can conclude that there is significant variation from one subgroup to another. Compare Cp and Pp values to benchmark values to determine whether to improve your process; many industries use benchmark values of 1.33. If values of capability indices are less than the benchmark values, you must take steps to improve the process. (Buffa, Sarin, 1987)

CHAPTER 03

METHODOLOGY

3.1 Methodology

Predominantly, a literature survey approach was followed, where information available in the public domain was researched to obtain the requirement relevant to the government legislation.

Then following steps were followed up to preparation of Specification Limits.

- Analyzing Current Loss
- Identifying the root cause by YY Analysis and 4M Analysis
- Brain-storming the legal requirements
- Analyzing the current process capability against the legal requirement
- Setting Specification Limits, LSL and USL

Following steps have to follow for the implementation of the determined Specification Limits:

- Preparation of new weight controlling and monitoring charts
- Training plant personnel – operators / workforce
- Implement weight monitoring procedure on every lines
- Shifting the bell curve to the left with LSL, USL and declared weight as the mean of the population
- Minimize the "Product Give Away"

3.2 Analyzing Current loss

Following Steps were followed to calculate the current loss of Product Give Away of nine different brands with different packaging sizes.

Table 3.1 Machines and Brands in Packaging processes at Hemas Manufacturing

Machine	Product
Vimko Machine & Norden Machine	Toothpaste
Sachets Machine No.05	Toothpaste Sachets
Sachets Machine No.01/02/03/04/07	Shampoo/ Hair Gel/Hair Cream Sachets
Sachets Multi Track(4)	Hair Gel Sachets
Tub Machine	Hair Gel/ Hair Cream Tubs
Volumetric Filler	Shampoo/ Cream/Body Lotion
3 - Nozzles Filler	Hair Oil/Cologne/Mouth Wash
Cologne Filler Machine	Cologne/Body Spray

Cost of "Product Give Away" was calculated for November 2007 to December 2008.In the case of calculating the cost of "Product Give Away", following manipulation was followed.

Product	Declared Net content	Calculated Nominal Quantity (D*) in g/ml	Unit Price (Rs)	Packaging Cost per unit Rs.	No of Units Produced per annum	Variance in g/ml (Target net content against declared net content)	Product Give Away in g/ml	No of Units can be produced from Give Away	Cost can be obtained from Give Away as per retail price Rs.	Packaging Cost for Give Away products Rs.	Gain can be obtained from Give Away deducting the Packaging Material cost Rs.
BC Aloe Cream	200ml	195.16	145	18.57	905597	0.8	760701	3898	565186	72399	492787
BC Aloe Oil	125ml	103.20	110	29.16	29286	1.8	52715	511	56188	14896	41292
BC Aloe Soap	75g	75.00	30	4.20	1207596	0.0	0	0	0	0	0
BC Aloe Cream	100ml	97.58	90	13.54	89051	1.0	90832	931	83776	12602	71175
BC Aloe Vera Oil	50ml	41.28	52	17.40	116706	2.2	259087	6276	326370	109197	217173

First of all number of units produced per annum (Nov.2007-Dec.2008) was calculated. In the 8th column "Product Give Away" in g/ml was calculated. According to the amount of "product Give Away" calculated, number of units can be produced from Give Away were calculated in 9th column.

Assuming the units produced from "Product Give Away" priced and the cost recovered from the customer was calculated in the 10th column. Here cost can be obtained form Give Away was calculated as per retail price. Cost can be obtained from Give Away as per the list price also calculated.

Only the thing has to be spending for the value addition to the "Product Give Away" is packaging material cost. So in the 11th column packaging material cost needed to pack the "Product Give Away" was calculated.

The actual saving of the "Product Give Away" was the raw material cost of "Product Give Away".

3.3 Identifying the root cause by YY Analysis and 4M Analysis

3.3.1 4M Analysis for Understanding the Root Cause for Product Give Away

Using a Fish Bone Diagram

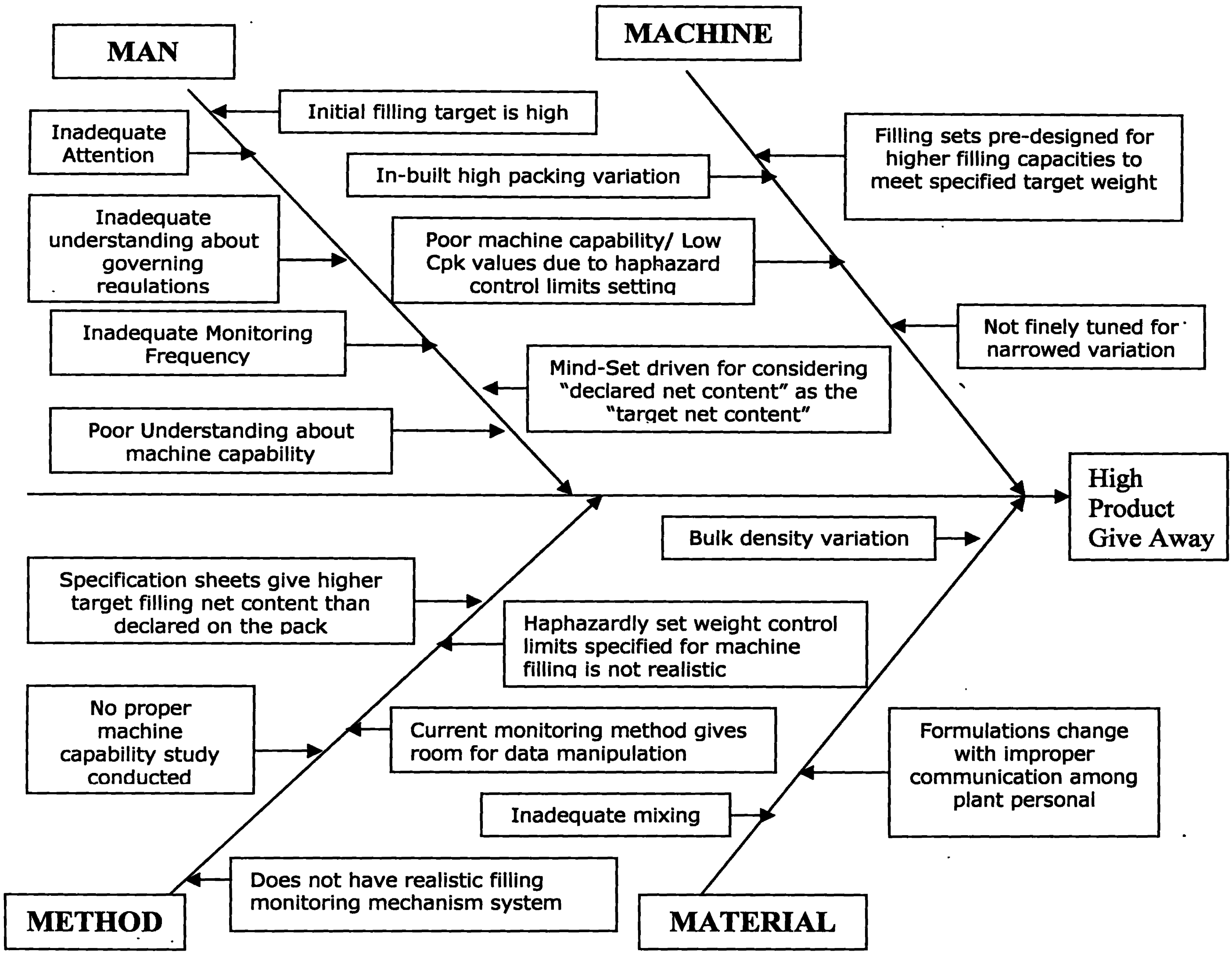


Figure 3.1 Fish Bone Diagram

Fish Bone diagram also known as the Cause and Effect Diagram. This diagram shows the analysis of determination of causes from 4M that is Man, Machine, Method, and Material which are affected for the high cast of "Product Give Away".

Main Causes effect for the high "Product Give Away" from Man:

- Inadequate understanding about governing regulations
- Poor Understanding about machine capability
- Mind-Set driven for considering "declared net content" as the "target net content"

Main Causes effect for the high "Product Give Away" from Machine:

- Filling sets pre-designed for higher filling capacities to meet specified target weight
- Poor machine capability/ Low Cpk values due to haphazard control limits setting

Main Causes effect for the high "Product Give Away" from Method:

- Specification sheets give higher target filling net content than declared on the pack
- No proper machine capability study conducted
- Does not have realistic filling monitoring mechanism system

Main Causes effect for the high "Product Give Away" from Material:

- Bulk density variation
- Formulations change with improper communication among plant personal

Then Countermeasures were analyzed using YY Analysis for main problems identified by Fish bone diagram.

3.3.2 Understanding root cause for countermeasures: YY Analysis

Table 3.2 YY Analysis

MAIN PROBLEM STATEMENT: Loss of Rupees 6.95 Million annually due to "Product Give Away"					
Phenomenon	**Why**	**Why**	**Why**	**Why**	**Countermeasures**
Mind set driven considering "declared weight or volume" as the "Minimum packing weight or volume"	General thinking if pack within a +/- tolerance cheat the consumers	Culture and mindset	Lack of awareness	Lack of adequate training	To conduct awareness creation sessions and roll out the session to factory floor level
Specification sheet itself gives higher target filing weight than declared on the pack	With assumption that our processes are not capable enough to give constant results	Not proper machine capability conducted before setting control limits	Lack of interest to conduct such study	Lack of adequate training	1.Change the concept of target weight 2.Set the " pack declared net content" as the "target filling net content" 3.Conduct training sessions
	Addressing present culture and mindset requirement				Conduct awareness creation sessions
Does not have realistic filling control monitoring mechanism	Poor awareness	Lack of adequate training			1.Design new online net filling content monitoring system 2.Set control limits after conducting extensive process capability study
Lack of understanding about governing regulations of net filling content	Poor awareness	Lack of concern and interest			Awareness creation sessions
Haphazardly set control limits for machine filling is not realistic	Lack of concern about machine capability	Improper communicati on			1.Conduct machine capability study 2.Set control limits as per the regulatory requirement 3.Set control limits according to the machine capability

YY Analysis is asking five Why's for a problem and the fifth Why is the countermeasure for the problem. Countermeasure for the phenomenon of Mind set driven considering "declared weight or volume" as the "Minimum packing weight or volume" was to conduct awareness creation sessions and roll out the session to factory floor level. Like wise this figure shows countermeasures for the relevant problem.

3.4 Brain-storming the legal requirements

3.4.1 Brain-storming

Concept of the target weight was changed as "Pack declared net content" should be the "target net content" by Brain storming. Addressing the preset culture and mindset requirement awareness creation sessions were conducted with the 100 percent contribution of the Hemas Manufacturing, managers, staff and workforce.

In this case legal requirement mentioned in Measurement Units, Standards and Services Act Bo 35 of 1995 was introduced thoroughly to the top management of Hemas Manufacturing.

3.4.2 Legal requirement

Tolerable Deficiencies Specified by the law

Legal limits were set for the allowable Deviation from standard and this was described as Tolerable Deficiency. Lowest deficiencies of all products were calculated according to the government requirement which is shown below.

Table 3.3 Tolerable Deficiencies (T) for mass and volume

DECLARED NOMINAL QUANTITY IN g/ml	%TOLERABLE DEFICIENCY [T], FROM [D]	TOLERABLE DEFICIENCY [T], IN g OR ml	EXAMPLE		
			DECLARED NET CONTENT [D] OF SKU	TOLERABLE DEFICIENCY [T]	
				-	+
0-50	9.00%	-	7 ml Sachet	6.37ml	7.63 ml
50-100	-	4.5	70g Tube	65.5 g	74.5 g
100-200	4.50%	-	125ml Bottle	119.375 ml	130.625 ml
200-300	-	9	250ml Bottle	241 g	259 g
300-500	3.00%	-	400 g Bottle	388 g	412 g
500-1000	-	15	500g Pack	485 g	515 g
1000-10,000	1.50%	-	1 kg Pack	985 g	1015 g
10,000–15,000	-	150	3 kg Pack	2955 g	3045 g

3.5 Analyzing the current process capability against the legal requirement

3.5.1 Data collection

- More than 80 samples with 2 to 5 sub group size of each and every products, with different brands and different packaging sizes packing by the Hemas Manufacturing were collected every 15 minutes/ 30 minutes/ 01hour for a period of 8 hours
- Each sample was weighed and recorded

3.5.2 Data Analyzing

- Process capability of each and every packaging process was analyzed statistically using Minitab 15 software

3.6 Setting Specification limits (LSL and USL)

Analyzing the current process capability using Minitab 15 software regarding to the legal requirement new specification limits which have the target net content as the declared net content of the pack were determined.

3.7 Implementation of determined Specification Limits

Instructions needed to the preparation of new weight controlling and monitoring charts according to the determined Specification Limits were given to the top management. To inline with the new weight controlling and monitoring charts, the plant personnel should have to train.

After the implementation of the new weight controlling and monitoring charts the loss of "Product Give Away" can be effectively utilized.

CHAPTER 04

RESULTS AND DISCUSSION

4.1 Analyzing Current loss

- Packaging material cost for the purpose of packing the Product Give Away was Rupees 12.6 Million
- Product Give Away was Rupees 6.95 Million per annum (See Appendix II)
- The cost which can be obtained by selling the products which can be produce from the Product Give Away was Rupees 50.7 Million as per list price (See Appendix II)

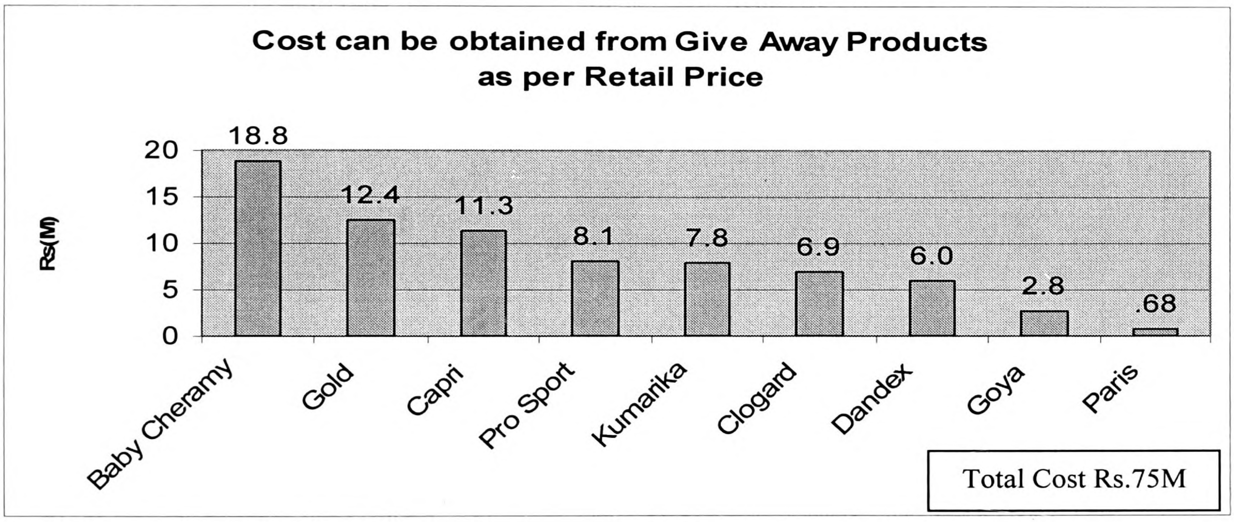


Figure 4.1 Cost can be obtained from "Product Give Away" as per retail price.

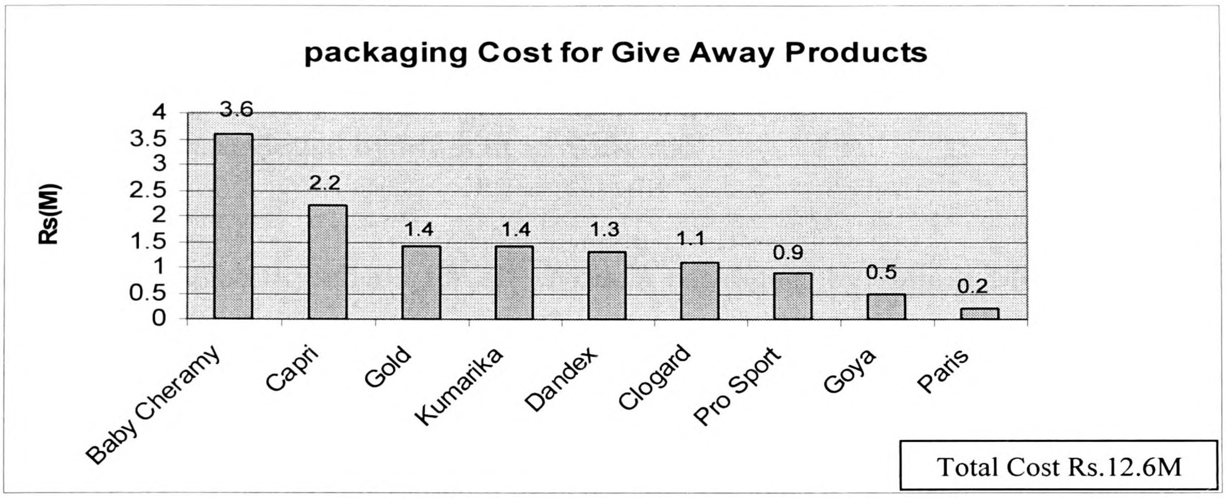


Figure 4.2 Cost of Packaging Material of "Product Give Away".

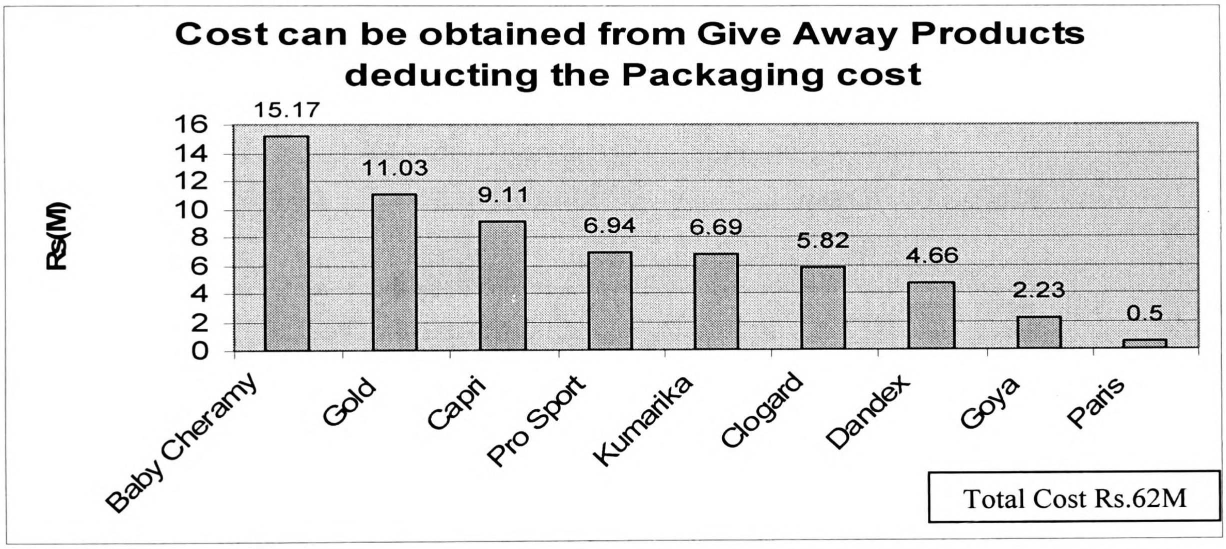


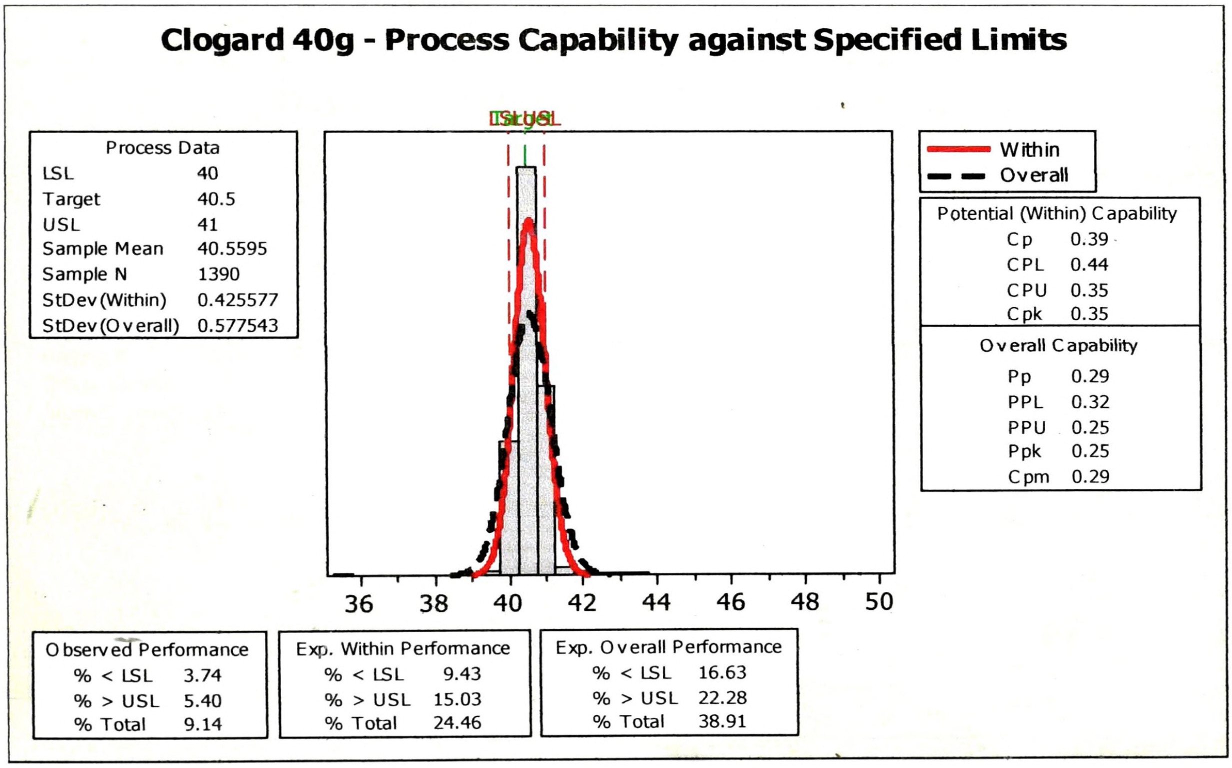
Figure 4.3 Cost can be obtained from "Product Give Away" as per retail price deducting Packaging Material cost.

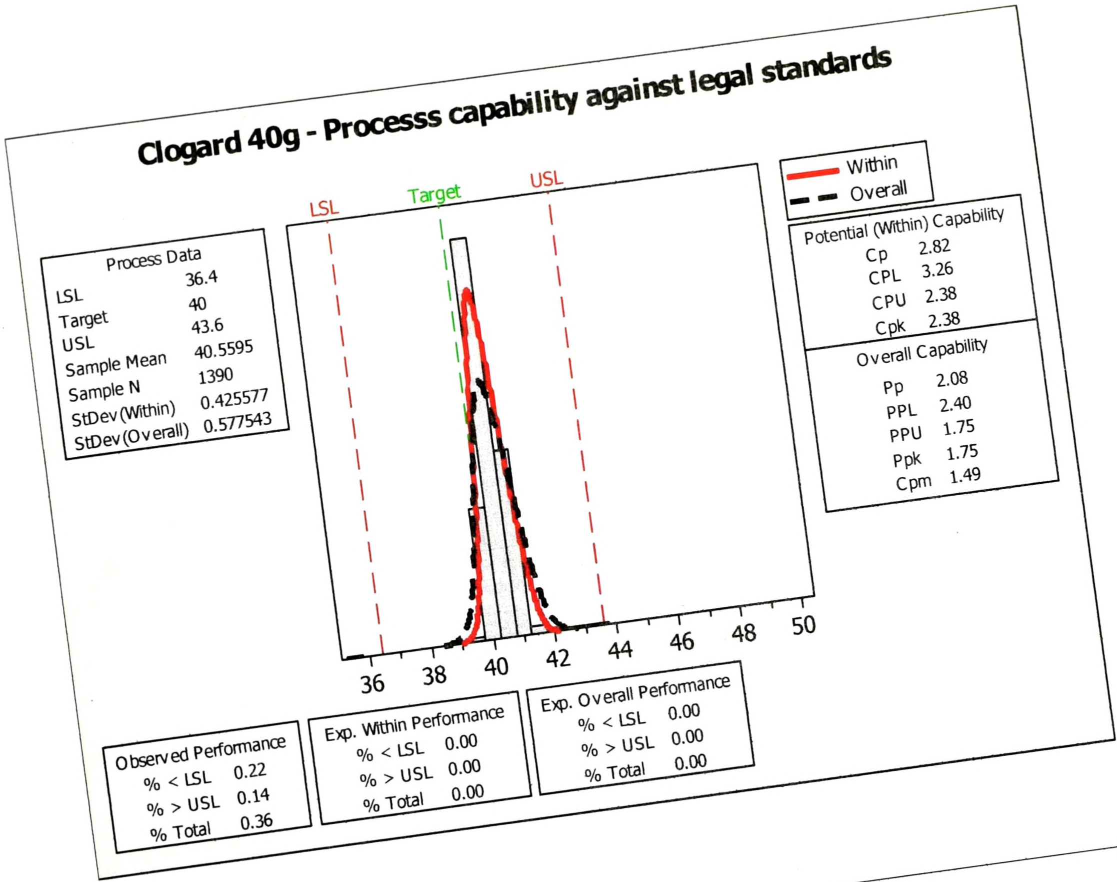
4.2 Analyzing the current process capability against the legal requirement

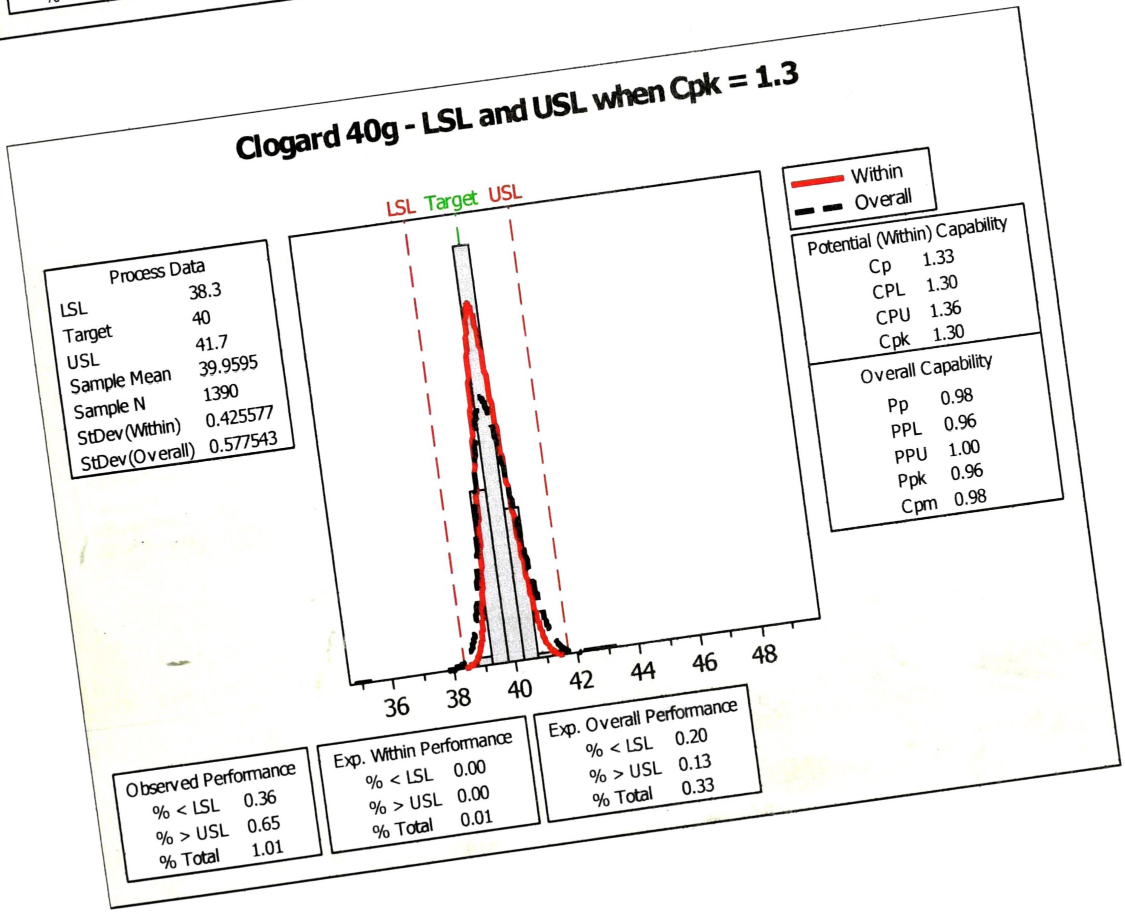
Process capabilities of all packing processes were analyzed using process capability charts which were plotted by Minitab 15 Software.

The process capability charts for all products packaging by Hemas Manufacturing were plotted and for an example Process capability charts for Clogard 40g, Clogard 70g, Clogard 120g and Clogard 170g are shown below. Process Capability chart plotted against specified limits which are given by the manufacturer, process Capability chart plotted against standard limits given by the governing law and Process Capability chart for calculated Specification limits for each and every products were calculated.

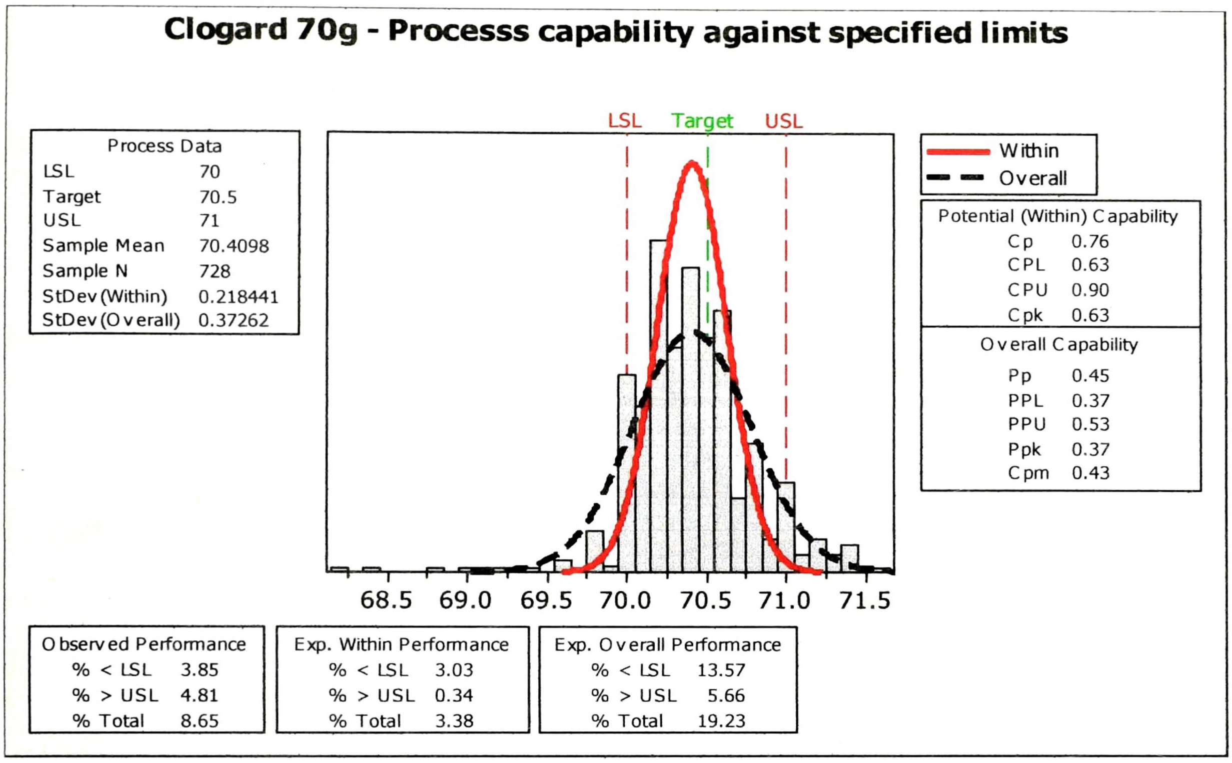
Clogard 40g

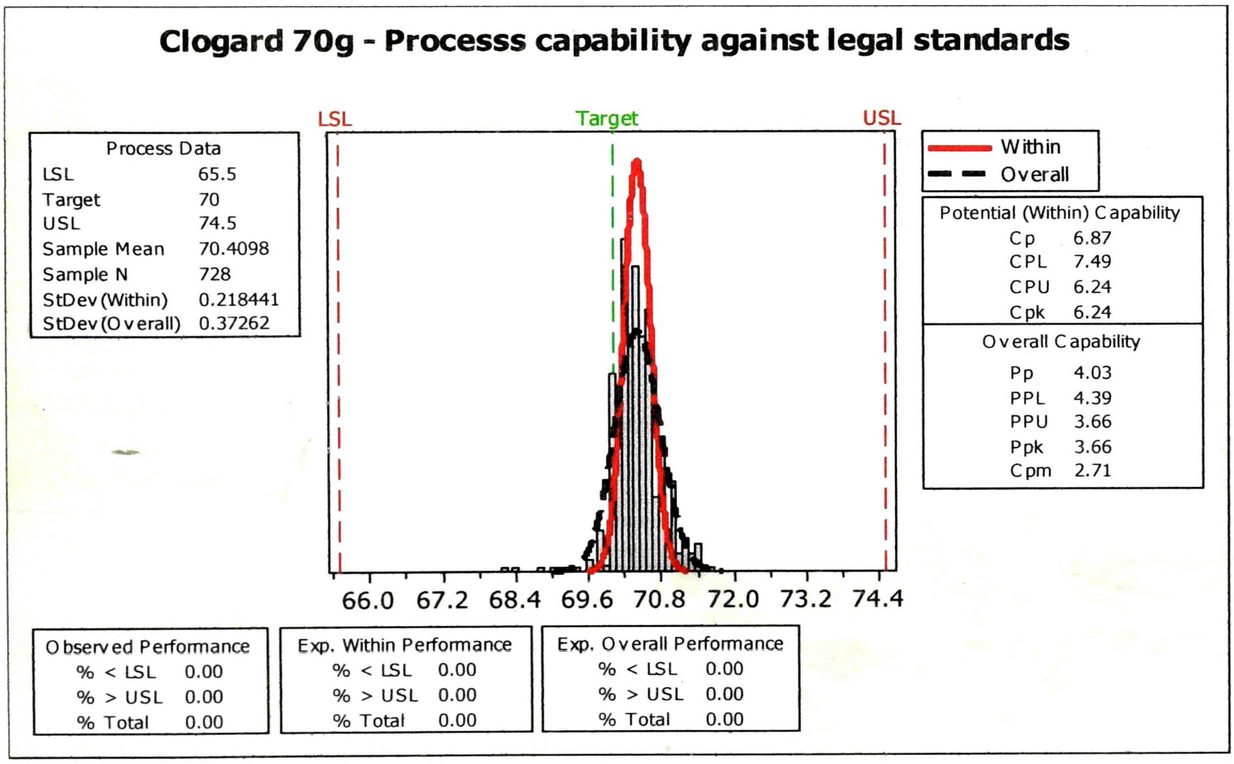


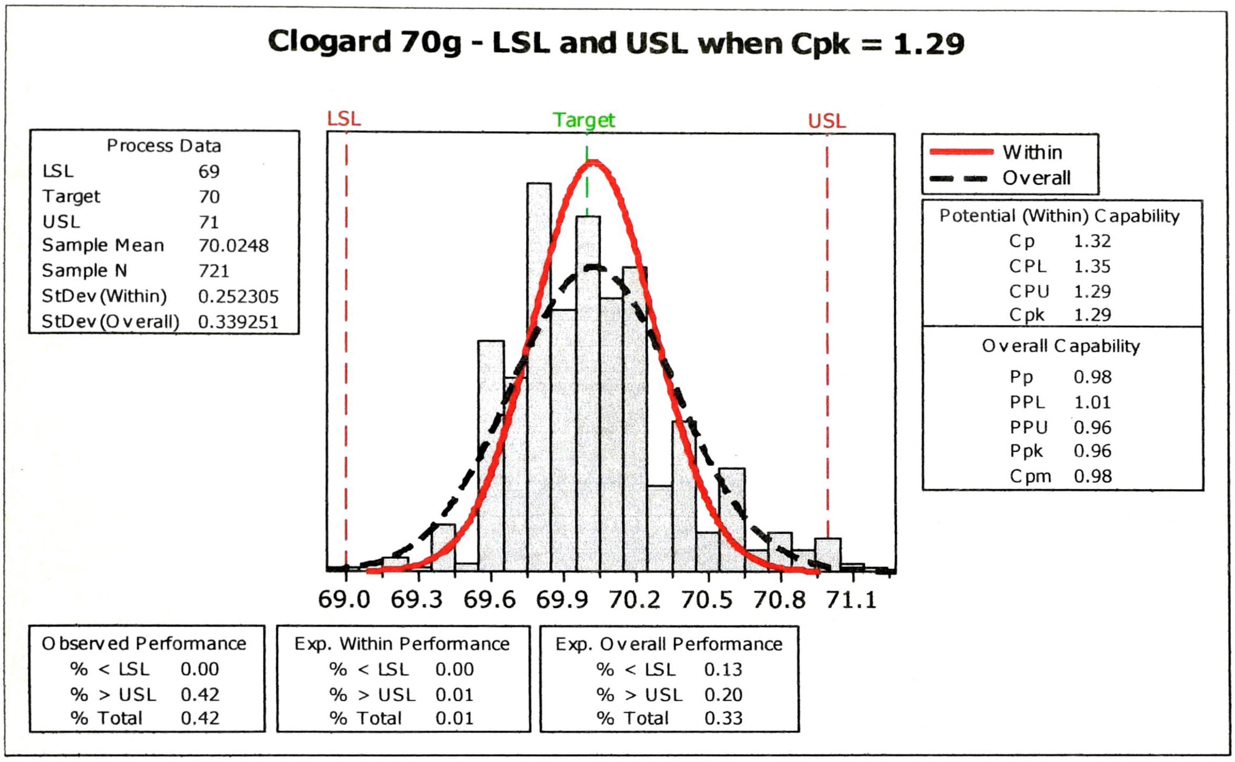

Clogard 40g - Processs capability against legal standards
LSL
Target
USL
Within
Overall
Process Data
LSL 36.4
Target 40
USL 43.6
Sample Mean 40.5595
Sample N 1390
StDev(Within) 0.425577
StDev(Overall) 0.577543
Potential (Within) Capability
Cp 2.82
CPL 3.26
CPU 2.38
Cpk 2.38
Overall Capability
Pp 2.08
PPL 2.40
PPU 1.75
Ppk 1.75
Cpm 1.49
36 38 40 42 44 46 48 50
Observed Performance
% < LSL 0.22
% > USL 0.14
% Total 0.36
Exp. Within Performance
% < LSL 0.00
% > USL 0.00
% Total 0.00
Exp. Overall Performance
% < LSL 0.00
% > USL 0.00
% Total 0.00


Clogard 40g - LSL and USL when Cpk = 1.3
LSL Target USL
Within
Overall
Process Data
LSL 38.3
Target 40
USL 41.7
Sample Mean 39.9595
Sample N 1390
StDev(Within) 0.425577
StDev(Overall) 0.577543
Potential (Within) Capability
Cp 1.33
CPL 1.30
CPU 1.36
Cpk 1.30
Overall Capability
Pp 0.98
PPL 0.96
PPU 1.00
Ppk 0.96
Cpm 0.98
36 38 40 42 44 46 48
Observed Performance
% < LSL 0.36
% > USL 0.65
% Total 1.01
Exp. Within Performance
% < LSL 0.00
% > USL 0.00
% Total 0.01
Exp. Overall Performance
% < LSL 0.20
% > USL 0.13
% Total 0.33

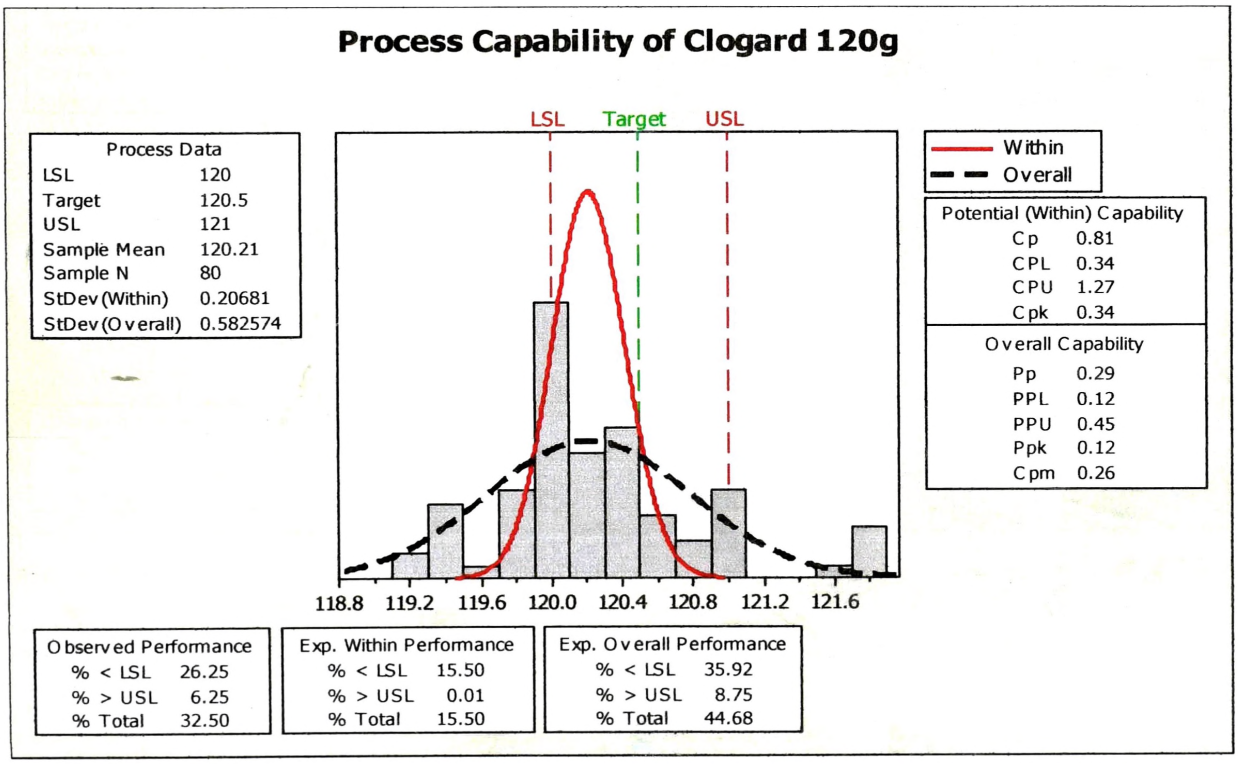
Clogard 70g

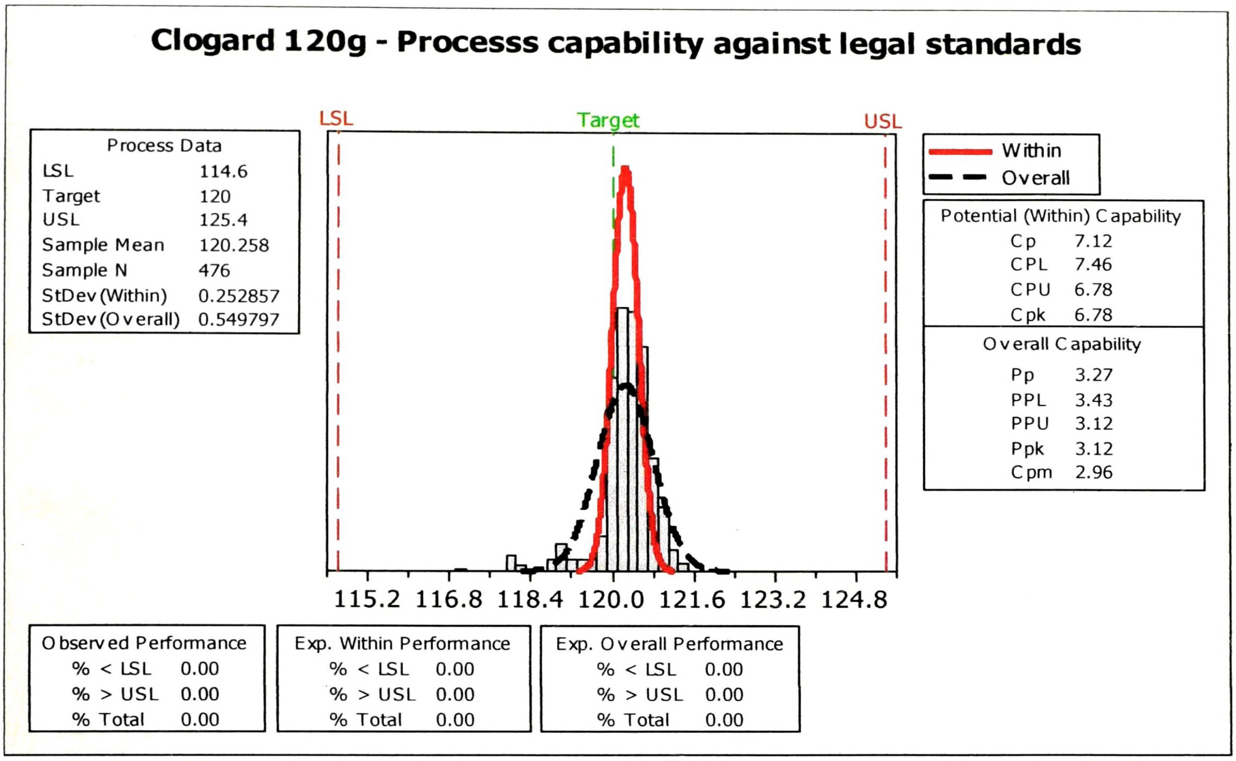

Clogard 70g - Processs capability against specified limits
Process Data
LSL 70
Target 70.5
USL 71
Sample Mean 70.4098
Sample N 728
StDev(Within) 0.218441
StDev(Overall) 0.37262
LSL
Target
USL
68.5 69.0 69.5 70.0 70.5 71.0 71.5
Within
Overall
Potential (Within) Capability
Cp 0.76
CPL 0.63
CPU 0.90
Cpk 0.63
Overall Capability
Pp 0.45
PPL 0.37
PPU 0.53
Ppk 0.37
Cpm 0.43
Observed Performance
% < LSL 3.85
% > USL 4.81
% Total 8.65
Exp. Within Performance
% < LSL 3.03
% > USL 0.34
% Total 3.38
Exp. Overall Performance
% < LSL 13.57
% > USL 5.66
% Total 19.23

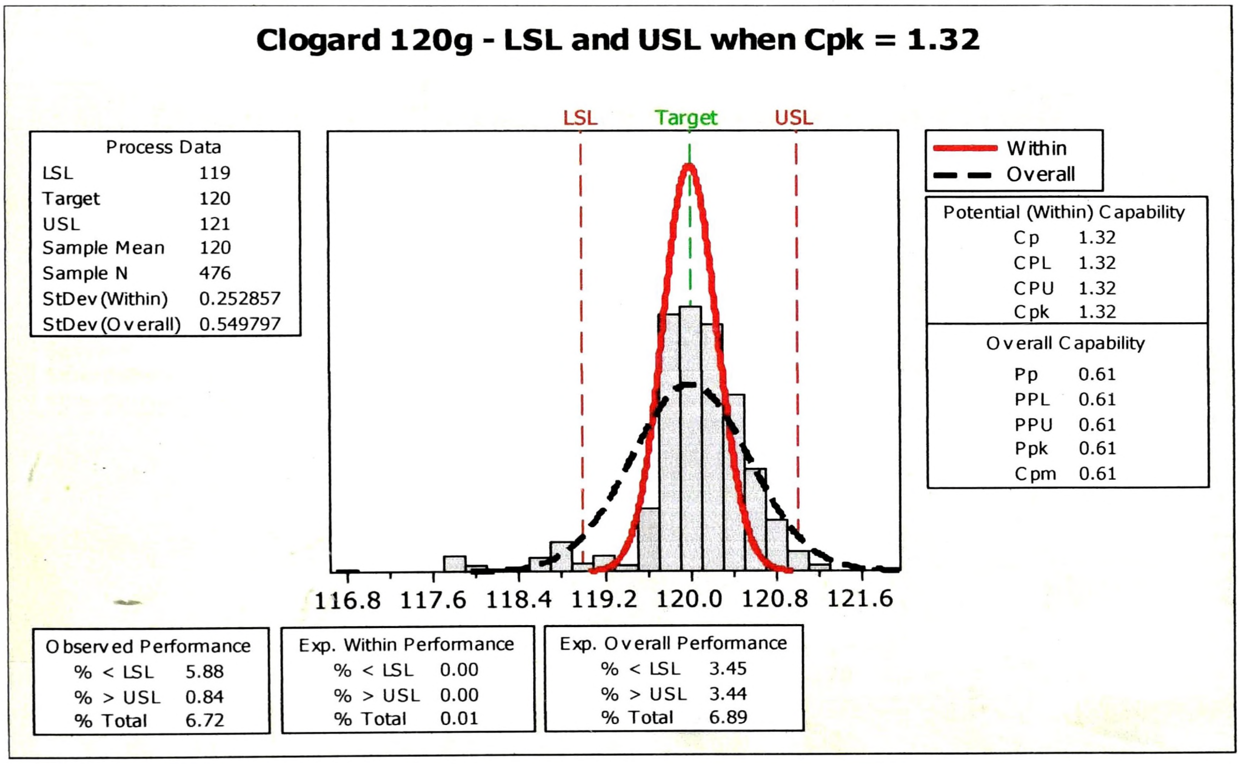

Clogard 70g - Processs capability against legal standards
Process Data
LSL 65.5
Target 70
USL 74.5
Sample Mean 70.4098
Sample N 728
StDev(Within) 0.218441
StDev(Overall) 0.37262
LSL
Target
USL
66.0 67.2 68.4 69.6 70.8 72.0 73.2 74.4
Within
Overall
Potential (Within) Capability
Cp 6.87
CPL 7.49
CPU 6.24
Cpk 6.24
Overall Capability
Pp 4.03
PPL 4.39
PPU 3.66
Ppk 3.66
Cpm 2.71
Observed Performance
% < LSL 0.00
% > USL 0.00
% Total 0.00
Exp. Within Performance
% < LSL 0.00
% > USL 0.00
% Total 0.00
Exp. Overall Performance
% < LSL 0.00
% > USL 0.00
% Total 0.00



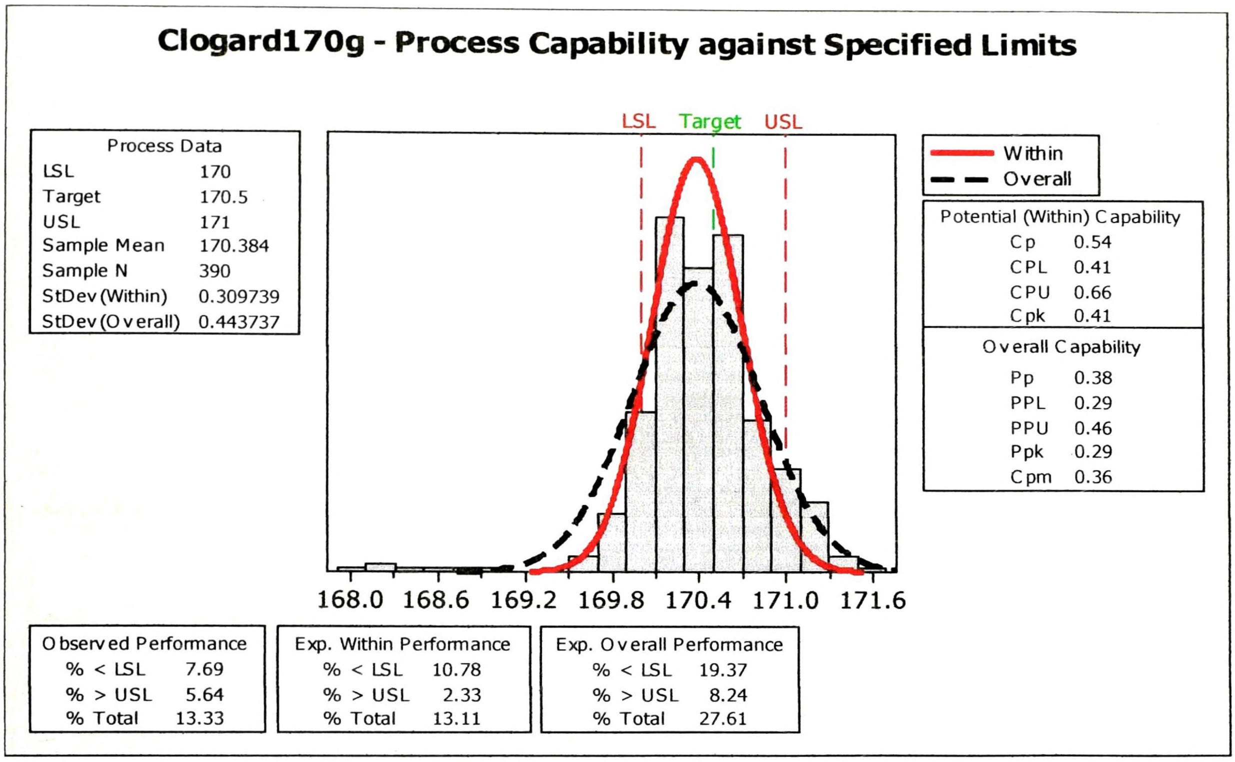
Clogard 120g

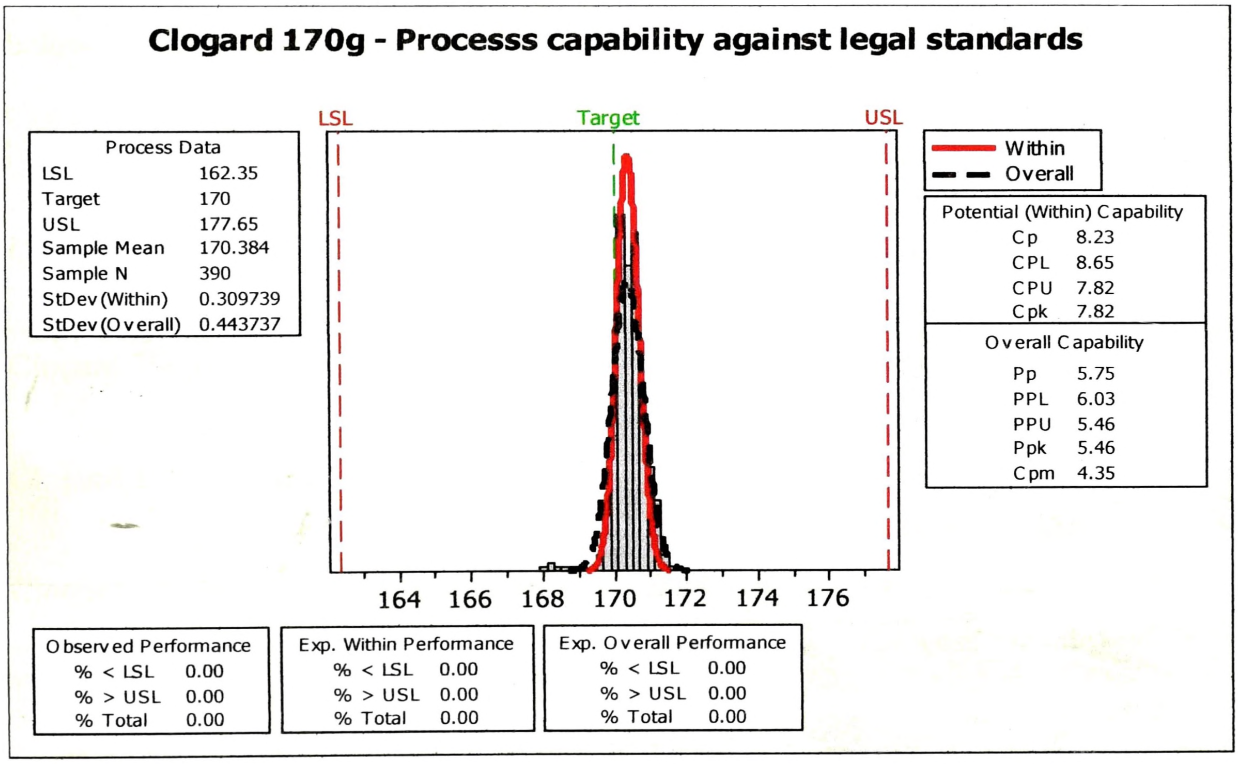


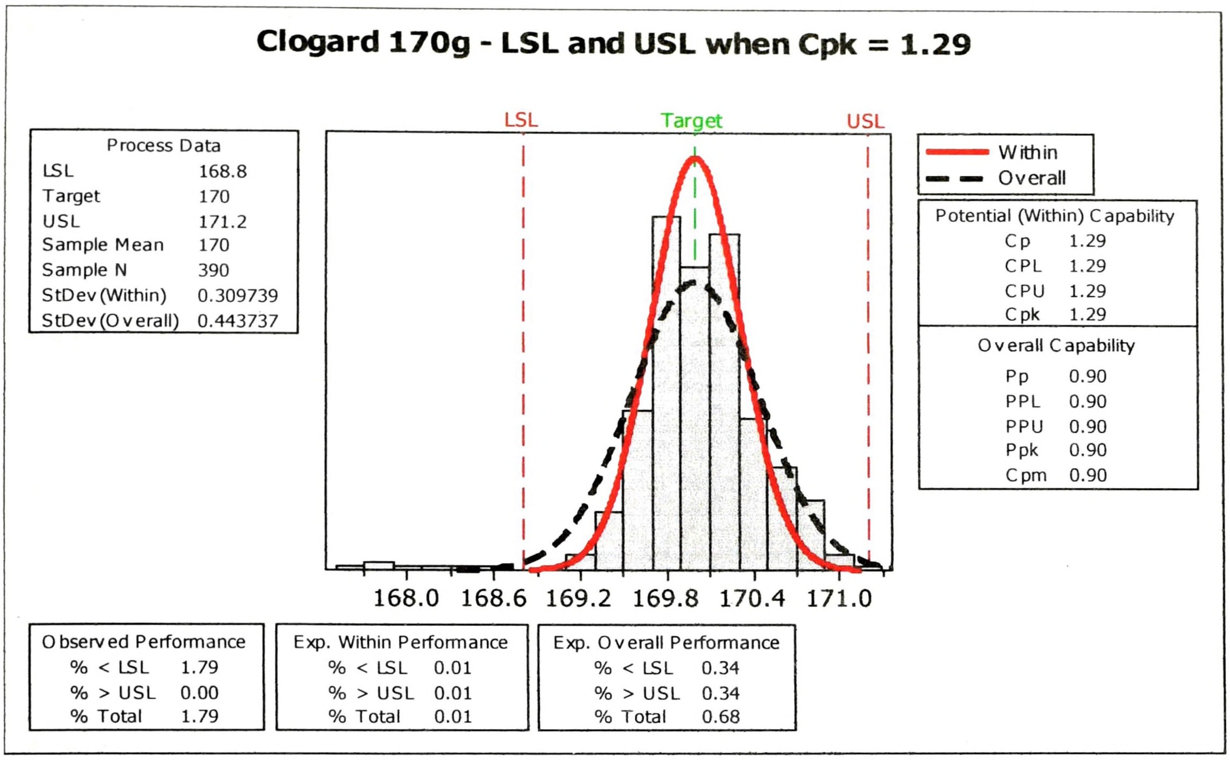

Clogard 120g - Processs capability against legal standards
Process Data
LSL 114.6
Target 120
USL 125.4
Sample Mean 120.258
Sample N 476
StDev(Within) 0.252857
StDev(Overall) 0.549797
LSL
Target
USL
115.2 116.8 118.4 120.0 121.6 123.2 124.8
Within
Overall
Potential (Within) Capability
Cp 7.12
CPL 7.46
CPU 6.78
Cpk 6.78
Overall Capability
Pp 3.27
PPL 3.43
PPU 3.12
Ppk 3.12
Cpm 2.96
Observed Performance
% < LSL 0.00
% > USL 0.00
% Total 0.00
Exp. Within Performance
% < LSL 0.00
% > USL 0.00
% Total 0.00
Exp. Overall Performance
% < LSL 0.00
% > USL 0.00
% Total 0.00


Clogard 120g - LSL and USL when Cpk = 1.32
Process Data
LSL 119
Target 120
USL 121
Sample Mean 120
Sample N 476
StDev(Within) 0.252857
StDev(Overall) 0.549797
LSL
Target
USL
116.8 117.6 118.4 119.2 120.0 120.8 121.6
Within
Overall
Potential (Within) Capability
Cp 1.32
CPL 1.32
CPU 1.32
Cpk 1.32
Overall Capability
Pp 0.61
PPL 0.61
PPU 0.61
Ppk 0.61
Cpm 0.61
Observed Performance
% < LSL 5.88
% > USL 0.84
% Total 6.72
Exp. Within Performance
% < LSL 0.00
% > USL 0.00
% Total 0.01
Exp. Overall Performance
% < LSL 3.45
% > USL 3.44
% Total 6.89

Clogard 170g







For an example collected data for Clogard 40g, Clogard 70g, Clogard 120g and Clogard 170g were analyzed against Current Specified Limits which were given by the manufacturer and relevant Legal Standards. Cp & Cpk values are summarized below.

Product	Cp	Cpk	
Clogard 40g (against Specified Limits)	0.35	0.35	(process not capable)
(against Legal Standards)	2.82	2.38	(process capable)
Clogard 70g (against Specified Limits)	0.76	0.63	(process not capable)
(against Legal Standards)	6.87	6.24	(process capable)
Clogard 120g (against Specified Limits)	0.66	0.34	(process not capable)
(against Legal Standards)	7.12	6.78	(process capable)
Clogard 170g (against Specified Limits)	0.54	0.41	(process not capable)
(against Legal Standards)	23	7.82	(process capable)

Cp and Cpk values are measures of potential process capability, calculated with data from the subgroups in the study. They measure the distance between the process average and the specification limits, compared to the process spread. Many industries use the benchmark value of Cpk is 1.33, to compare the Cpk values of processes and to determine whether improve the processes or not.

4.3 Setting Specification Limits (LSL and USL)

New Specification limits were determined by analyzing Process Capability for each and every packaging process.

To decide the LSL and USL limits on a meaningful manner these values are calculated when the process is capable of achieving a Cpk value around 1.33. According to that requirement specification limits for all packaging processes were suggested.

For an Example suggested specification limits of Clogard 40g, Clogard 70g, Clogard 120g and Clogard 170g are given below:

Product	LSL	Mean	USL
Clogard 40g	38.3	40.0	41.7
Clogard 70g	69	70	71
Clogard 120g	119	120	121
Clogard 170g	169.8	170	171.2

Therefore, adjusting the Target mean weight equal to the declared weight can be done in all Clogard packaging processes, as well as in almost all packaging processes without changing the current machine efficiency in order to minimize the Product Give Away.

Clogard tubes filling machines, Vimco machine and Norden machine can comply with suggested new Specification Limits shifting the last target weight to new specified target weight that is to declared net content without enhancing machine efficiency, because the process has minimum standard deviation. That is these processes have high process capabilities and the process do not need to have high line capabilities. But in the Clogard 14g sachet filling process has a problem with high standard deviation, so it is difficult to inline with given Specification Limits as well as with suggested Specification Limits. This problem can prevent increasing line capabilities, that is frequent adjustments of the filling process is required.

Sachets Machine No.01, No.02, No.03, No.04 and No.07, which are used to package all shampoo sachets and hair gel sachets have very minimum standard deviations, so changing only declared weight as the target mean weight minimizing "Product Give Away" can be achieved. In the case of hair cream filling process, it is difficult to inline with the specification limits for about four hours after batching. According to the observations, main reason is the increment of the viscosity of the hair cream with time, blocking the piston of the sachet machine leading to high variation of the package filling net content. So it needs to do a development in order to overcome this difficulty. There is a high standard deviation of Hair gel Sachets filling process using Multi Track (4) machine, so it needs high frequent machine adjustments.

Tub filling machine of hair cream and hair gel has a difficulty in complying with specification limits. That is in the case of foil sealing, the foil sealed tightly only if the tub contains higher cream or gel content than specified content. So it is better to change their foil sealing method.

Volumetric Filler machine which is used for the packaging processes of baby creams, shampoos and body lotions has low standard deviation and these filling processes can easily inline with the specifications. But the filling process of Baby Cheramy creams using 8 Multi Track Filling machine has a large variation of the filling weight content arising large amount of Product Give Away. So it is essential to do a development of the machine to improve the machine efficiency.

Filling processes of Hair oils, Colognes and mouth wash can easily inline with the specifications; because of these filling processes used 3 – Nozzles Filler machine which is mainly controlled by manually. It is better to change the length of three nozzles when filling mouth wash; because of short length of nozzles leads to form formation which is take more time to filling the bottle and it cause the variation of the net content.

Cologne machine which is used to fill colognes and cologne sprays has sufficient accuracy to inline with the specifications. But the problem is most of cologne bottles capacity already grater than the declared amount. To solve this problem the declared amount can increase or the bottle capacity can decrease. But changing bottle capacity spends big cost which needs to change the mould of the bottle.

Accuracy of the talc machine is sufficient to comply with the specification limits, but sometimes because of reducing the bulk density, bottle capacity would be insufficient to fill even the declared weight. In the case of that development should have to do to increase the bulk density of talc.

CHAPTER 05

CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

It can be concluded that there is a Product Give Away, which contribute to a loss of 6.95 Million Rupees from raw materials.

Specification Limits for all packaging processes were calculated by analyzing current process capabilities to achieve the process capability index, Cpk value around 1.33. Calculated Specification Limits can be effectively utilized the loss producing due to Product give Away.

Changing the previous Specification limits to calculated Specification limits result to Minimize the "Product Give Away" loss in all packaging processes.

5.2 Recommendations

Minimization of the Product Give Away of Clogard tubes packaging processes, Shampoo and Hair Gel Sachets packaging processes can done easily only changing the declared net filling content as the target net content.

Weight variations of Hair Cream Sachets due to decreasing the viscosity of the mixture with time should have to prevent to minimize the "Product Give Away" loss.

It is better to increase the length of three nozzles of mouth wash filling machine; because of short length of nozzles leads to form formation which is take more time to filling the bottle and it cause the variation of the net content.

The Product Give Away of Cologne bottles and Oil bottles which have high capacity than the declared amount can be reduced changing the declared amount rather than changing the bottle mould which spends high investment.

5.3 Suggestions for further developments

As a further development, applying a suitable automation option, which have ability to capture weights on-line in the production process and display captured weights in a graph consisting of mean, USL and LSL. Display window would be controlled by a Product ID card which is driven by a bar code scanning for the In-Process control records.

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Appendix I

Cost of "Product Give Away"

Product	Declared Net content	Calculated Nominal Quantity (D*) in g/ml	Unit Price (Rs)	Packaging Cost per unit Rs.	No of Units Produced per annum	Variance in g/ml (Target net content against declared net content)	Product Give Away in g/ml	No of Units can be produced from Give Away	Cost can be obtained from Give Away as per retail price Rs.	Packaging Cost for Give Away products Rs.	Gain can be obtained from Give Away deducting the Packaging Material cost Rs.
BC Aloe Cream	200ml	195.16	145	18.57	905597	0.8	760701	3898	565186	72399	492787
BC Aloe Oil	125ml	103.20	110	29.16	29286	1.8	52715	511	56188	14896	41292
BC Aloe Soap	75g	75.00	30	4.20	1207596	0.0	0	0	0	0	0
BC Aloe Cream	100ml	97.58	90	13.54	89051	1.0	90832	931	83776	12602	71175
BC Aloe Cream	300ml	292.74	205	25.40		1.3	0	0	0	0	0
BC Aloe Vera Oil	50ml	41.28	52	17.40	116706	2.2	259087	6276	326370	109197	217173
BC Aloe Vera Oil	200ml	165.12	165	46.51	35849	0.9	31547	191	31524	8885	22639
BC Cologne	50ml	50.00	105	21.21	1425503	1.0	1425503	28510	2993556	604768	2388788
BC Cologne	60ml	60.00	80	9.52	80923	4.3	347969	5799	463959	55193	408766
BC Cologne	100ml	100.00	180	30.52	698991	2.0	1397982	13980	2516368	426658	2089710
BC Cologne	115ml	115.00	140	11.19	446204	1.0	446204	3880	543205	43400	499805
BC Cologne	200ml	200.00	285	46.76	50916	1.0	50916	255	72555	11903	60652
BC Cream	50ml	48.79	52	9.52	882224	1.0	891046	18263	949670	173805	775865
BC Cream	100ml	97.58	90	13.54	1685375	1.0	1719082	17617	1585544	238496	1347048
BC Cream	200ml	195.16	145	18.57	396646	0.8	333183	1707	247548	31710	215838
BC Cream	300ml	292.74	205	25.40	127190	1.3	160259	547	112226	13906	98321
BC Flower Cologne	100ml	100.00	165	26.36		2.0	0	0	0	0	0
BC Flower Cologne	50ml	50.00	105	21.21	158071	1.0	158071	3161	331949	67061	264888
BC Flower Cologne	200ml	200.00	270	32.88	30143	1.0	30143	151	40693	4955	35738

BC Flower Talc	100g	100.00	65	13.52		1.0	0	0	0	0	0
BC Flower Talc	200g	200.00	95	19.26	42961	1.0	42961	215	20406	4138	16268
BC Nappy Rash Cream	100ml	97.58	85	13.54	25952	1.0	26471	271	23058	3672	19386
BC Nourishing cream	50ml	48.79	52	9.52	4011156	1.0	4051268	83035	4317809	790231	3527578
BC Nourishing cream	100ml	97.58	90	13.54	336219	1.0	342943	3514	316304	47578	268726
BC Oil	50ml	41.28	57	17.19	394368	2.2	875497	21209	1208898	364540	844359
BC Oil	125ml	103.20	110	37.17	348010	1.8	626418	6070	667694	225602	442092
BC Oil	200ml	165.12	165	45.86	139292	0.9	122577	742	122488	34041	88447
BC Petals Talc	100g	100.00	65	13.52	97353	1.0	97353	974	63279	13160	50120
BC Petals Talc	200g	200.00	95	19.26	56614	1.0	56614	283	26892	5453	21439
BC Petals Talc	400g	400.00	165	32.37	5729	1.0	5729	14	2363	464	1900
BC Prickly Heat Talc	100g	100.00	68	13.52	114686	1.0	114686	1147	77986	15503	62484
BC Shampoo	125ml	127.50	90	10.20	209802	0.5	104901	823	74048	8395	65652
BC Shampoo	200ml	204.00	130	8.31	33343	1.0	33343	163	21248	1358	19890
BC Soap	75g	75.00	30	4.20	21366852	0.0	0	0	0	0	0
BC Talc	50g	50.00	33	12.80	229299	1.0	229299	4586	151337	58702	92636
BC Talc	100g	100.00	65	13.52	972689	1.0	972689	9727	632248	131486	500762
BC Talc	200g	200.00	95	19.26	271794	1.0	271794	1359	129102	26179	102923
BC Talc	400g	400.00	165	32.37	47109	1.0	47109	118	19432	3813	15620
Capri Cologne	30ml	30.00	195	39.88	20311	4.0	81244	2708	528086	107997	420089
Capri Cologne	50ml	50.00	257	50.36	15309	8.0	122472	2449	629506	123362	506144
Capri Cologne Spray	50ml	50.00	319	60.46	57576	8.0	460608	9212	2938679	556998	2381681
Capri Shim Cologne	30ml	30.00	195	37.89	192687	4.0	770748	25692	5009862	973419	4036443
Capri Shim Cologne	50ml	50.00	257	50.36	27530	8.0	220240	4405	1132034	221840	910193
Capri Shim Cologne Spray	50ml	50.00	319	56.12	20311	8.0	162488	3250	1036673	182387	854286
Clogard	40g	40.00	33	6.22	5455013	0.5	2727507	68188	2250193	424405	1825788
Clogard	70g	70.00	51	7.73	4242161	0.5	2121081	30301	1545359	234185	1311174

Clogard	120g	120.00	74	10.02	3680923	0.5	1840462	15337	1134951	153618	981333
Clogard	170g	170.00	89	11.50	2112990	0.5	1056495	6215	553106	71496	481611
Clogard Mouth Wash	200ml		135	17.44	181734	8.0	1453872		22	0	0
Clogard Non Fluoride	40g	40.00	33	6.22	1383139	0.5	691570	17289	570545	107610	462935
Clogard Sachet	14g	14.00	11	1.41	2197058	0.5	1098529	78466	863130	110663	752467
Dandex Plus Shampoo Sachet	6ml	6.12	4	0.60	2550560	0.2	459101	75016	300066	44653	255412
Dandex Family Shampoo	50ml	51.00	36	9.63	2563950	1.0	2563950	50274	1809847	484255	1325592
Dandex Family shampoo	100ml	102.00	80	12.47	176189	1.0	176189	1727	138187	21531	116656
Dandex Family Shampoo Sachet	6ml	6.12	4	0.60	3808920	0.2	685606	112027	448108	66684	381424
Dandex Hair Cream	30g	30.00	46	12.94	37960	1.0	37960	1265	58205	16378	41828
Dandex Hair Cream	100g	100.00	106	20.58	56809	1.0	56809	568	60218	11692	48526
Dandex Hair Oil	75ml	61.92	70		11978	1.1	12936	209	14624	0	14624
Dandex Hair Gel	4g	4.00	5	1.39	432143	0.3	129643	32411	162054	45055	116998
Dandex HG	30ml	30.60	55	18.44	16611	1.4	23255	760	41799	14015	27784
Dandex HG	100ml	102.00	128	39.49	15776	1.0	15776	155	19797	6108	13689
Dandex Plus Shampoo	50ml	51.00	46	9.63	2976480	1.0	2976480	58362	2684668	562170	2122499
Dandex Plus Shampoo	100ml	102.00	95	12.47	189330	1.0	189330	1856	176337	23137	153199
Dandex Plus Shampoo	200ml	204.00	170	30.36	62037	1.0	62037	304	51698	9233	42464
Gold Black Jeans Cologne	100ml	100.00	264	77.00	9237	2.0	18474	185	48771	14226	34546
Gold Cologne	50ml	50.00	151	23.23	74021	1.0	74021	1480	223543	34390	189153
Gold Cologne	100ml	100.00	264	25.45	56703	1.0	56703	567	149696	14434	135262
Gold Hair Cream	4g	4.00	5	0.44	3193920	0.2	638784	159696	798480	70496	727984

Gold Hair Cream	30ml	28.69	53	28.40	77352	1.3	101176	3526	186894	100147	86747
Gold Hair Cream	100ml	97.58	114	89.80	89801	0.4	37716	387	44063	34709	9354
Gold HC	4g	4.00	5	0.44	3193920	0.3	958176	239544	1197720	105744	1091976
Gold HG	4g	4.00	5	0.44	24954240	0.3	7486272	1871568	9357840	826179	8531661
Gold HG	30ml	30.6	59	28.40	83291	1.4	116607	3811	224831	108224	116607
Gold HG	100ml	102	127	89.80	97340	1.0	97340	954	121198	85697	35500
Gold Obsession Cologne	100ml	100.00	264	67.75	33887	1.0	33887	339	89462	22959	66503
Goya Body Lotion	100ml	97.15	83	11.71	341380	0.8	290173	2987	247909	34970	212939
Goya Body Spray(Cologne)	75ml	75	210		157952	1.0	157952	2106	442266	0	442266
Goya Cologne Aral	35ml	35.00	168	43.07	7335	1.0	7335	210	35208	9026	26182
Goya Cologne Blush	35ml	35.00	164	43.07	2577	1.0	2577	74	12075	3171	8904
Goya Cologne BR	35ml	35.00	168	43.07	93934	1.0	93934	2684	450883	115588	335295
Goya Cologne Gardinia	35ml	35.00	168	43.07	71536	1.0	71536	2044	343373	88027	255346
Goya Cologne Jasmine	35ml	35.00	168	43.07	124682	1.0	124682	3562	598474	153424	445049
Goya Cologne Lavender	35ml	35.00	168	43.07	61856	1.0	61856	1767	296909	76115	220793
Goya Cologne Pleas	35ml	35.00	164	43.07	2604	1.0	2604	74	12202	3204	8997
Goya Cologne Sun	35ml	35.00	168	43.07	2646	1.0	2646	76	12701	3256	9445
Goya Talc	100g	100.00	80	16.28	205803	1.0	205803	2058	164642	33511	131131
Goya Talc	100g	100.00	80	16.28	205803	1.0	205803	2058	164642	33511	131131
Kumarika Aloe Shampoo Sachet	7ml	7.14	5	0.61	4351840	0.2	696294	97520	487601	59451	428151
Kumarika Aloe vera Shampoo	100ml	102.00	80	12.16	104605	1.0	104605	1026	82043	12468	69575
Kumarika Hair Oil	100ml	85.73	120	25.76	1539841	1.3	1955598	22811	2737335	587722	2149614
Kumarika Hair Oil	200ml	171.46	218	43.77	632343	0.5	341465	1992	434150	87160	346990
Kumarika Hair Oil	415ml	355.78	380	82.93	90405	1.2	110339	310	117851	25720	92131
Kumarika Herb	7ml	7.14	5	0.61	3692892	0.2	590863	82754	413769	50449	363321

Shampoo Sachet										
Kumarika Herbal Shampoo	100ml	102.00	80	12.16	1957905	1.0	1957905	19195	1535612	233413	1302199
Kumarika Hibiscus Shampoo Sachet	7ml	7.14	5	0.61	2241680	0.2	358669	50234	251169	30624	220545
Kumarika Hibiscus Shampoo	100ml	102.00	80	12.16	1736616	1.0	1736616	17026	1362052	206987	1155065
Kumarika Nelli Shampoo	100ml	102.00	80	12.16	85724	1.0	85724	840	67235	10217	57017
Kumarika Nelli Shampoo Sachet	7ml	7.14	5	0.61	5155996	0.2	824959	115541	577703	70436	507266
Paris Charm Cologne	50ml	50.00	110	40.84	13169	1.0	13169	263	28972	10756	18215
Paris Charm Spray	50ml	51.00	157	51.00	40358	0.0	0	0	0	0	0
Paris Cologne	50ml	50.00	110	30.31	19090	1.0	19090	382	41998	11573	30425
Paris Floral Body Lotion	100ml	97.15	60	14.25	52638	0.8	44742	461	27633	6563	21070
Paris Jasmine Body Lotion	100ml	97.15	60	14.25		0.8	0	0	0	0	0
Paris Jasmine Cologne	50ml	50.00	157	30.31	72096	1.0	72096	1442	226381	43707	182674
Paris Jasmine Talc	85g	85.00	56	15.34	159678	1.0	159678	1879	105200	28808	76392
Paris Spray	50ml	50.00	157	33.25	50357		0	0	0	0	0
Paris Sandal wood Body Lotion	100ml	97.15	60	14.25	73461	0.8	62442	643	38564	9159	29405
Paris Talc	50g	50.00	34	12.77	121802	1.0	121802	2436	82825	31109	51717
Paris Talc	85g	85.00	56	15.34	194463	1.0	194463	2288	128117	35084	93033
Pro Sport Hair Cream	30ml	28.69	56	17.27	57827	1.3	75638	2636	147627	45536	102091
Pro Sport Hair Gel	4g	4.00	5	0.38	8370240	0.3	2511072	627768	3138840	237186	2901654
Pro Sport Hair Gel	30ml	30.60	67	12.75	35937	1.4	50312	1644	110160	20958	89202
Pro Sport Wet Look Hair Gel	4g	4.00	5	0.38	6988320	0.3	2096496	524124	2620620	198027	2422593

Pro Sport Wet Look Hair Gel	30ml	30.60	72	12.75	35937	1.4	50312	1644	118381	20958	97423
Pro Sport Deep After Shave	100ml	100.00	246	53.16		3.0	0	0	0	0	0
PS Deep Cologne	50ml	50.00	161	33.00	17211	1.0	17211	344	55419	11358	44062
PS Deep Cologne S	100ml	100.00	289	60.39	43100	3.0	129300	1293	373677	78084	295593
PS Deep Cologne Spray	50ml	50.00	289	60.39	63602	1.0	63602	1272	367620	76818	290801
PS Deo Talc	100g	100	70			1.0	0	0	0	0	0
PS Extreme A/S	100ml	100.00	246	53.16	39986	3.0	119958	1200	295097	63766	231331
PS Extreme Cologne AS	50ml	50.00	123	60.39	46265	1.0	46265	925	113812	55879	57933
PS Extreme Cologne N	50ml	50.00	147	33.00		1.0	0	0	0	0	0
PS Extreme Cologne S	100ml	100.00	289	60.39	6843	3.0	20529	205	59329	12397	46931
PS Hair Cream	100ml	97.58	122	36.24	70788	0.4	29731	305	37171	11042	26130
PS Hair Gel	100ml	102.00	147	18.23	211443	1.0	211443	2073	304727	37787	266940
PS Intense A/S	100ml	100.00	246	53.16		3.0	0	0	0	0	0
PS Intense Cologne	50ml	50.00	147	33.00	1951	1.0	1951	39	5736	1287	4448
PS Intense Cologne	100ml	100.00	289	53.16		3.0	0	0	0	0	0
PS Wet Look HG	100ml	102.00	153	18.23	51068	1.0	51068	501	76602	9126	67476
Velvet Milk	75g	75.00	31	0.84	1631664	0.0	0	0	0	0	0
Velvet Rose	75g	75.00	31	0.84	2910816	0.0	0	0	0	0	0
Velvet Sandal wood	75g	75.00	31	0.84	1735920	0.0	0	0	0	0	0
								Total	74747474	12599662	62147790
									75M	**12.6M**	**62M**

Appendix III

Detail Breakdown of Product Give Away Savings Cost

	SKU	BC Cream 50ml	Clogard 40g	Gold Hair Gel 4g	Goya Cologne BR 35ml
	Total No of Units Produced per annum	882224	5455013	24954240	93934
	Give away (g/ml) by specification	891046	2727506	7486272	93934
	No of Units can be produced from give away	18263	68188	1871568	2684
Per Unit	Retail Price (Rs)	52	33	5	162
	List Price (Rs)	43.14	28.5	4.17	136.8
	Direct Labour Cost (Rs)	0.54	0.25	0.08	1.49
	Direct Packaging Material Cost (Rs)	7.61	5.48	0.54	40.34
	Direct Raw Material Cost (Rs)	4.24	4.62	0.46	22.22
Per total No of Units can be produced from Give away	Retail Price (Rs)	949676	2250204	9357840	434808
	List Price (Rs)	787866	1943358	7804439	367171
	Direct Labour Cost (Rs)	9862.02	17047	149725.44	3999.16
	Direct Packaging Material Cost (Rs)	138981.43	373670.24	1010646.72	108272.56
	Direct Raw Material Cost (Rs)	77435.12	315028.56	860921.28	59638.48
	Savings from Units can be produced from Give away as per **Retail Price**	**810695**	**1876534**	**8347193**	**326535**
	Savings from Units can be produced from Give away as per **List Price**	**648884**	**1569688**	**6793792**	**258899**

Raw material cost for Product Give Away :**Rs.6.95Million**
Cost can be obtained from Product Give Away deducting the Packaging material cost As per list Price: **Rs.50.7Million**

Appendix III

Calculated Specification Limits:

Machine	Product	In Current Practices		Suggested Limits (In g/ml) When Cpk = 1.33		
		Cpk Value Agaist Spec. Limits	Cpk Value Agaist Legal Limits	LSL	Target	USL
Vimko Machine	Clogard 40g/NF	0.35	2.38	**38.3**	**40**	**41.7**
Norden Machine	Clogard 70g	0.63	6.24	**69**	**70**	**71**
	Clogard 120g	0.34	6.78	**119**	**120**	**121**
	Clogard 170g	0.41	7.82	**169.8**	**170**	**171.2**
Sachets Machine No.05	Clogard 14g Sachete	0.01	0.4	**12.7**	**14**	**15.3**
Sachets Machine No.01/02/03/04/07	Kumarika Herbal Shampoo7ml	0.95	3.8	**6.9**	**7.1**	**7.3**
	Kumarika Nelli Shampoo 7ml	0.95	3.8	**6.9**	**7.1**	**7.3**
	Kumarika Hibiscus Shampoo 7ml	0.95	3.8	**6.9**	**7.1**	**7.3**
	Kumarika Aloe Shampoo 7ml	0.95	3.8	**6.9**	**7.1**	**7.3**
	Dandex Plus Shampoo 6ml	-0.04	- 1.65	**5.9**	**6.1**	**6.3**
	Dandex Family Shampoo 6ml	-0.04	1.65	**5.9**	**6.1**	**6.3**
	Gold Hair Gel 4g	0.13	-0.22	**3.7**	**4**	**4.3**
	ProSport Hair Gel 4g	0.38	0.08	**3.7**	**4**	**4.3**
	Dandex Hair Gel 4g	0.38	0.08	**3.7**	**4**	**4.3**
Sachets Multi Track(4)	Gold Hair Gel 4g	0.29	0.13	**3.7**	**4.2**	**4.7**

	ProSport Hair Gel 4g	0.29	0.13	**3.7**	**4.2**	**4.7**
Tub Machine	Gold Hair Gel 30g	-0.02	2.03	**27.5**	**30**	**32.5**
	Gold Hair Gel 100ml	0.58	2.46	**100**	**102**	**104**
	Gold Hair Cream 30g	-0.08	0.03	**28**	**30**	**32**
	Gold Hair Cream 100ml	-0.45	1.46	**95.4**	**97.6**	**99.7**
	PS HG 30g	-0.02	2.03	**27.5**	**30**	**32.5**
	PS HG 100ml	0.58	2.46	**100**	**102**	**104**
	PS HC 30g	-0.08	0.03	**28**	**30**	**32**
	PS HC 100ml	-0.45	1.46	**95.4**	**97.6**	**99.7**
	DX HG 30g	-0.02	2.03	**27.5**	**30**	**32.5**
	DX HG 100ml	0.58	2.46	**100**	**102**	**104**
	DX HC 30g	-0.08	0.03	**28**	**30**	**32**
	DX HC 100ml	-0.45	1.46	**95.4**	**97.6**	**99.7**
Tub Machine	BC Aloe Cream 100ml	0.15	1.14	**94**	**98**	**102**
	BC Aloe Cream 200ml	0.02	1.83	**190**	**195.2**	**200**
	BC Aloe Vera Cream 300ml	0.24	0.21	**286**	**293**	**300**
	BC Cream 50ml	0.25	2.98	**46.4**	**48.8**	**51.2**
	BC Cream 100ml	0.15	1.14	**94**	**98**	**102**
	BC Cream 200ml	0.02	1.83	**190**	**195.2**	**200**
	BC Cream 300ml	0.24	0.21	**286**	**293**	**300**
	BC Nappy Rash Cream 100ml	0.15	1.14	**94**	**98**	**102**
	BC Nourish cream 50ml	0.25	2.98	**46.4**	**48.8**	**51.2**
	BC Nourish cream 100ml	0.15	1.14	**94**	**98**	**102**
	BC Shampoo 125ml	0.72	2.77	**125**	**127.5**	**130**
	BC Shampoo 200ml	-0.08	0.88	**198**	**204**	**210**
	Dandex Family shampoo 100ml	-0.05	1.4	**99.5**	**102**	**104.5**
	Dandex Plus Shampoo 100ml	-0.05	1.4	**99.5**	**102**	**104.5**

	Dandex Plus Shampoo 200ml	-0.08	0.88	**198**	**204**	**210**
	Goya Body Lotion 100ml	-0.38	0.59	**94**	**97.2**	**100.4**
	Kumarika Aloe Shampoo 100ml	-0.03	1.29	**98**	**102**	**106**
	Kumarika Herb Shampoo 100ml	-0.03	1.29	**98**	**102**	**106**
	Kumarika Hibis Shampoo 100ml	-0.03	1.29	**98**	**102**	**106**
	Kumarika Nelli Shampoo 100ml	-0.03	1.29	**98**	**102**	**106**
	Paris Floral BL 100ml	-0.38	0.59	**94**	**97.2**	**100.4**
	Paris Jas BL 100ml	-0.38	0.59	**94**	**97.2**	**100.4**
	Paris Swood BL 100ml	-0.38	0.59	**94**	**97.2**	**100.4**
3 - Nozzles Filler	BC Aloe Oil 125ml	-0.29	0.83	**100**	**103.2**	**106.4**
	BC Aloe Vera Oil 50ml	-0.6	1.48	**39**	**41.3**	**43.6**
	BC Aloe Vera Oil 200ml	-0.11	0.52	**160**	**165**	**170**
	BC Oil 50ml	-0.6	1.48	**39**	**41.3**	**43.6**
	BC Oil 125ml	-0.29	0.83	**100**	**103.2**	**106.4**
	BC Oil 200ml	-0.11	0.52	**160**	**165**	**170**
	BC Cologne 60ml	0	0	**58**	**60**	**62**
	BC Cologne 115ml	0	0	**112**	**115**	**118**
	Clogard Mouth Wash 200ml	-0.05	0.88	**204**	**209.2**	**214.2**
	Kumarika Hair Oil 100ml	0.32	1.64	**83**	**85.7**	**88.4**
	Kumarika Hair Oil 200ml	-0.11	0.52	**160**	**165**	**170**
	Kumarika Hair Oil 415ml	-0.66	2.46	**352**	**355.8**	**359.6**
Cologne machine	BC Flower Cologne 200ml	-0.41	0.63	**195**	**200**	**203**
	BC Flower Cologne 100ml	0.1	1.44	**98**	**100**	**102**
	BC Flower Cologne 50ml	-0.01	0.74	**47**	**50**	**53**
	BC Cologne 50ml	-0.01	0.74	**47**	**50**	**53**
	BC Cologne 100ml	0.1	1.44	**98**	**100**	**102**
	BC Cologne 100ml	0.1	1.44	**98**	**100**	**102**

	BC Cologne 200ml	-0.41	0.63	**195**	**200**	**203**
	Capri Cologne 30ml	0	0	**27.3**	**30**	**32.7**
	Capri Cologne 50ml	0	0	**46**	**50**	**54**
	Capri Cologne Spray 50ml	0	0	**46**	**50**	**54**
	Capri Shim Cologne 30ml	0	0	**27.3**	**30**	**32.7**
	Capri Shim Cologne 50ml	0	0	**46**	**50**	**54**
	Capri Shim Cologne Spray 50ml	0	0	**46**	**50**	**54**
	Gold Black Jeans Cologne 100ml	0.1	1.44	**98**	**100**	**102**
	Gold Cologne 50ml	0.98	3.87	**48**	**50**	**52**
	Gold Cologne 100ml	0.1	1.44	**98**	**100**	**102**
	Gold Obsession Cologne 100ml	0.1	1.44	**98**	**100**	**102**
	Goya Body Spray(Cologne) 75ml	-0.33	0.35	**72**	**75**	**78**
	Goya Cologne Aral 35ml	-0.1	0.1	**33**	**35**	**37**
	Goya Cologne Blush 35ml	-0.1	0.1	**33**	**35**	**37**
	Goya Cologne BR 35ml	-0.1	0.1	**33**	**35**	**37**
	Goya Cologne Gar 35ml	-0.1	0.1	**33**	**35**	**37**
	Goya Cologne Jas 35ml	-0.1	0.1	**33**	**35**	**37**
	Goya Cologne Lav 35ml	-0.1	0.1	**33**	**35**	**37**
	Goya Cologne Pleas 35ml	-0.1	0.1	**33**	**35**	**37**
	Goya Cologne Sun 35ml	-0.1	0.1	**33**	**35**	**37**
	Paris Charm Cologne 50ml	0.98	3.87	**48**	**50**	**52**
	Paris Charm Spray 50ml	0.98	3.87	**48**	**50**	**52**
	Paris Cologne 50ml	0.98	3.87	**48**	**50**	**52**
	Paris Jas Cologne 50ml	0.98	3.87	**48**	**50**	**52**
	Paris Spray 50ml	0.98	3.87	**48**	**50**	**52**
	PS Deep Cologne N 50ml	0.98	3.87	**48**	**50**	**52**
	PS Deep Cologne S 100ml	0.23	0.15	**97**	**100**	**103**

	PS Deep Cologne Spray 50ml	0.98	3.87	**48**	**50**	**52**
	PS Extreme A/S 100ml	0.23	0.15	**97**	**100**	**103**
	PS Extreme Cologne AS 50ml	0.98	3.87	**48**	**50**	**52**
	PS Extreme Cologne N 50ml	0.98	3.87	**48**	**50**	**52**
	PS Extreme Cologne S 100ml	0.23	0.15	**97**	**100**	**103**
	PS Intense A/S 100ml	0.23	0.15	**97**	**100**	**103**
	PS Intense Cologne 50ml	0.98	3.87	**48**	**50**	**52**
	PS Intense Cologne 100ml	0.23	0.15	**97**	**100**	**103**
Talc Machine	BC Petals Talc 100g	-0.52	0.63	**96**	**100**	**104**
	BC Petals Talc 200g	0	1.01	**193**	**200**	**207**
	BC Petals Talc 400g	0	0.67	**392**	**400**	**407**
	BC Prickly Heat 100g	-0.52	0.63	**96**	**100**	**104**
	BC Talc 50g	0.27	1.19	**47**	**50**	**53**
	BC Talc 100g	-0.52	0.63	**96**	**100**	**104**
	BC Talc 200g	0	1.01	**193**	**200**	**207**
	BC Talc 400g	0	0.67	**392**	**400**	**407**
	BC Flower Talc 100g	-0.52	0.63	**96**	**100**	**104**
	BC Flower Talc 200g	0	1.01	**193**	**200**	**207**
	Goya Talc 100g	-0.52	0.63	**96**	**100**	**104**
	Paris Jas Talc 85g	0.5	0.65	**83**	**85**	**87**
	Paris Talc 50g	0.27	1.19	**47**	**50**	**53**
	Paris Talc 85g	0.5	0.65	**83**	**85**	**87**
	PS Deo Talc 100g	-0.52	0.63	**96**	**100**	**104**
Soap machine	BC Soap 75g	0.27	4.13	**74**	**75**	**76**
	Velvet Milk	0.27	4.13	**74**	**75**	**76**
	Velvet Rose	0.27	4.13	**74**	**75**	**76**
	Velvet S.wood	0.27	4.13	**74**	**75**	**76**

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