Quality product and labelling assurance systems at

BAKKAVOR SPRING VALLEY FOODS

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1. INTRODUCTION

1.1. Company Background

Bakkavor Group is a leading international food manufacturing company specialising in fresh prepared foods and produce, with 57 factories and 20 000 employees in ten countries. Spring Valley Foods (SVF) is part of this leading organization situated in Bapsfontein, South Africa. The company specializes in the production and packing of fresh fruits for various grocery retailers. The primary customers are Woolworths (WW) a well known South African retailer and Marks & Spencer (M&S) a Leading British retailer in the United Kingdom.

1.2. Project Background

Thousands of goods are produced daily and distributed worldwide. The process of producing a fresh prepared product is divided into sections internally known as Medium Risk, Prepping, Packing and Collation. This distinction is made due to the different processes and the hygiene area it is allocated to. Where fruits are open and prone to human contact the area is a high risk area and procedures are very specific in ensuring a clean safe product.

The production processes at Spring Valley Foods include the labelling and packing of goods. The Collation area receives sealed goods from the packing area which makes this a low risk area. This is the area where Product labelling is done and it is the final step in producing a finished good, as indicated in Appendix A. Customers have specific labels assigned to different products and these labels are ordered by the company with the predefined design already printed. It is the company's responsibility to print the product details onto the label and ensure the label is ready when requested for production. The printed details include the product expiry date, mass etc.
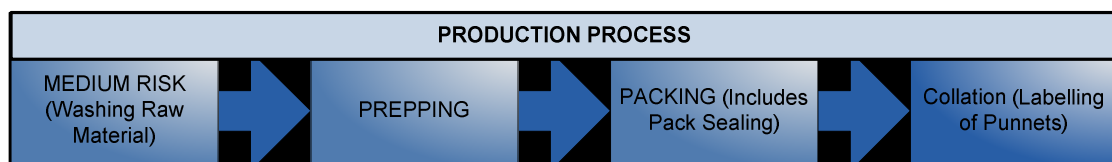
Figure 1: Production processes

1.3. Problem Statement

The Collation labelling system responsibilities refers to the printing, applying and verification of company labels. This Labelling system has proven to be insufficient not only because of customer complaints but also due to a number of Marks and Spencer Code of Practise specifications that are not met.

In addition, it is a company goal to implement systems for continuous improvement. The company is however not accustomed to change and it was recommended to approach every area individually to ensure successful results. This project seemed to be the appropriate starting point to implement measurable processes within the collation area.

1.3.1. Label Printing System

The product label details are printed in the print room, situated within the collation area. When label details are printed it is the employees' responsibility to provide all the necessary details of the products. This method of printing labels has proven to be unsuccessful as numerous customer complaints were received due to incorrect printed details. In situations like this, if there isn't time for relabeling, the goods are dumped and results in a great loss of profit for the company.

1.3.2. Label Verification System

Throughout the past year it became apparent that not all Marks and Spencer supplier specifications were met. The M&S Code of Practise is updated regularly with required changes constantly appearing. The next M&S audit will be during October 2011 and the main specifications stipulated that a product verification system is required. M&S requires a system that will ensure them food products are packed using the correct packaging and date coding as well as removing allergenic risks to the customer.

1.3.3. Continuous Improvement

One concern within the company's operations is that there are no methods in place to measure the production efficiency. The purpose of this project is not only to design and implement Labelling systems that would ensure a quality product but also a way of creating measurable processes. As soon as a measurable process is created the opportunity for continuous improvement and cost reduction arises. Future projects will work backwards from the collation area in creating systems which will later be integrated in performing one common goal of improving production efficiency and reducing operational costs.

2. PROJECT AIM

The aim is to design labelling systems, which will guarantee Bakkavor Spring Valley Foods' of a Quality Product with Quality labelling systems, at the least possible cost. This includes removing 'allergenic' risks to the customer by eliminating the possibility of using incorrect packaging on any food products. This will also be used as the first step for the company to create a system for the purpose of future continuous improvement.

3. PROJECT SCOPE

This project was phase one of a series of projects that will follow in the future, which is why it was extremely important to design systems that will support future continuous improvement projects.

3.1. Label Printing System

This branch of the project existed from customer complaints on the printing of label details. Through this however an opportunity existed for the improvement of other areas within the print room. The Label printing system includes all the processes and procedures from when a preliminary order is received up to where the left over labels are dumped. The following areas were investigated; method of printing labels, the print room location and layout, server information technology, mass balance systems. System implementation and staff training was a vital process in ensuring a successful system.

3.2. Label Verification System

The Label verification system includes all the processes associated with assuring a quality product with the correct label and date coding. The Marks and Spencer specification stated that every produced product will need to be checked, as soon as a label is applied, to ensure the correct label was used. This system includes all the processes from when a label is applied to a product up to where it is boxed and sent to dispatch. Processes were designed, conveyor specifications were identified and the information technology required in performing the task was carefully planned.

3.3. Continuous Improvement

All the processes and procedures developed in the Label printing system and Label Verification System were developed with special consideration for measurable processes. This will provide the basis for continuous improvement.

The Project Scope included the project Implementation, employee training and the development of Procedure Manuals. A system design or change, of this stature, need to concern the employee training as one of the fundamental areas to ensure a successful system. A perfect system can be designed and implemented but without a well trained staff errors are a certainty.

4. LITERATURE REVIEW

4.1. Label Printing System

To reduce the employees' responsibilities in the print room a semi automated information technology system is required. A modern automated printing system relies heavily on Information Technology to ensure correct information is supplied and sufficient data is recorded.

When designing a printing system it is extremely important to take a company's constraints and specifications into account. Information Technology has a wide variety of functions to offer which is why organizations will have unique printing systems designed to perform according to their specific requirements.

4.2. Label Verification System

Modern society has opened up a new world for verification systems. A vast amount of research has been done on this subject and solutions such as bar coding and RFID tags have been developed and used successfully in organizations across the world. Verification devices can be integrated in-line, attached to the printer to monitor the quality of every printed label or they can be used in a standalone configuration to audit batches and labels. Depending on the company specifications and constraints an automated or manual system can be developed.

When designing a verification system the main concern is the construction, implementation and maintenance costs involved. These costs can be very high and the return on investment along with a payback period will give an indication of the project's success, if applicable. The need for this verification system existed from a Marks and Spencer supplier specification and is therefore not an investment for increase in profit but for customer satisfaction. Nevertheless great opportunities for improvement can rise from verification systems.

4.3. Continuous Improvement

Continuous Improvement on processes will only be possible if the processes are measured. If nothing is measured no data is

GOAL	MEASURE
Effectiveness	Productivity (or Production coefficient)
Efficiency	Rework as a fraction of total effort

available to support management in making decisions. Organizations have different methods of measuring, as can be seen in the table. The measurements will depend on the types of processes within the operations.

5. SUPPLEMENTARY TOOLS AND METHODS

5.1. Process Design

Quality plays an essential role in any organisation, and more critically in a company where products are produced and need to conform to various safety standards and internal specifications.

Company procedures were created and used to identify and design processes which will form the base of continual improvement within the company. These processes will provide a foundation for employees uncertain of any procedure and assist in ensuring processes are completed as required. The processes and procedures will assist in improving the quality management system through acting as a reference point for any uncertainty within the company.

Processes were designed for all the responsibilities assigned to the collation area and new responsibilities with processes were created where necessary. These processes are simple and easy to understand, as can be seen in Appendix B.

5.2. Layout Design

Label Printing

There are thousands of processes that are performed in a company of this stature. To create process flow patterns and accommodate for new processes the layout of areas were redesigned.

Label Verification

The new verification system required new equipment that would be added to the existing equipment. Every piece of equipment and information technology involved in this process will be vital in performing the goal successfully. This is why the design of the system was developed in-depth with every detail considered in full.

The design of the equipment also needed to consider the collation layout and available space. The final construction will be done by a contractor and will be received on the day of implementation. There is no room for error on this day and every detail of size and space involved need to be designed according to the available resources.

6. CONCEPTUAL DESIGN AND SOLUTION

6.1. Label Printing System

6.1.1.   Development of Solutions

All the problems were identified with the possible solutions developed. The solutions were reviewed and compared to one another with consideration for the constraints and the most appropriate solution was then selected.

CATEGORY OF CONCERN	PROBLEMS AND SOLUTIONS		SOLUTION
Space	The upstairs location of the print room created problems for the line leaders to retrieve labels. They are up and down the stairs numerous times a day and the stairs only allow movement of one person at a time.		A bigger space was available downstairs. The print room's flow of processes will be improved by this move, including the process of retrieving labels. This area is closer to the collation area which will save time. The available space is bigger than the old print room which will create opportunities for other improvements.
	SOLUTION	CONSTRAINT	
	• Store labels for the days productions on line	• M&S Supplier Code of practice stipulates that only one label is allowed on a production line.	
	• Design a process to transport the labels by alternative methods	• Complication of a simple process	
	• Move the print room to a location down stairs, closer to production lines	• Need to find the available space	

	During peak seasons the issue window is too crowded and line leaders waste too much time on requesting labels.	The best solution, when considering all the specifications from customers, is to increase the size of the issue window. With the development of the new print room this will be a simple task. The Issue window will have to accommodate up to four line leaders at a time. (There are eight production lines and it almost never occurs that more than three lines start new production runs at the same time)
	The storage of printed labels are inconvenient and impossible to work with, all the labels are stored on the same shelves (+- 80 different labels). Marks and Spencer specified within the code of practise that every label needs to be stored separately with a method to indicate the labels details and planned production day	This was a difficult task to approach because of a space constraint, even with the new print room in development. A shelf will be designed to store at least 95% (peak season) of the labels with specific indication of a label's location. During peak seasons there might have to be one or two labels stored on the same location but if this is indicated clearly it shouldn't create any problems

SOLUTION	CONSTRAINT
• A shelf will be constructed which will allow for individual storage of labels. The self will separate the labels from one another and an area to indicate the label details will be available	• There are +-80 different labels during a peak season • Cost of construction
• Only print a label	• During peak

	an hour before the request is expected	seasons not enough time will be available to avoid bottlenecks • Staff and printing resources might not be enough	
	Unprinted Labels are difficult to collect from the storage area. It is a requirement for printed and unprinted labels to be stored separately and be locked away. Print Room staff retrieves the labels from outside the print room where the labels are piled onto one another with no indication of where to find specific labels	A method that would allow only for the daily unprinted labels to be stored within the print room is required. This creates more control and easy accessible labels

SOLUTION	CONSTRAINT
• Construct a shelf that will store the unprinted labels individually	• High cost involved and limited space available
• Only request necessary labels in the mornings from packaging and return left over labels at the end of the day	• Resistance • If employees do not follow the correct procedure the customer code of practice will be broken

	Storage of promotional stickers as well as box coding and colour coding is unorganized with no clear indication of where labels should be stored or collected	A storage shelf will be constructed by the Engineering department which will have clearly indicated spaces for every type of label to be stored in

System Design	The Print room employees are making a number of mistakes when printing label details. Not only because of the stress of constantly being behind demand but also because of an uneducated work force		This was where the customer complaints came from. Spring Valley Foods works with an Uneducated work force and excessive errors will be a given if too much responsibilities are assigned to workers. During this investigation it became clear that a system that would reduce employee responsibilities was necessary. Methods have been investigated and a semi-automated system with a server connected to the printers was identified as the best solution. Only Authorised personnel will have access to update the information on the server. Print room employees will have to scan the label, enter customer, depot date (date the label is printed for) and number to be printed.
	SOLUTION	CONSTRAINT	
	• Create an automated information system and remove the input from staff members	• Highly complex information system • High Cost • Not a necessity	
	• Create a Semi automated information system to partially remove the staff input	• Input from staff members could still create problems	
	Job Descriptions, Roles and Procedures weren't clear and available to employees which made it impossible to improve in their work areas and complete responsibilities sufficiently.		Procedures with Roles and Job Descriptions will be developed to give exact instructions on what needs to be done by whom. This will be openly available in the print room and job descriptions will be signed off by employees.

Time	The paper work involved in completing any process within the print room takes up way too much time. This delays the issuing of labels and creates a bottle neck within the collation area. The paper work is a Marks and Spencer Specification and includes the requirement for Mass Balance.		A device with a Scale, camera and interface working together will be designed. Whenever a label is printed, issued, returned or dumped the label is placed on the scale. The Print Room Line leader will Enter the function (print) and the system will automatically take a photo and store the weight. The Employee name is then entered with the date and time automatically recorded. This will make the process of recording data quick and easy. Creating reports on what has been done and mass balance will be a possibility.
	• Semi-automated device to record the data on an information system	• Change Resistance	
	The Print room was under way too much stress when a label was issued or returned. Procedures weren't followed and documentation not completed as instructed		A procedure will be developed for the Print room employees to keep track of the daily production plan. With this knowledge the next run's labels are prepared and provided at the window for a quick method of issuing labels. There are eight production lines and eight boxes will be available at the issuing window where labels will be ready to be requested ahead of schedule
	• Creating a process where a line's next label requirement is prepared in advance	• Change Resistance	
	• Complete the paperwork ahead of the time it is required for	• Information changes frequently • All relevant parties need to sign off on the document	

Figure 2: Photo of stairs to Print Room entrance

Figure 3: Top Photo of stairs leading to Print Room

Current Upstairs Layout
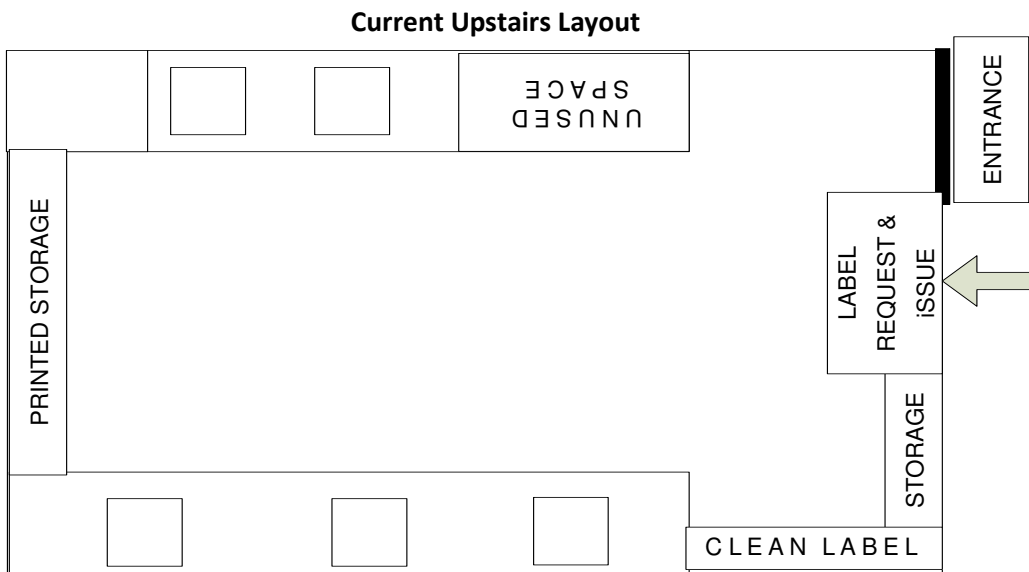
Figure 4: Current Print Room design and layout (Upstairs)

6.1.2. Conceptual Design

The problems were identified and solutions were created which finally lead to the commencement of the conceptual design. This design will be the basis for the project development and construction. Changes during development are possible but this will be the reference point throughout the project.

Job Descriptions and Procedure Manual

A template was designed for the job descriptions necessary, this will be used for all the roles identified within the print room. Meetings will be arranged with managers and all the relevant employees to discuss the responsibilities in full. These meeting will provide information to create sufficient and clear job descriptions. The procedure manual will be created according to standard and the main topics to discuss were identified to ensure a sufficient document.

The following topics will be discussed in the procedure manual with complete steps to follow. This will ensure the correct procedure and standards are followed at all times.

— Purpose/Background

— Applicability

— Scope

— Roles and Responsibilities

— Procedure

— Ordering and returning labels

— Calculating Required Labels

— Preliminary Print

— Final Print

— Recording Processes

— Manual Forms

— Server Device

— Day end Responsibilities

— Mass Balance

— Cleaning

— Forms

— Appendices

Woolworths and Marks and Spencer Label Storage

Separate shelves were designed for Woolworths and M&S. This design allows for the storage of individual labels and a space where label details will be displayed to ensure labels are not mixed. Spring Valley Foods' production systems operate according to a colour coding scheme to ensure products are produced and dispatched on the correct date. Every production batch will have a release form attached to it with a colour code to indicate the dispatch date, as can be seen in the picture.

Figure 5: Photo of label detail display

Figure 6: Photo of batch with colour coding release form

The shelves are designed to store up to 45 labels for Woolworths and 30 labels for Marks and Spencer. Every label will be separated by a thin piece of steel. The separation steel used will be as thin as possible to ensure space isn't wasted. Various options have been investigated to ensure the separation can be completed at the least possible cost and labour. The investigations proved that a steel rod will be the best option. The old shelves will be used in which holes, same diameter as the rod, will be made. The rod will be welded to the shelf and this will finally create a storage shelf for a great number of labels.
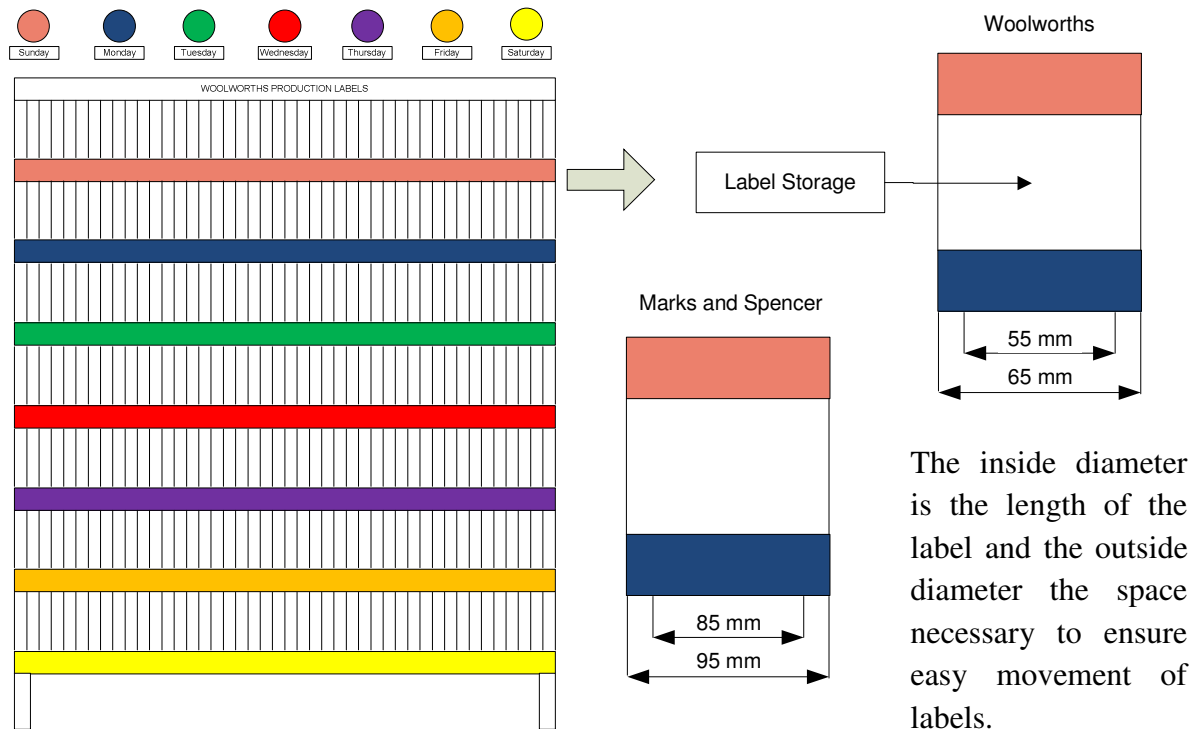
Figure 7: Label storage design

Storage of Promotional Stickers

The storage of the promotional stickers is a simple task to improve on. An engineering construction to allow for the storage of 15 different types of stickers is required. This storage device was designed and will be attached to the wall next to the issue window for easy issue access and a quick issue method.

Storage of unprinted labels

Unprinted labels will not be stored in the print room anymore. The labels, necessary for the daily prints, will be ordered from packaging in the mornings and issued back to packaging at the end of every day. This will remove the responsibility of recording extra data for the print room staff.

Print Room re-location

There is an available space downstairs for the re-location of the print room. The space has an improved location with more space available for sufficient processes.

Proposed Ground Floor Layout
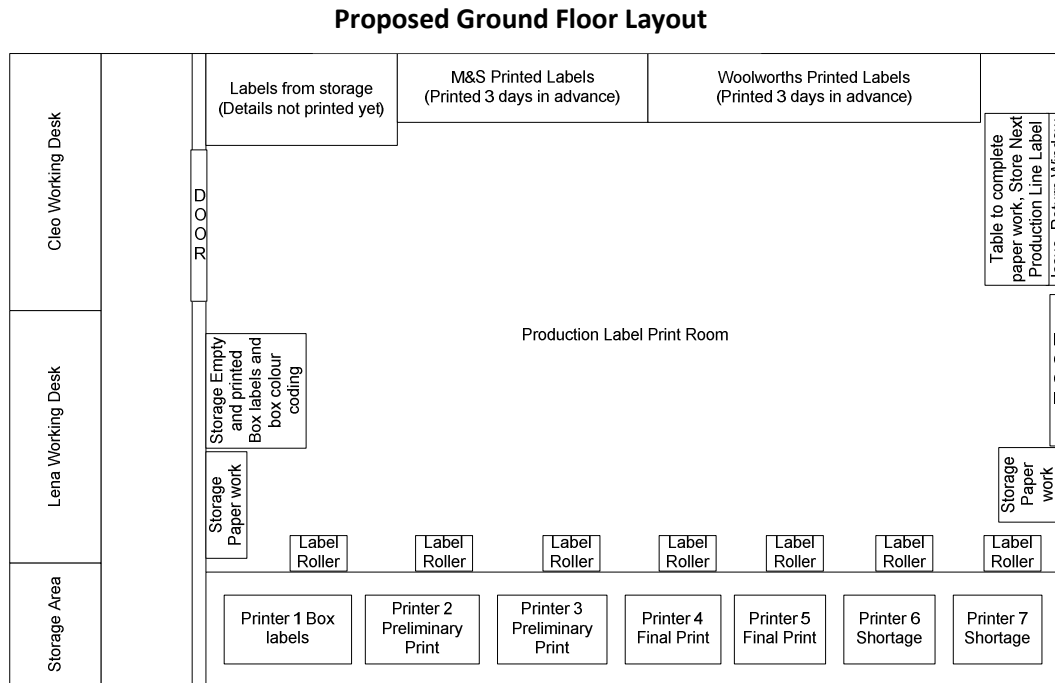
Figure 8: Illustration of proposed Print Room design and layout (Ground Floor)

Semi-automated label data storage

A simple design of what is required was created. This design will be used to improve on with adjustments to develop a successful semi-automated recording device.
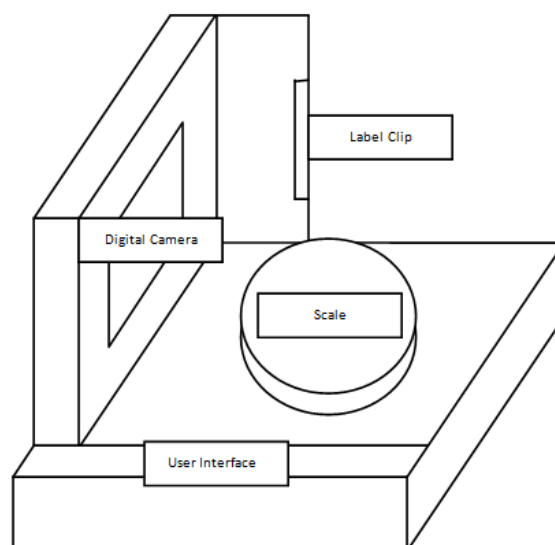
Figure 9: Illustration of data recording device

Printing errors

Information technology will be the main concern in this area of the project. The IT equipment and programming will be completed by Julian Powers from Cab Technology. This will be done according to the following system specifications.

- Semi-automated system

- Record printer name, date printed, product details and expiry date

- Provide all relevant information. Expiry date, product (staff only need to scan the bar code), product mass etc

- Restricted access to change the information on system

- All employees are required to login with a personal ID and password

- Minimum information provided by print room employees

Prepared production labels

There are eight production lines and every line has a daily production plan. The print room employees also receive the daily production plan and this will be used to prepare labels in advance. Eight boxes will be available at the issue window with the next production runs' label prepared in advance. The box will be big enough to hold any size label and the process will be simple. As soon as a label is issued from a box the line's next label is prepared.

| LINE 1 | LINE 2 | LINE 3 | LINE 4 | LINE 5 | LINE 6 | LINE 7 | LINE 8 |
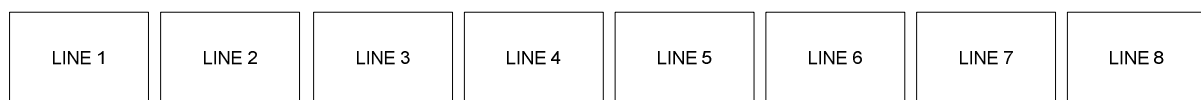
Figure 10: Prepared line boxes

6.2. Label Verification System

6.2.1. Physical Design

The verification system design will be completed in two phases. Phase 1 will be the design without a label applicator, when labels are still applied manually. Trial and error is always a factor associated with change and will be a method of obtaining success in phase 1. Phase 2 will then be to add the label applicator to the line which will help increase the efficiency of production.

During the design of both phases there will be factors to consider with constraints allocated. It is a vital point in the design to ensure all factors are considered with appropriate solutions developed.
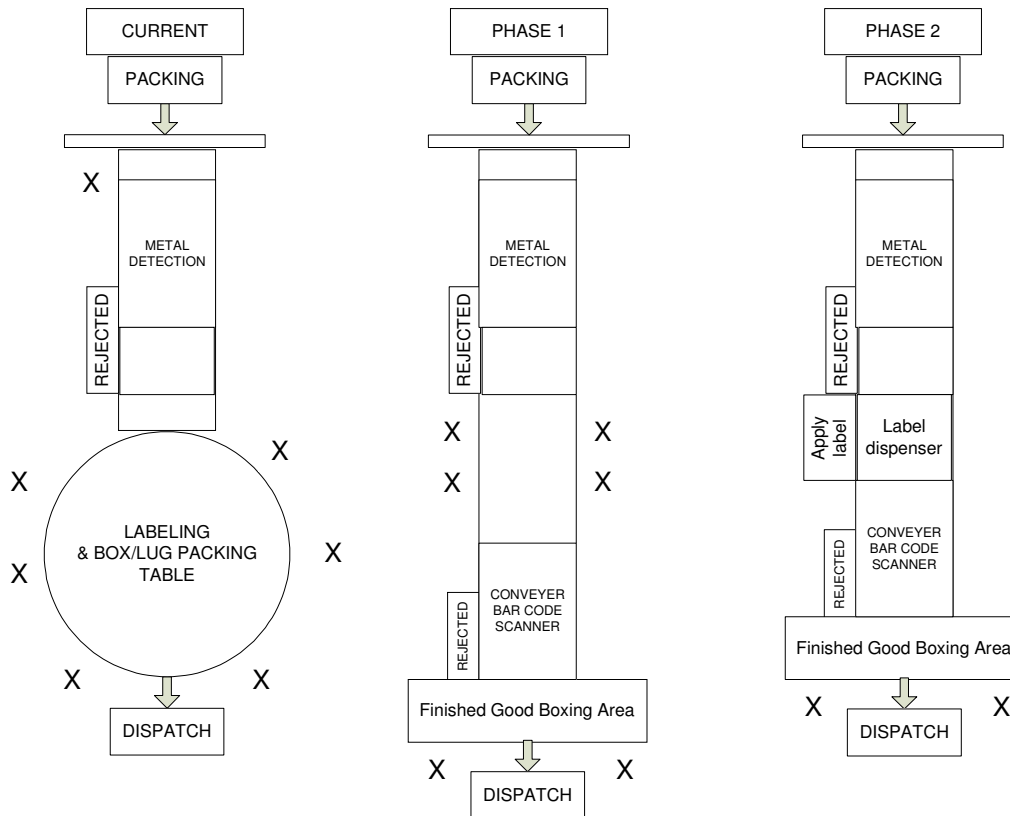
Figure 11: Illustration of the collation layout changes

Design Factors to Consider			
	Issue	Possible Solutions	Constraint
Phase 1	Enough space needs to be available for walking and movement of batches at line ends (See Appendix A)	Consider reduction of length provided for employees to apply labels	Might not be enough space left for 4-6 employees to apply the labels
	The design will have to consider the implementation of the label applicators in the next phase	The manual process of applying labels will need to consist of a roller bed stand that can lock to the ground and be removed at a later stage	High cost involved
	Labels need to be scanned from the bottom	The conveyor will be designed with two separate belts and an opening in the centre	Conveyor stability uncertain

	If labels are not applied correctly the label scanner might find false errors	Employee Training will have to include the re-training of applying labels	Change resistance
	Labels shouldn't be able to be shifted on the conveyor. This might complicate the scanning process	At the start of the feed a mould will be required which will ensure that the punnet is in the correct position on the conveyor	
	Employees might feed the products in intervals faster than accepted (False errors)	A stopper will be required before the scanning conveyor feed starts to ensure correct time elapsed for next product	
	Procedure if there is a malfunction with the barcode scanner	A procedure will need to be developed for machine malfunction which in a peak season will need to be done manually	During Peak seasons every line is in use and critical for production
	The design to manually apply labels might affect the employees' efficiency and the possibility of not physically fitting into the line will be considered	The design will need to include ergonomics to ensure employees are comfortable and can perform responsibilities efficiently	Change resistance
Most factors related to phase 2 have been considered in phase 1 and special consideration for the label dispenser is required now.			
Phase 2	If there is a malfunction with the label dispenser preparations are necessary to eliminate unnecessary production down times	Allow employees to apply labels manually	Is there enough space available for the label scanner before the next label is scanned
		Continue the production run on another line	With the massive demand in a peak season all production lines will be in use

Figure 12: Photo of current line design   **Figure 13: Photo of Staff manually applying Labels on line**

6.2.2. Functional Design

The functions to consider when the system is designed are:

- System stops and alarms are triggered when labels are unreadable

- A setup procedure is required that will test the Scanner

- Accurate scanning of bar codes

- A Product is rejected when the label is incorrect or unreadable

- Rejected product is recorded

- Accepted Product is recorded

- Future Projects will include the calculation of estimated starting and finishing time

- Display screen to show amount left to produce during production run

- Interface with scanner to allow sufficient insertion of production run details

- Coloured lights to indicate the completion of the setup and the production run

The physical design will be completed by Theunis Taljaard (*Ingenior*), Automation and Machine Specialists. Ingenior specializes in customized automation systems to provide functions designed for a company's unique specifications. There are standardized systems available from European countries but the associated maintenance costs are unnecessary and will exceed the company's budget. Ingenior is located in Centurion, Pretoria only 40 min from Bakkavor's premises.
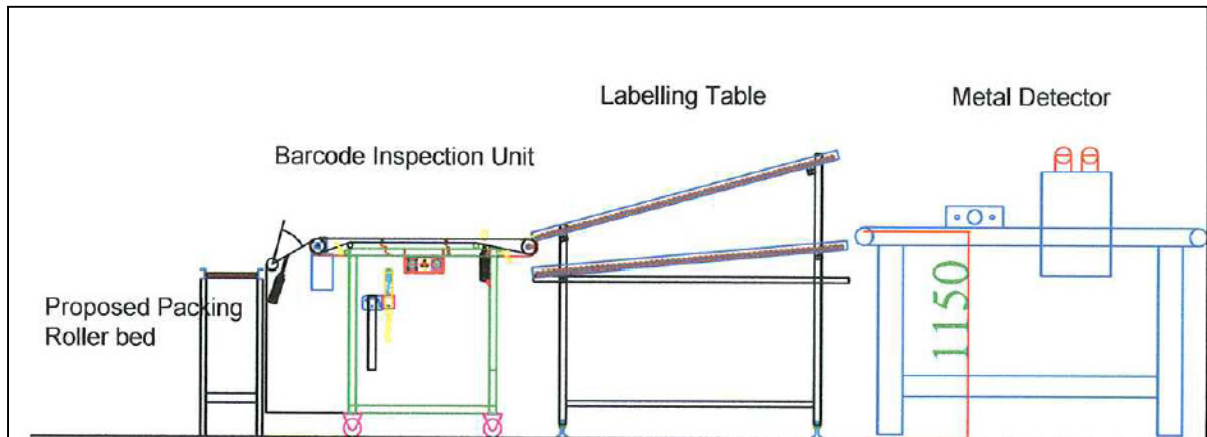
Figure 14: Front Picture of Phase 1, proposed scanning system for BAKKAVOR SVF
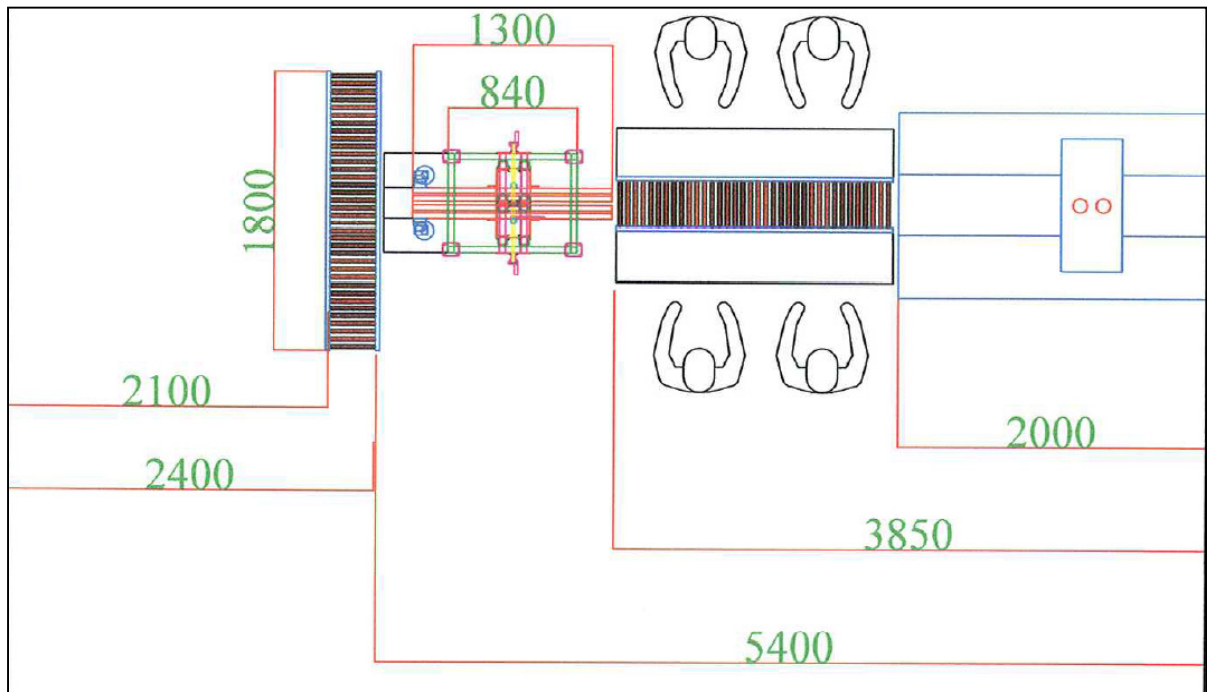
Figure 15: Top Picture of proposed scanning system for BAKKAVOR SVF

6.3. Continuous Improvement

In the system design the Information Technology involved will need to record certain data that will be used to create reports for analysis of production efficiency.

The following data will be recorded:

- Starting time of a production run

- Finishing time of a production run

- Number rejected products due to metal rejection

- Number rejected products due to unreadable label

- Number quality Products produces during production run

- Number Setup failures

- Number labels printed incorrectly

- Label wastage (Mass Balance)

- Calculate number goods to be produced during production run

- Records the Line leader's information running the production line

7. PROBLEM SOLVING AND RESULTS

The printing system will take care of numerous errors that were identified and the verifications system will do checks to ensure a quality product. This will include collecting data, providing reports and creating measurable processes which will present an opportunity of improvement for the company.

7.1. Label Printing System

Adjustments have been made to various areas of the Label Printing System. The print room was moved down stairs to create more space for additional storing and different methods of storing. The methods of printing labels and issuing have been changed into a semi-automated system with less responsibility assigned to employees. The changes will now be discussed as either a physical or information technology system change.

7.1.1. Physical Changes

The initial Print room didn't utilize the available space and didn't have enough space available for storage of labels. It was located upstairs in the collation area with little space available for line leaders to request labels at the issue window.

The following changes have been made:

- Prepared line labels are provided at the Issue window (according to the production plan)

- The new layout of the print room is situated on the ground floor where access for line leaders to request labels are convenient, easy and quick.

Figure 16: Photo of new print room location

Figure 17: Photo of print room issue window

- The planning manager is now situated within the print room to ensure more control and to assist where necessary

- Shelves were designed to store 95% of Woolworths and 100% of M&S Labels (peak season)

Figure 18: Photo of storage design for individual product labels

- Every label is now stored individually with the specific label identified and the day it is required for indicated (company colour coding used to indicate production day). There are seven shelves for every day of the week and a row for every product in production.

- Job descriptions, roles and procedures were created and staff members trained (See Appendix)

- With the development of the new print room the size of the issue window was increased

Figure 19: Photo of shelf with label storage

Figure 20: Photo of label storage identification method

- Labels are prepared three days in advance (possible with new storage method)

- Storage shelf constructed by engineering department for storage of promotional stickers

Figure 21: Photo of storage design for promotional stickers

- Unprinted labels are now ordered in the morning (according to demand) and returned at the end of the day. This method ensures enough space for storage and easy access to specific labels.

7.1.2.   IT System Changes

Printing Control

The changes increased the printing control in the print room; this was where the customer complaints existed from. Employees were making mistakes when label details were printed and the employee responsibility of providing details needed to be reduced.

A server connected to the printers was identified as the best solution with special consideration for the constraints. A server with a database was created, containing product details provided by authorised personnel. This data is updated regularly by assigned staff members and when this is done the date, changes made and person who made the changes are recorded for traceability purposes.

The printing employees have fewer responsibilities and all the processes performed by the print room employees are recorded via a connection between the server and printers. When a preliminary order is received the employee's responsibilities only consists of the following steps.

1. Scan the label

2. Enter the customer

3. Enter Label Version

4. Enter Product Depot date

5. Enter Number to be printed

This method of printing labels reduces the possible number of errors and provides traceability for all processes associated with printing labels.

Figure 22: Photo of a printer connected to a scanning device

Issuing System

Changes in this area were made to remove the massive amount of paper work (necessary for traceability and calculation of mass balance) as well as to reduce the time associated with labels issued and returned.

To reduce the paperwork, but still ensure that all the necessary data is recorded, a label issue device was designed. This device is connected to the server and records the weight and time as well as staff involved with a photo of the label's printed area. The print room employee places the printed labels on the scale and follows the instructions as indicated by the interface. This process is necessary when a label is printed, issued, returned or dumped. This data is then available to create reports (including mass balance) and investigations on any errors are possible. This saves paper, costs are reduced, the time to completing processes is less and the labour required in the print room is less.

The print room employees are now instructed to keep track of the daily production plan. With this knowledge the labels required for the next run are prepared and temporarily stored at the issuing window. This method reduces the time it takes to issue a label.

7.2. Label Verification System

The Marks and Spencer specifications only require a system that verifies the label details but this project will be divided into phases using the verification system as the basis for improvement.

7.2.1. Physical Design and Layout

Verification System

The design was completed by Theunis Taljaard (*Ingenior*), Automation and Machine Specialists along with Julian Powers (*Cab Technology*), Technology equipment and programming.

The physical design allows the process to first conduct the existing metal test (if labels are applied before this process it will be a waste of labels) then applying the labels and finally the product is scanned. As soon as the scanning process is completed the products are boxed and sent to dispatch.

The manual labelling area consists of a roller bed at an angle; this leads the product to the scanning process. As soon as the product descends to the scanning area it follows the conveyor through an adjustable mould to ensure it is in the correct position. The scanner has a stopping device (functioning on a timer) which ensures enough time has elapsed before the next product is received by the scanner.

Each product is transported through the scanning system by two conveyor belts that are both adjustable. The adjustment was a requirement for products that are labeled differently.
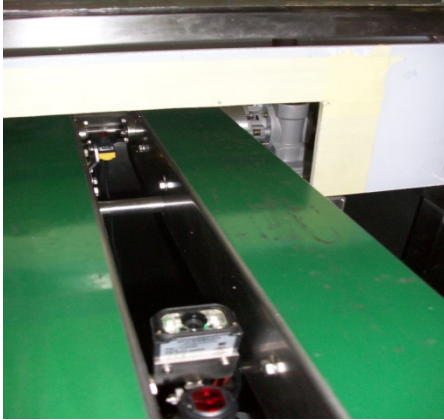
Figure 23: Photo of conveyor belts with scanner

Figure 24: Photo of angled roller beds

A product is moved forward by the belts with the barcode displayed at the bottom through the gap. The barcode moves over the scanning head which reads the barcode details and compares it to the product setup details. If any errors occur the system will trigger the next feed to be lifted on a timed interval, allowing the rejection of a faulty label. Accepted labels are transferred to the boxing process.

Figure 25: Photo of roller bed feed to the conveyer
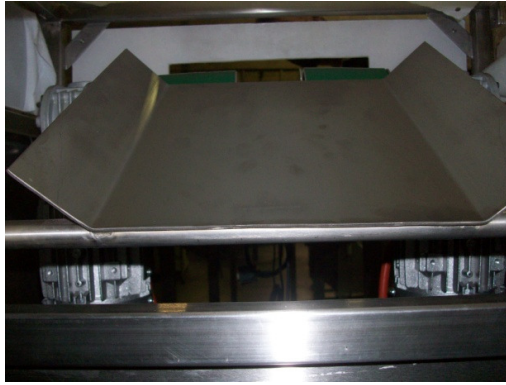
Figure 26: Photo of rejection hatch

Figure 27: Photo of the rejection box

Label applicator

The next phase of the project is the label applicator which will only be completed in December of 2011. The application is a C-strap method and the length of the label could cause problems which is why numerous tests are being conducted by *Ingenior*.

7.2.2.   System Setup

A key element in the success of the verification system is the procedures and functions associated with the setup of the system. The system will need to undergo a test to check that all functions are working before a production run commences.

The setup process will occur every time a new production run is required.

STEP	SYSTEM	LINE LEADER
1.	Request an Authorization card to be swiped	Swipe the card
	Line leaders are responsible for production runs. When a production run occurs the system will record the line leader information which will be used for traceability. Only line leaders will be allowed to initiate a production run.	
2.	Approve Card	
	The system will read the card and authorise the production run as well as record the information for the production run	
3.	Request to Scan a label	Scan Label
	To ensure the correct label is scanned and checked the required label will need to be scanned for the system to recall the label details to be scanned and approved	
4.	Read and display label	
	To ensure the correct label is about to be used and system functions are correct the system will display the information and request input from the line leader	

5.	Request approval input	"Approve"
6.	Start Conveyor Movement	
	The IT system and conveyor is connected and soon as the initial information is approved the IT system will trigger the conveyor to start moving	
7.	Request Correct Labelled Product	Insert Correct Product
	The first step in testing the scanner functionality is to request the product with the correct label	
8.	Approve and Trigger Light	
	If this process was accepted the system will trigger the light that will indicate to the line leader that the test was successful and the next test is required	
9.	Request Incorrect Labelled Product	Insert Incorrect Product
	The next test will require a product with an incorrect label to test the functionality	
10	Approve and Trigger Next Light	
	If the product was rejected and the test approved the next light will be triggered	
11	Request Product without a label	Insert Unlabelled Product
	The final step in the test will be to check a product without a label	
12	Approve and Trigger Next Light	
	If this test was successful the next light will be triggered and it will be clear to a line leader that the setup was successful and the system is ready for the production run	
13	Request number to be Scanned Successfully	Input Total Production Run
	The final step before the production run commences is to indicate the production number (batch size). During Production the system will display the number to be produced and ensure products are not over produced	
14	Trigger final light indicating Running session	
15	Start Production Run	

Below is a figure of what will appear during a production run to confirm a successful setup. The green light will indicate that the setup was successful and a production run is in session.
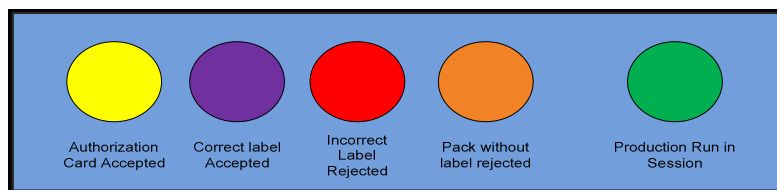
Figure 28: Illustration of the production setup indicators

7.2.3.   Scanning Process and IT Functions

The actual scanning process will ensure that the correct label is applied and that the label is readable to scanners. The design includes the processes and procedures when a label is rejected (Appendix F illustrates exactly what processes occur, the sequences of processes and who are responsible for them).

When a product is unreadable or unrecognizable the IT system triggers the opening of the rejection box to ensure the product is not distributed to customers. The line leader removes the product from the rejection box, removes the label and places the product back on the roller bed to be relabelled. The IT system records the information regarding label rejections and this data is available in different types of reports.

The Marks and Spencer specifications indicated that when a Label is rejected the Line will have to stop. The IT system immediately triggers the conveyor to stop when a label is rejected and request an authorised card to continue production. This authorised person is the collation manager; he/she will investigate the reason for the rejection and swipe the authorization card to proceed with production when it is safe to do so.

During a production run the number to be produced will be displayed, this information is used by the line leader and communicated to the packing area to ensure products are not over produced or short. As soon as the production number (entered by the line leaders) is reached the production run is completed and the IT system will trigger the conveyor to stop and reset itself to its initial state.

7.3. Continuous Improvement

The following data is now recorded and can be used to create reports, review production efficiency and identify areas on which can be improved.

- Starting time of a production run

- Finishing time of a production run

- Number rejected products due to metal rejection

- Number rejected products due to unreadable label

- Number quality Products produced during a production run

- Number Setup failures

- Number labels printed incorrectly

- Label wastage (Mass Balance)

- Calculate number goods to be produced during production run

- Records the Line leader's information running the production line

8. RECOMMENDATIONS AND CONCLUSIONS

8.1. Label Printing System

8.1.1. Conclusion

The implemented systems have created an improved flow of processes while simplifying and removing the massive amount of paper work required. The processes are now semi-automated to assist in removing human errors. The changes in this area of the project are straightforward and uncomplicated which should be easy to adapt to and could only benefit the employees in completing tasks.

- Reduced the cost of tasks (paper removed and less labour time required)

- Assist in making decisions through easy accessible process reports

- Reduced the number of labour required in the print room

- Decreased the number of printed errors by reducing employee responsibilities

- Reduced the time it takes to print, issue and return labels as well as calculating the mass balance

8.1.2. Recommendation

Printing the Labels on line will remove a number of responsibilities and increase the speed at which production is occurring. However, there are always other factors to consider and it would be suggested to compare the current methods to an on-line printing method. On line printing methods will have disadvantages that need to be investigated and compared to the advantages and cost reduction, if any.

8.2. Label Verification System

8.2.1. Conclusion

The label verifications system complies with all Marks and Spencer Code of Practise specifications and is used for so much more. Every product produced is now checked by the

scanner to ensure the correct label was used and that the label is readable to customers. While a production run is in session information that can be used in making decisions and reviewing collation efficiency is recorded. Data is a vital aspect in a production process and the method of recording the data will make a huge impact on the utilization of the data. This method allows for the data to be recorded automatically and create easy accessible reports for management to use.

- Marks and Spencer supplier specifications are met

- Data is recorded on systems for easy use and to assist in making production changes

- Every label is scanned ensuring a quality product with the correct label and readable bar code

- Display for line leaders to be notified of number to be produced in production run. This removes the processes of over producing products and shorts in production

8.2.2. Recommendation

The information technology designed in this system allows for continuous improvement on processes and methods used. It was developed with the idea of adding tools to it to improve on methods, increase productivity and be completely assured of a quality product.

This system needs to be utilized and improvements should constantly be made where appropriate to the system. As mentioned previously this is the first step in creating measurable processes and other production areas will be next in line to create these processes.

Future project should consider the scanning device to include the checking of the printed area. This would assure management 100% of quality labels with every label checked and boxed according to standard.

8.3. Continuous Improvement

8.3.1. Conclusion

The collation area now has numerous methods installed to capture data and create measurable processes. It is the first step within the company that will make continuous improvement a possibility. These tools need to be utilized to ensure the company benefits from these new systems.

The processes can now be analyzed and used as reference in making production decisions. It can also be used to create future improvement products and assist in cost reduction calculations. The system records the number of products produced during a production line as well as the time it took to complete a production run. This information will give the company a solid indication of its efficiency.

8.3.2.   Recommendations

As mentioned previously future project will now be to create measurable processes within all areas of production.

The next area will be the packing area which is in the high risk production area. Working backwards assures the company of removing bottlenecks and creating a continuous flow within the production area. All project should later be considered as a whole.

9. APPENDICES

9.1. Appendix A: Ground Floor Production Layout

Not to scale

9.2. Appendix B: Collation Process

BAKKAVOR   **SPRING VALLEY FOODS**

PROCESS TITLE:	COLLATION PROCEDURE
PROCESS OWNER:	JOHANNES MTSWENI
STAFF:	LINE LEADERS, SHOP FLOOR
OBJECTIVE(S):	Correct procedures are followed when labels are printed, issued and applied. Ensuring a quality product

INPUTS
- Product Order
- Punnet from Packing

PROCESS MONITORING
- Automatic Barcode system
- Quality Assurance Checks
- Traceable Paper work

Input

Print Labels ← Receive Order Details (LINE LEADER) → Daily Metal Detector Test

PRINTING LABELS

Request Engineering Assistance ← NO — Accepted? → YES

METAL DETECTOR SETUP — Setup/Test Metal Detector ← Supply Label to Shop Floor ← Request Product Label — REQUEST LABELS

BARCODE SCANNER SETUP — Setup system Scanner/Test → Receive Punnet on Conveyor from high risk → Punnet Passes Metal Detector (CONVEYOR)

LABEL SCANNING PROCESS — Perform label Scanning Test ← Apply labels/stickers (SHOP FLOOR) ← YES — Metal Test passed? — NO

Pack Product in Box/Punnet/Bag → Collect Boxes/Lugs until batch size is reached

Reject Defective (IT SYSTEM)

SHOP FLOOR

Record Batch Completion ← Complete/Attach Batch Release form

Retrieve Defective

Signal Transport Employee (LINE LEADER)

NO — Second test — YES

Move Batch to Dispatch Checking Point (TRANSPORT EMPLOYEE)

Third Test — YES → Place on Defective Conveyor — NO

Collect Left Over Labels

Investigate Problem → System Records Information

PRINTING LABELS — Return labels to Print Room

Dump Rejected Product (LINE LEADER)

Check/Scan Line to ensure all labels are removed

Clean Line Area (Day end Procedure) (LINE LEADER)

Clean Line (New product procedure) → Complete Production paper work → YES — Daily line Production Finished — NO

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9.3. Appendix C: Collation Metal Detector Setup

BAKKAVOR   **SPRING VALLEY FOODS**

PROCESS TITLE:	COLLATION PROCEDURE – METAL DETECTOR SETUP
PROCESS OWNER:	JOHANNES MTSWENI
STAFF:	COLLATION MANAGER, LINE LEADERS, SHOP FLOOR
OBJECTIVE(S):	Correct procedures are followed when labels are printed, issued and applied. Ensuring a quality product

PAGE 1

Collect Test objects from Print Room — LINE LEADER

Collect four Sealed products from High Risk — LINE LEADER

Insert different objects in punnets — LINE LEADER

Insert Product information into system — LINE LEADER

Place Punnets with objects on conveyor to pass metal detector — LINE LEADER

All four rejected? — YES → Place quality Punnets on conveyor to pass metal detector — LINE LEADER

NO

Problem Fixed — YES / NO ← Report Problem to Engineering Department — LINE LEADER ← YES — Rejected — NO

Inform Collation Manager — LINE LEADER

LINE LEADER — Complete Paperwork (Test was passed)

Return Test objects to Print Room — LINE LEADER

Continue Production Run

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9.4. Appendix D: Collation Barcode Scanner Setup

BAKKAVOR **SPRING VALLEY FOODS**

PROCESS TITLE:	COLLATION PROCEDURE – BARCODE SCANNER SETUP
PROCESS OWNER:	JOHANNES MTSWENI
STAFF:	COLLATION MANAGER, LINE LEADERS, SHOP FLOOR
OBJECTIVE(S):	Correct procedures are followed when labels are printed, issued and applied. Ensuring a quality product

PAGE 1

Collect incorrect label punnet from Collation Table — LINE LEADER

Apply Correct Label to punnet from high Risk — LINE LEADER

IT SYSTEM — Request Authorized Card Scan

Scan Authorized Card — LINE LEADER

Approve Card — NO / YES

Do Not Allow Production Run

Reset to Initial State

Process Stopped

Record Card Detail — IT SYSTEM

Request Label Scan

Scan Correct label — LINE LEADER

Scan Successful — YES / NO

Display Product Name & Bar Code

IT SYSTEM — Request Approval Input

LINE LEADER — Input Approval

INPUT "YES" — NO / YES

Request Authorised Assistance

IT SYSTEM — Request Version Number & Amount to be scanned successfully

LINE LEADER — Input Version Number and Amount to produce

IT SYSTEM — Record Version Number and Product detail

IT SYSTEM — Start Production Run

Adjust conveyor with Punnet size & press Enter — LINE LEADER

Place Correct Label Pack on conveyor — LINE LEADER

LINE LEADER — Wait for problem to be resolved

Request Authorized assistance

Punnet Approved? — NO / YES

LINE LEADER — Document failed Quality Test

Scan Authorization Card to over ride system

Place incorrect label on conveyor

AUTHORIZED PERSONEL — Reduce number produced on system

Punnet Rejected? — NO / YES

Retrieve Punnet, Remove Label and replace onto conveyor

Scan Authorization Card to over ride system — COLLATION MANAGER

Card Approved — YES / NO

Request Authorized assistance — LINE LEADER

Document Approved Scanning Test — LINE LEADER

Swipe Authorised Card to over ride system — AUTHORIZED PERSONEL

Inform Engineering Department — LINE LEADER

Proceed with Production Run

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9.5. Appendix E: Printing Labels

BAKKAVOR　　　　　　　　　　**SPRING VALLEY FOODS**

PROCESS TITLE:	COLLATION PROCEDURE – PRINTING LABELS
PROCESS OWNER:	CLEO PLESCIA
STAFF:	PRINTROOM MANAGER, PRINTROOM STAFF, LINE LEADERS
OBJECTIVE(S):	Correct procedures are followed when labels are printed, issued and applied. Ensuring a quality product

Assess Input

Receive signal that Packaging is Low
- Complete Package Request Document
- Send Document to Packaging
- Wait for Labels from Packaging
- Receive and check label details
- Labels Correct? → YES → Approve packaging And Sign Doc
- NO → Send Labels back to packaging
- Store Packaging

Receive Preliminary Order / Receive Final order
- Collect label from storage
- Insert label in Printer
- Insert Employee Print Number
- Scan Label Barcode
- Input Depot Date
- Enter Version Number
- Enter Customer M&S, TVL, NATAL, WP
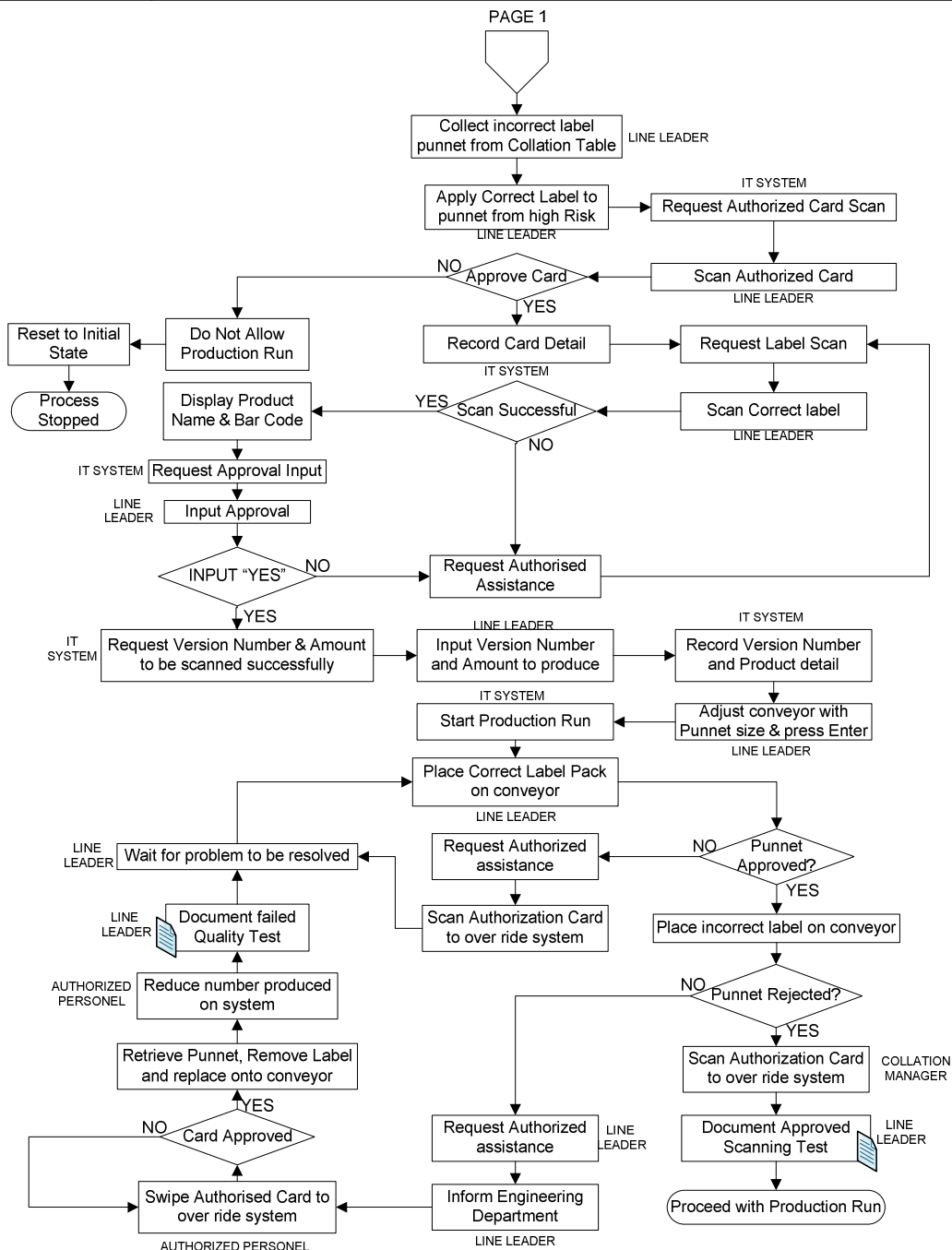- Enter Amount to be printed
- Check printed, Detail Area

Label request
- Collect label from storage
- Weigh label
- Scan label and insert weight issued
- Stick/check sample, with date & parties on doc
- Sign Doc
- Instruct Line leader to sign/accept doc
- Store doc appropriately

Label Returned
- All parties sign return doc
- Weigh label
- Scan label and insert weight returned
- Store left over label

Day end
- Remove Left over Labels
- Weigh label
- Scan label and insert weight Dumped
- Dump labels
- Clean daily shelf area

Press Enter ← Correct?? → YES → Check Label Throughout printing
- NO → Press Y to adjust Horizontally and x to adjust vertically
- Check Label Throughout printing → Collect when finished → Complete Paper work → Weigh and update inventory information
- Unprinted Left? → YES → Return Left over to Storage → Store label
- NO → Store label

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9.6. Appendix F: Label Scanning Process

BAKKAVOR **SPRING VALLEY FOODS**

PROCESS TITLE:	COLLATION PROCEDURE – LABEL SCANNING PROCESS
PROCESS OWNER:	JOHANNES MTSWENI
STAFF:	INFORMATION TECHNOLOGY SYSTEM
OBJECTIVE(S):	Correct procedures are followed when labels are printed, issued and applied. Ensuring a quality product

PAGE 1

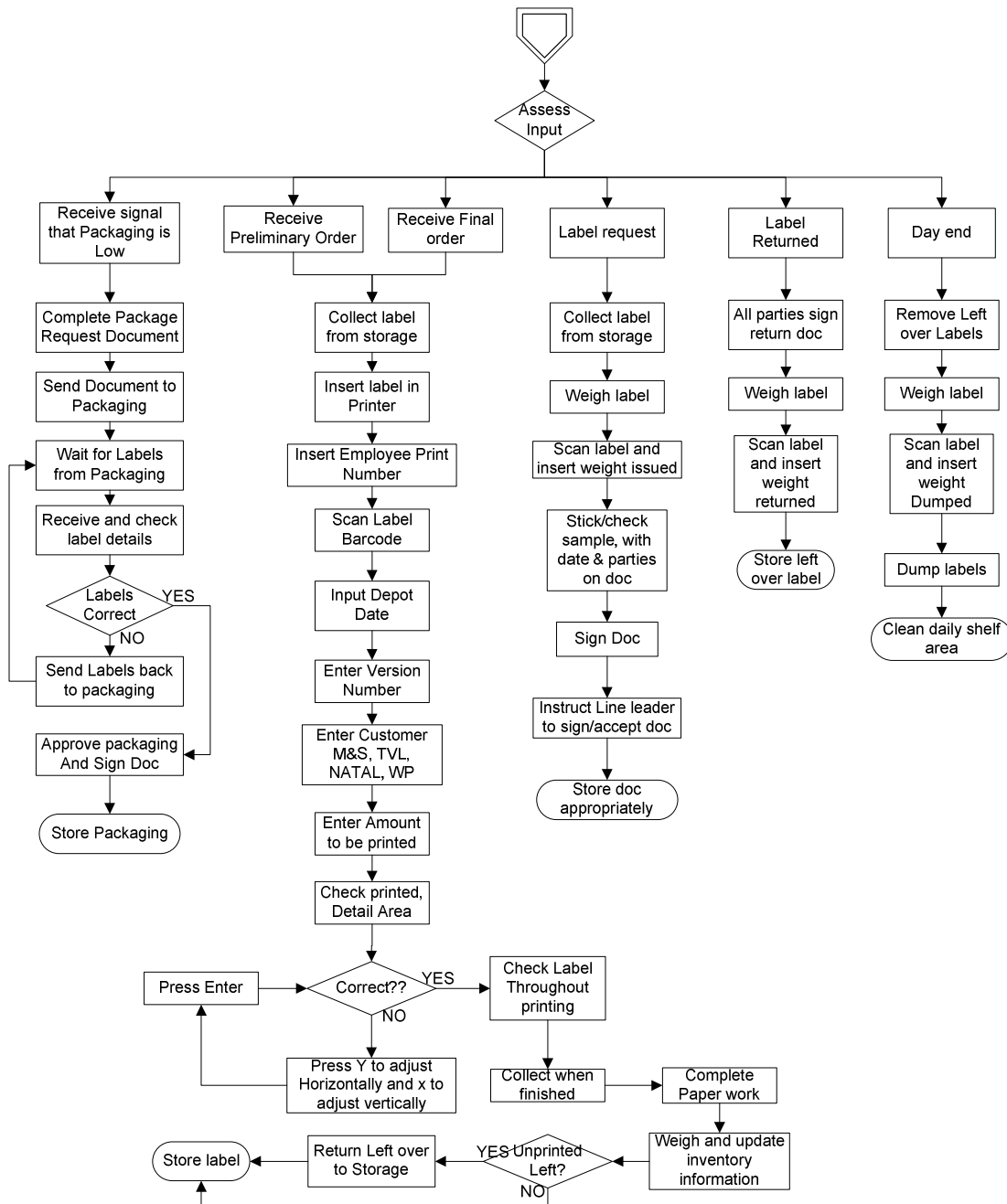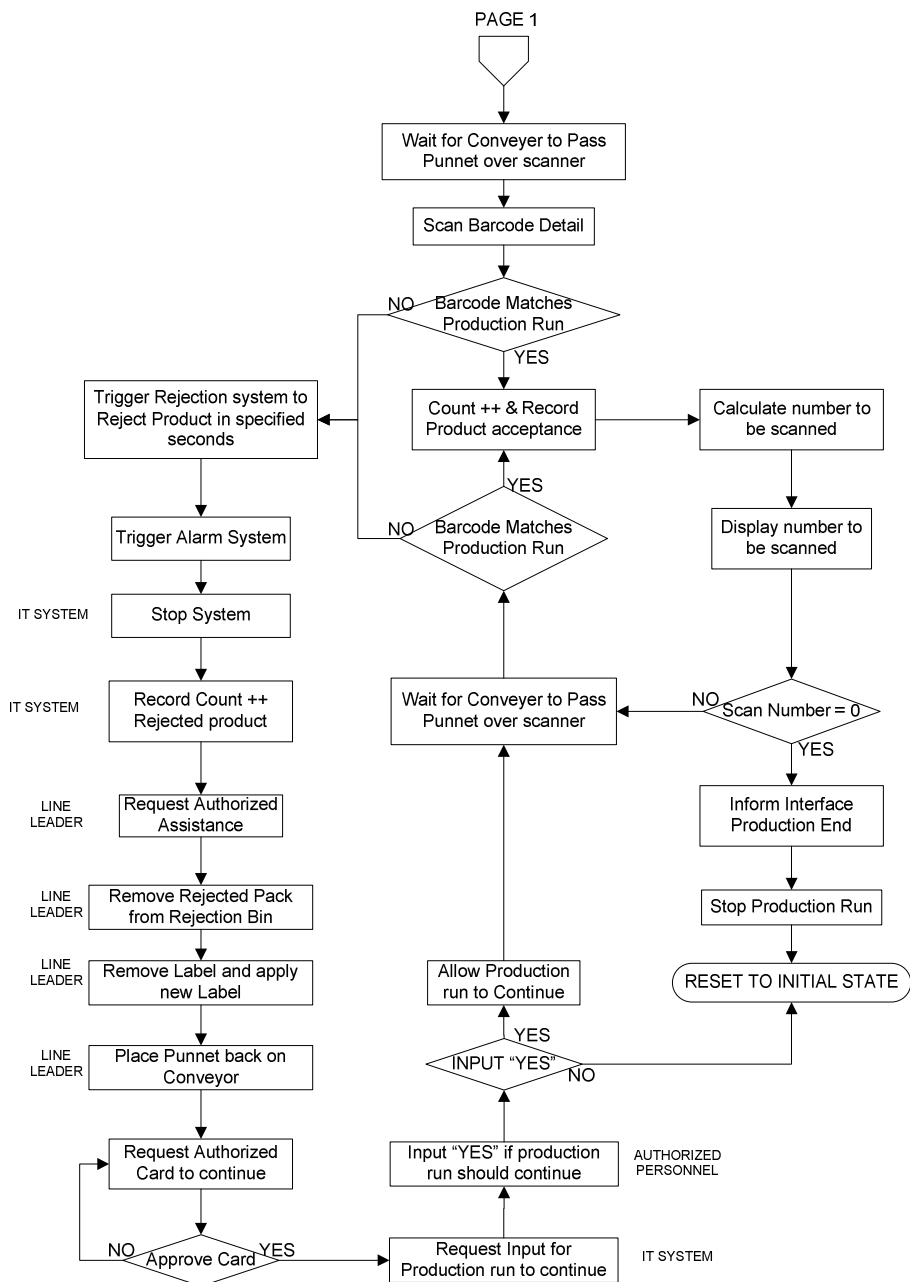Wait for Conveyer to Pass Punnet over scanner

Scan Barcode Detail

Barcode Matches Production Run — NO / YES

Count ++ & Record Product acceptance

Calculate number to be scanned

Trigger Rejection system to Reject Product in specified seconds

Barcode Matches Production Run — YES / NO

Display number to be scanned

Trigger Alarm System

IT SYSTEM — Stop System

IT SYSTEM — Record Count ++ Rejected product

Wait for Conveyer to Pass Punnet over scanner

Scan Number = 0 — NO / YES

LINE LEADER — Request Authorized Assistance

Inform Interface Production End

LINE LEADER — Remove Rejected Pack from Rejection Bin

Stop Production Run

LINE LEADER — Remove Label and apply new Label

Allow Production run to Continue

RESET TO INITIAL STATE

LINE LEADER — Place Punnet back on Conveyor

INPUT "YES" — YES / NO

Request Authorized Card to continue

Input "YES" if production run should continue — AUTHORIZED PERSONNEL

Approve Card — NO / YES

Request Input for Production run to continue — IT SYSTEM

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9.7. Appendix G: Print Room Job Descriptions

	BAKKAVOR **SPRING VALLEY FOODS** It is important that we provide our people with the opportunity to fulfill their potential – it's a fundamental part of our Can-do approach			

Job Title:	Print Room Line Leaders	**Date:**		29/08/2011

Job Description:

A trained employee who has experience in the Print Room area to the extent of knowing exactly how the processes work and what procedures are necessary. The Print Room Line Leader needs to be competent and trusting.

Responsibilities:

Labour
- Ensure all staff members in the Print Room are trained on their roles and responsibilities
- If any disciplinary issues should occur it is the Line Leaders responsibility as well as duty to report the issue to Print Room Management

Material
- Need to Manage the Total Stock Control of the Print Room

Technical/Other Support
- Ensure that all Customer Technical procedures are followed at all times.
- Ensure that a Clean as you go Policy is followed
- Responsible for the up keep of all Print Room Equipment. If any problems occur it is the Line Leaders responsibility to report the problem to Engineering or other authorized personnel

Health and Safety
- Ensure that all staff members are wearing the required safety PPE

Other
- If any team members or support staff prevents you from meeting the above targets or standards then you must discuss the issues immediately with your senior. This should include all operational issues and may include poor timekeeping, attendance or break disciplines
- If any equipment, machinery or services prevent you from meeting any of the above targets or standards then you must discuss with your senior immediately
- You must ensure that you report/replace any missing procedure/technical paperwork/standards/procedures that prevent you from achieving the above standards

Employee Name:		**Clock Number:**	
Job Location:	South Africa, Bapsfontein	**Joining Date:**	
Employment Status:	Full-time	**Employment Type:**	
Company Industry:	Production	**Manages Others:**	
Number of Vacancies:	1	**Contact Number:**	

Job Description Agreement

_____   _____
PRODUCTION MANAGER SIGNATURE   **POSITION HOLDER SIGNATURE**

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4. Ingenior, Automation and Machine Specialist - Theunis Taljaard

5. Information Technology, Equipment and Programming - Julian Power +2782 415 4141

6. Marks and Spencer Code of Conduct (Confidential Document)

7. *Stutzke R.D. (2005) Measuring and Estimating Process Performance*, Presented at the 5th Annual CMMI Technology Conference & Users Group Meeting. Denver, Colorado

8. Due to confidentiality of internal company documents and procedures certain documents were not included in this document. For verification of these documents please contact the Operations Manager at Bakkavor Spring Valley Foods.