

# Gap Analysis, Corrective Actions to Reduce the Wastage of Potatoes Returned From Lanka Sathosa Limited Sales Outlets

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**Abstract:** This study was carried out to reduce the wastage of potatoes (*Solanum tuberosum* L) returned back from Lanka Sathosa Limited (LSL) sales outlets. Preliminary study was carried out to identify the root cause by using a brain storming sessions with employees and observed that; sprouted, rotten, dirty skin, shrunken nature of potatoes were major defects among returned potatoes. Existing condition of the factors inducing the poor quality nature of potatoes were analyzed using 60 pre-tested questionnaires within the warehouse employees. It was observed that; poor quality of the potatoes during receiving, improper machinery used and insufficient vehicles, improper stock handling system, improper handling of the bags during loading and unloading and poor warehouse and storage conditions were the gaps between acceptable level and existing condition. Also a fish bone diagram was constructed to identify the root causes to implement the corrective action exactly (4Ms and Environment).

Possible corrective actions were implemented to improve the root causes observed and monitored continuously. It revealed that; the conditions were improved and quality gaps were reduced significantly ( $P < 0.05$ ) by having a significant differences in the amount of returned potatoes. Also, there were significant differences ( $P < 0.05$ ) observed in the quality parameters such as freshness, skin colour, size and moisture. Also defects such as sprouted, rotten, dirty skin, small or large tubers, high external moisture, high internal moisture, tubers with cut or damages were observed with significant differences ( $P < 0.05$ ) while no significant differences observed in defects such as low customer preference and problems with packaging, before and after the project. This study concluded that, considerable quality losses of potatoes, sold by LSL sales outlets were dramatically reduced after this project.

**Keywords:** Potatoes; quality; gap analysis; defect; quality improvement.

## 1. Introduction

Lanka Sathosa Limited (LSL) is a state owned largest scale retail network business in Sri Lanka with over 400 outlets island wide & over 6000 employees. In the Super market business, we have to consider both product quality and service quality; thereby Lanka Sathosa has higher consideration about quality improvement. Perishable food items are categorized as provisional goods by Procurement Department of LSL. Essential food items like big onion, fresh potatoes, garlic, Maldives-fish, sprats, canned fish, sugar, grains and pulses are included into this group. There is a demand for high-quality dehydrated shelf stable foods for convenient, quick-cooking dishes for home consumption as well as for manufacturers

(Maté et al. 1998). Potatoes (*Solanum tuberosum* L) are tuber in nature. Consumed by most part of the world and it is a staple food for some countries. Quality potatoes shall have sound physical characteristics such as freshness, free from mud or soil, smooth and shiny surface. Potato tubers with bright-colored skin are attractive to consumers, but producing potatoes with attractive skin color and maintaining that color in storage is challenging. Production year (Rosen et al. 2009; Waterer 2010; Roe et al. 2014) and production environment (Reyes et al. 2004; Roe et al. 2014) have pronounced effects on the appearance of red-skinned potatoes.

Local and imported are two main varieties of potato purchased by LSL. Potatoes are fastest moving item in LSL sales outlets, especially during festival and New Year season, a large quantity will be sold out

within short period of time meanwhile a considerable amount of potatoes are returned from the outlets to warehouses those are damaged, oversized, undersized, sprouted and rotten. A special consideration is needed to reduce this wastage is a challenge. It was identified as a research gap and a questionnaire survey (60 pre-tested) was done to analyze the factors affecting the quality of fresh potatoes at LSL. These poor quality potatoes are become waste, increase the logistic and labour cost for LSL. Yield and quality reduction can have significant economic and ecological effects (Pfleeger et al. 2008)

### 1.1. Objectives

1. Improve the quality of fresh potatoes sold by LSL sales outlets.
2. Maximize customer satisfaction through enhancing the quality of the selling product.

### 2. Methodology

This project was carried out at one of the Lanka Sathosa Limited warehouse located in Enderamulla which was considered as a main focal point of this supermarket warehouse chain. A GAP analysis method was used to collect of data on existing situation through a pre-tested questionnaire. In order to identify the major causes for the quality issue, a preliminary questionnaire survey was carried out and the possible causes were pointed out. A questionnaire was used to collect data about the existing quality situation and possible improvement. Data was collected from all top to bottom level such as, quality assurance officers, warehouse managers, shop managers, warehouse supervisors and skilled laborers. Each question was allocated with 10 points and the totals points were obtained by each parameter with respect of existing condition shown in the figure 01. Middle point of poor and acceptable level was calculated according to the points obtained and 75 points were marked as the standard. Factors received below the standard were considered as very poor or

poor and those were focused to improve immediately to reduce the quality gap of potatoes.

The implementations of the possible corrective action were carried out to minimize the issues, and data was collected after the implementation of corrective action. Data was analyzed by using Minitab-15 statistical software and MS Excel 2017. Gaps between before and after the implementation of corrective actions were identified with (p-0.05) significant level.

### 3. Results and discussions

#### 3.1. Gap identification and implantation of solutions

##### 3.1.1. Analyzing the current situation

The analysis carried out to identify the existing quality situation of potatoes at the study location were focused on several quality characters such as sprouted, rotten, dirty skin and some other factors stated in figure 01. It was observed that, sprouted, rotten, dirty skin & shrunken and spongy natures were identified as major defects causes for the market return of poor quality potatoes. Fresh produce attributes (appearance, texture, flavour and nutritional value) have been traditional quality criteria, but increasingly safety (chemical, toxicological and microbial) and traceability are important for all the role players along the supply chain, from the farm to consumers. Fresh produce is often eaten raw or after minimal processing and food pathogen contamination can present risk of outbreaks of food borne illnesses (Mahajan et al. 2014). Imported potatoes have high internal and external moisture content. If the price of local potatoes has gone up vigorously; the imported potatoes were purchased through the well organized government procurement procedure. Batt, P. J., (2003) reported that the major retailers have moved towards procuring greater quantities of the fresh produce they require directly from growers, the market agents' share of the business has declined. Also long transportation will also lead to perish the potatoes because of the high internal heat in the transport container.

**Table 01: Comparison of quality parameters before and after implementation.**

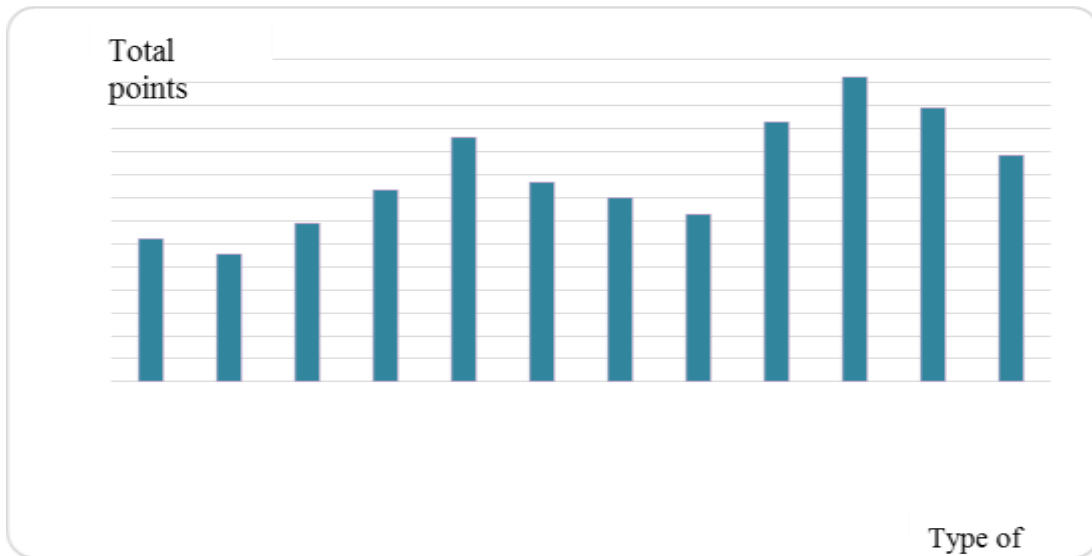
	Freshness	Skin color	Size/uniformity	Moisture
Pooled StDev	0.358	0.284	0.323	0.354
P value	0.000	0.000	0.000	0.000

An efficient transport chain was suggested to schedule by connecting the nearest outlets to ensure

the fast delivery of potatoes to the outlets. Sorting process was also suggested to all potato bags to

minimize the market return from the outlets. Sorting shall be done at warehouse before send the potatoes to the outlets. Attractive appearance is highly desirable for fresh market red-skinned potatoes. Red potatoes derive their skin color from anthocyanins. Some growers attempt to enhance red potato skin color by treating vines with the synthetic auxin 2,4-D

(Busse et al. 2019). Freshness, skin color, uniformity and moisture of potatoes before and after the implementation of corrective action were found to be significantly different.



**Figure 01: Type of defects frequently observed in returned poor quality potatoes**

**Table 02: Comparison of returned quantity of potatoes before and after implementation**

Description	Pooled StDev	P value	Significant level
Average Weight of weekly returned potatoes from the sale outlets (Before and After Comparison)	5074	0.000	0.050

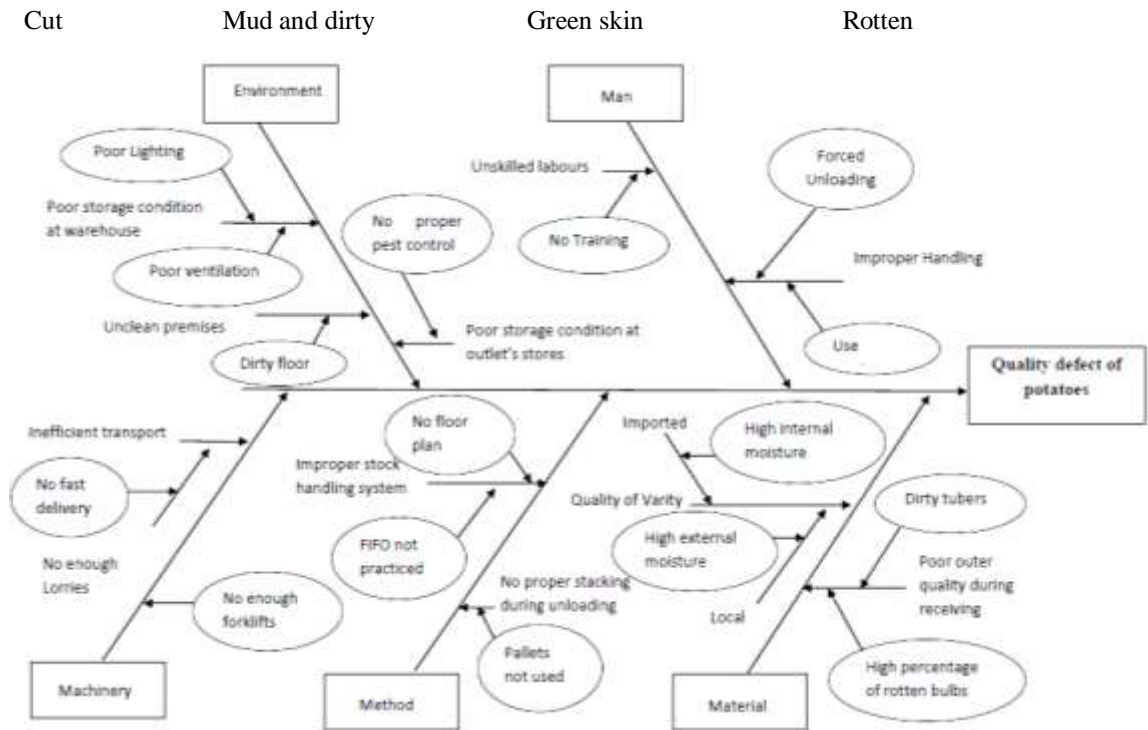
**3.1.2 Fish bone diagram**

A fish bone diagram was constructed to identify the root causes to implement the corrective action exactly. (4Ms and Environment)

- ✓ Material-Poor quality of the potatoes during receiving.

- ✓ Machinery-No proper machinery used and no enough vehicles.
- ✓ Method-Improper stock handling system.
- ✓ Man-Improper handling of the bags during loading and unloading.
- ✓ Environment-Poor warehouse and Outlet’s storage conditions.





### 3.1.3 Determination and implementation of solution.

Solutions for the defects were identified through brain storming session with the participation of food technical committee members, pest control team, engineering team members, quality assurance officers, warehouse managers, selected outlets managers, warehouse supervisors and skilled labourers.

### 3.1.4 Implementation of corrective actions

#### 3.1.4.1 Poor quality nature of the product during receiving

Nature of the product at the receiving point was affected the shelf-life of the product. Tubers with mud, dirty and rotten were rejected and also wet on external surface and green colour skins were also rejected at receiving point and maximum quality cut was decided.

Variety and quality of the potatoes were highly considered during the selection in process instead of considering prices. When Chinese potatoes were received at the point, moisture content and cool condition of the tubers were inspected properly. If the sample tubers were not in the acceptable condition,

that lots were rejected. Suppliers were advised and informed to supply fresh and quality potatoes which should be complied with the tender board sample.

#### 3.1.4.2 Poor storage condition of the warehouse and stores

Potatoes are able to sprout and produce a new plant when climate conditions are suitable for them (Gumataw, 2013). To prevent the sprouting, we need to maintain good ventilation and lower temperature conditions during storage when the potatoes are at the warehouses and also in shops level too. Additional exhaust fans were installed and existing fans were repaired in the warehouse to improve the ventilation. Broken lights were replaced with new lights to increase the light intensity. Floor, wall and roof of the warehouse were cleaned and rodents entering points were closed to ensure the pest free zone. Strip curtains were installed at the main door of the warehouse to prevent the dust. Storage condition of the outlets were inspected and improved.

#### 3.1.4.3 Improper handling of bags by labourers

Labourers were instructed to do the proper unloading and loading process. Fast unloading on the floor was prevented. Bags were staged carefully on the pallets.

Hook usage was prohibited and strictly monitored by supervisors during loading and unloading periods to minimize the damages by hooks. Training programs were conducted by LSL Quality Assurance Team to the labors and supervisors to prevent the quality defects during handling. Sufficient amount of forklifts and transport Lorries were provided to distribute the potatoes to outlets without delay. Potatoes to send from warehouse to outlets, transport vehicles were ensured to be free from dust and properly fumigated before transportation.

### 3.1.4.4 Improper stock handling

Proper stacking floor plan was implemented to store the potatoes bags. Enough pallets were provided to stack the bags and stacking high also limited. First in First out (FIFO) method was implemented to improve the quality of potatoes. It was used three colours as red colour- Just arrive stock, yellow colour - pending stock and green stock - movement stock.

**Table 03 Level of defects found on return potatoes before and after implementation**

Identified problems	Pooled StDev	P value	Significant level
Sprouted	0.713	0.000	0.050
Rotten	0.625	0.000	0.050
Dirty skin	0.807	0.000	0.050
Small or large tubers	0.546	0.000	0.050
High external moisture	0.680	0.000	0.050
High internal moisture	0.657	0.000	0.050
Tubers with cut or damages	0.712	0.000	0.050
Shrunken and spongy	0.621	0.000	0.050
Low customer preference	1.070	<b>0.813</b>	0.050
High price	0.923	0.000	0.050
Problems with packaging	1.217	<b>0.189</b>	0.050
Green colour tubers	0.650	0.000	0.050



Sprouted, rotten, dirty skin, small or large tubers, high external moisture, high internal moisture, tubers with cut or damages, tubers with cut or damages,

shrunken and spongy nature, high price and green colored tubers were less than 0.05, which imply there were significant differences in these parameters

before and after the improvement project. Low customer preference and problems with packaging were greater than 0.05, which implied that there were no significant differences in low customer preference and problems with packaging before and after the project

#### 4. Conclusion

Major quality defect identified for gap between acceptable level and very poor level were sprouted, rotten, dirty skin, shrunken nature. Quality defects were manipulated and ruled by numbers of causes were improved to a satisfactory level.

This improvement helps to reduce quality gap and open a new trend on selling best quality potatoes with less market return. Numbers of customer complaints also reduced after improvement.

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