Chapter 3

Methodology and Analysis of Results

3.0 Introduction

This chapter will describe the actual steps taken to collect the required data based mainly on the methodology described in Chapter 2. Some slight modifications to the method are being made to suit the scope and nature of the project.

A benchmark was made to see how a different factory of similar nature, perform the same core processes. In this case, the Hong Kong Motorola Semiconductor factory was benchmarked as it is producing similar products as what Motorola Malaysia Sendirian Berhad is producing.

3.1 Selecting the QA OFI gate to be studied

The QA OFI gate process step was chosen as the candidate for investigation because of its economic and human considerations. As described in Chapter 1, the problem is the creation of bottlenecks in the QA OFI gate. This process is also very tedious and repetitive in nature i.e. every lot will have to go through this process and every packing container label has to be checked. Some lots have a few hundred labels to be checked and it could take up to 2 hours to complete an average lot with a size of 120 containers. To cope with this problem, additional manning was created in this

process i.e. 5 QA specialist per shift were needed to run this process compared to only 4 in the beginning. The management observed the situation and they have given the approval to add in another head count if the process is continued in the current manner.

Another consideration in choosing this particular process step is the building of employee dissatisfaction. Due to the nature of the task, the QA specialists will have to stand most of the time and the work pressure increases when the next process step awaits them to complete their task. This is also coupled by the large amount of labels to be audited per lot. The strict auditing was an initiative driven down by top management to have zero administrative errors on the products shipped to the customer a few years ago. As the process of packing and labelling is still very much a manual task, the only way to ensure perfect work is to perform 100% audit check on every packing container by an independent party i.e. QA specialist. This move has indeed been successful in reducing the administrative complaints significantly but at an added cost.

The objective of this study is to improve the efficiency of the QA OFI gate process step without jeopardising its effectiveness. As mentioned earlier, the scope will be limited to the use of Method Study on one particular process step in order to obtain reasonable data in the limited 3 months time available.

3.2 Recording the Present QA OFI Gate Process

This is the step where most of the work is done in collecting data to understand the current situation and also evaluating the new proposed method. The present way of performing the task is studied closely. The first

step done was drafting the physical layout of the packing area where the process is being done as shown in Figure 3.1.

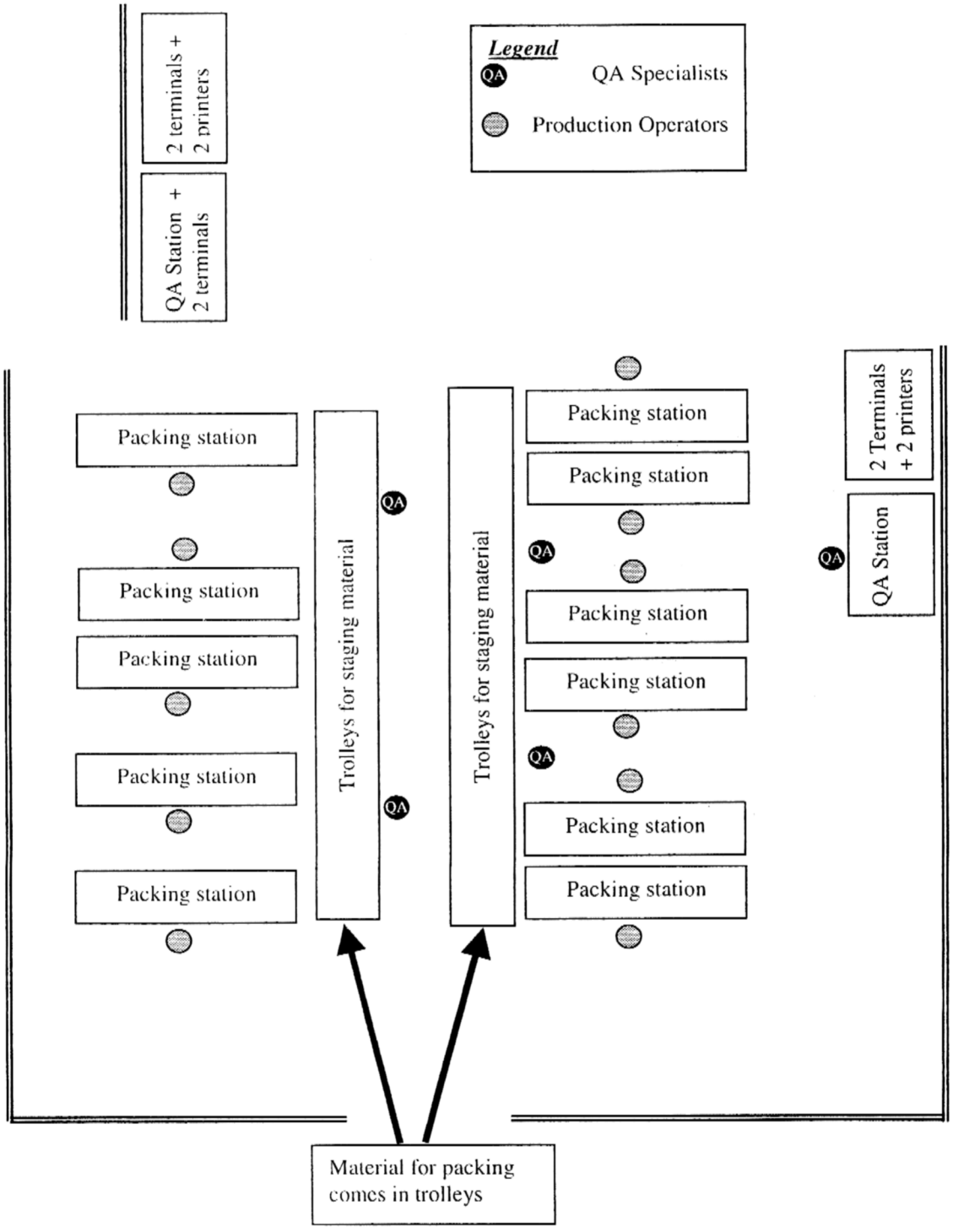

Figure 3.1: Physical Layout of the Packing Area in EOL Operations

An outline process flow chart of the current packing and labelling process is then drafted as shown in Figure 3.2 as follows. This gives a bird's eye view of the whole process. There are basically 5 "operation" type of activities and 3 "inspection" activities. The inspection activities, which are performed by the QA specialists, are the ones that will be focused on in this project to explore the opportunities for improvements.

Next, the detail process flow chart is created to document the current way of performing the inspection works as show in Figure 3.3. In this case, a material type flow process chart is used. Several observations were made and an average was taken since the number of bags/boxes varies from lot to lot ranging from a single box to several hundred boxes. Different shifts and operators also perform the tasks at a different rate depending on their skills, complexity of the individual product packing requirements and also the time of the shift. There are usually more materials during the second half of the shift. In order to compare "apple-to-apple" with the proposed method, an overall average for a "standard" lot size was made i.e. 120 bags and boxes per lot. The individual observations are documented in Appendix A. Data put in this form can be conveniently analysed to identify opportunities for improvement.

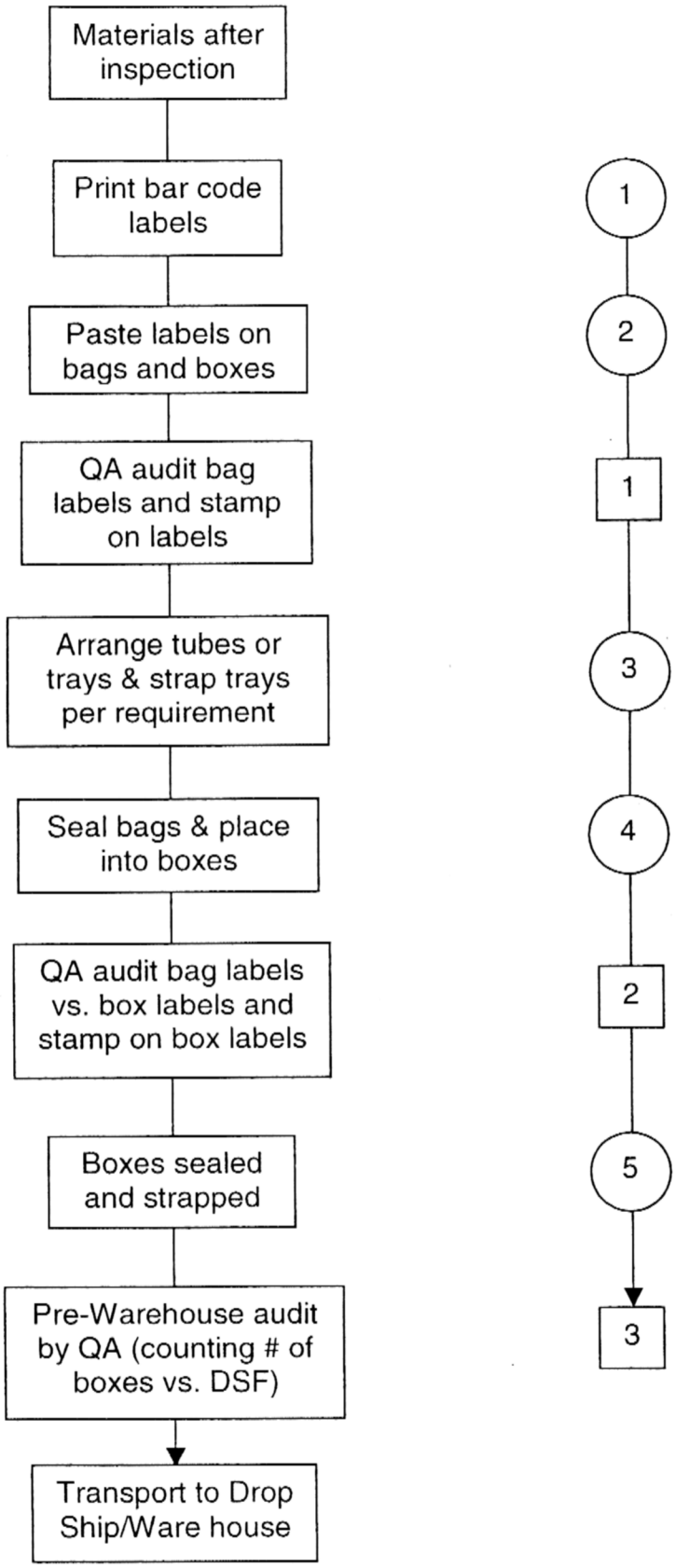

Figure 3.2: Outline process chart: Present Pack and Labelling process

Flow process chart - Average										
Chart No. 1 Sheet No. 1 of 1				Summary						
Subject charted:	Activity			Present		Proposed			Saving	
Pack and Label	Operation			11						
	Transport			1						
Activity:	Delay			5						
Labeling, sealing, inspection, straping & packing	Inspection			8						
	Storage			1						
Method: **Present**	Distance (m)									
Location: ***Packing Area***	Time (work-h)			232						
Operative(s):	Cost									
B and C shift			Labour	5						
Prepared by: YH Chia Date:20Dec2000			Material	-						
	Total									

Description	Quantity	Overall Ave-rage (min/ unit)	Time (min)	Process Symbol					Remarks
				○	⇨	D	□	▽	
Print and paste labels on bags & boxes				X					
Bags sent to QA and wait for audit	1	12.5	12.5			X			
QA check s/order and count the no. of bags	120	0.119	14.3				X		
QA program the Telxon portable scanner	1	3	3.0	X					
QA scan bar code labels 100%	120	0.371	44.5				X		
QA stamp on all bags' labels	120	0.269	32.3	X					
Wait for bag sealing						X			
Arrange/strap tube/trays per requirement				X					
Vacuum seal bags and place in boxes				X					
Wait for QA Drypack audit	1	20	20.0			X			
QA check dry pack quality	120	0.108	13.0				X		
Program Telxon portable scanner	1	3	3.0	X					
Scan box labels 100%	120	0.098	11.8				X		
QA check bag labels vs. box labels	120	0.083	10.0				X		
QA stamp on all the boxes' labels	120	0.038	4.6	X					
QA go to terminal and End lot at Genesis	1	6	6.0	X					
Seal boxes and strap				X					
Go to terminal and print DSF				X					
Stage for QA final audit	1	24	24.0			X			
QA pick up the DSF and verify lot numbers	1	10	10.0				X		
Count number of boxes on the trolley	120	0.113	13.5				X		
Check for QA Stamp on the box label	120	0.068	8.2				X		
QA stamp on the DSF	1	1	1.0	X					
Wait for transport to warehouse						X			
Push lot to drop ship					X				
Staged for orders at drop ship								X	
Total			232	11	1	5	8	1	

Figure 3.3: Pack and Label Process Flow Chart - Present Method

3.3 Critical Analysis of the Data

Each activity in the chart in Figure 3.3 is then examined critically with the questioning techniques described in Chapter 2. Table 3.1 shows the results of the questioning techniques on one of the activities listed in Figure 3.3 i.e. "QA check Shop Order". The rest of the activities are analysed as shown in Appendix B.

These questions will force us to view the activities critically and consider the alternatives to eliminate, combine, rearrange or simplify it. Some activities are however still necessary to be done the present way. For example in Table 3.1, we can see that there are very little chance for the task to be totally skipped by the QA personnel as they act as an independent third party to ensure things are done correctly. This is necessary, as the production operators are still vulnerable in making mistakes due to the nature of the manual work.

Table 3.1: Questioning Techniques applied

Activity		Primary & Secondary Questions	Answers
1. QA Check Shop Order	Purpose	What is done?	Flip the shop order looking for lot number and quantity and past processes.
		Why is it done?	To ensure correct lot number and quantity and also past processes are completed properly
		What else might be done?	This is a necessary step.
		What should be done?	Reduce scope to just check for processes after VM Gate
	Place	Where is it done?	At the QA OFI gate station
		Why is it done there?	QAs need to sit down and scan the bags
		Where else might it be done?	At the trolley where the materials are staged
		Where should it be done?	At the place most convenient to the QAs and at the place where the materials has minimum movement
	Sequence	When is it done?	After labels have been pasted on bags but before materials are placed in the bags
		Why is it done then?	More convenient to check empty bags
		When might it be done?	When the pack and label is completed
		When should it be done?	After all the pack and label processes are completed
	Person	Who does it?	QA specialists
		Why does that person do it?	As an independent party to ensure proper processes is done
		Who else might do it?	Production operators
		Who should do it?	Both QA and production
	Means	How is it done?	Visually read and flipping the shop order
		Why is it done that way?	That's the only way to do it
		How else might it be done?	No other ways
		How should it be done?	N/A

3.4 Developing the Improved Method

Just by asking these primary and secondary questions, some obvious opportunities and solutions can be identified. This will also help identify activities which are carried out for reasons which are important at the time it was first created but does not matter now. These are the activities that can be totally eliminated.

One of them is the stamping of bar code labels by the QA. Please see the results of the questioning technique for this activity in Appendix B3. This activity was initiated to have accountability and to indicate that the QA specialist has performed the bar code label inspection. This practice has also created unnecessary problems like illegible stamp and missing stamps which are detected by the next operation. With the use of the TELXON verifier to inspect the labels and the availability of the CIM systems to ensure the QA OFI process is not by-passed, there is no need to perform this tedious activity anymore.

3.4.1 Benchmarking

A brief one-day benchmark was made to compare and identify best practices from the Hong Kong Silicon Harbour Centre (SHC) factory. A comparison of the overall flow is shown in Figure 3.4. A number of good observations were noted as below in Table 3.2. Elimination of QA stamp on the label was the first thing to be noted as opportunity for improvement.

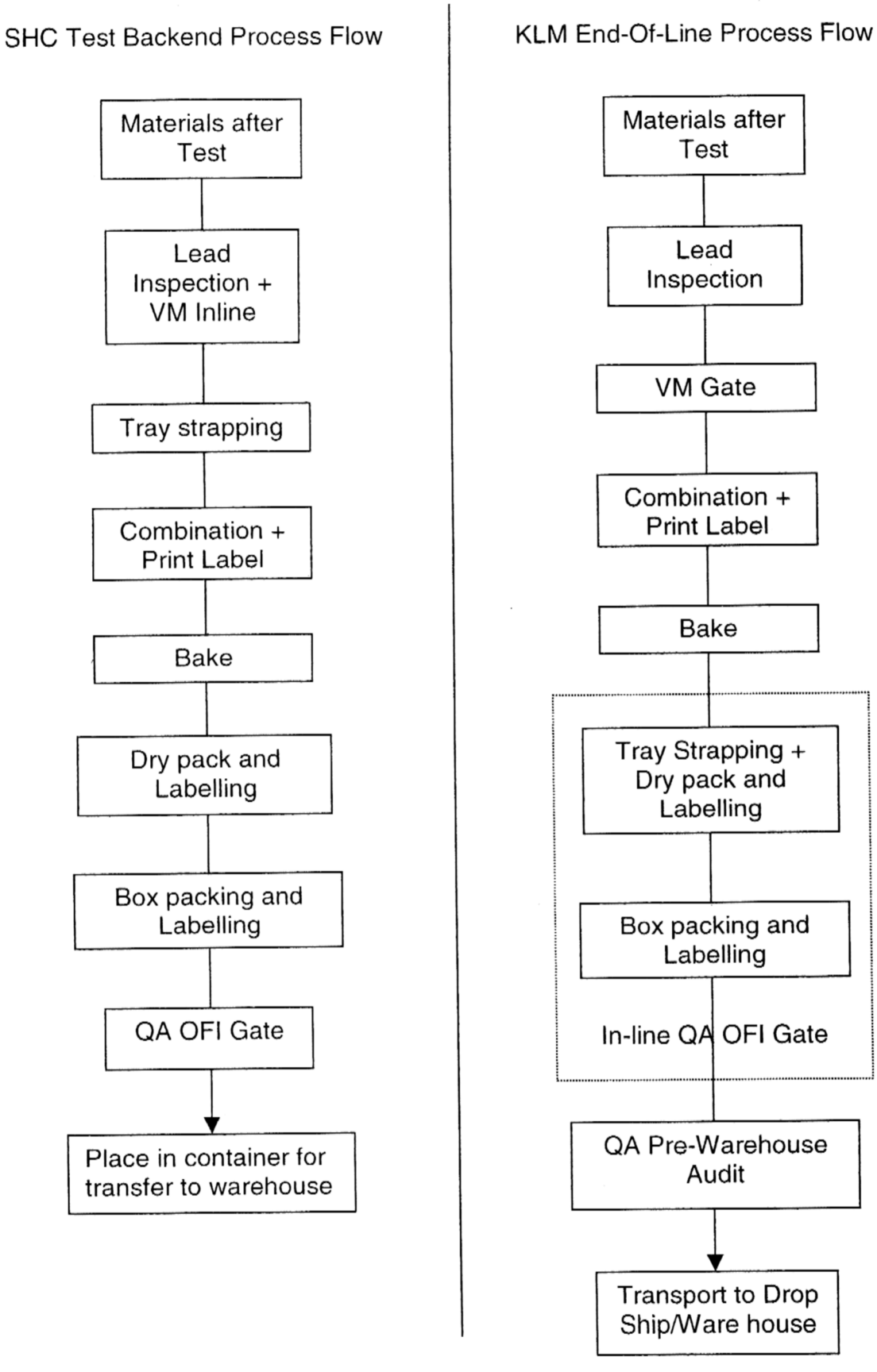

Figure 3.4: Process Flow Comparison between SHC and KLM

Table 3.2: Comparison between SHC and KLM

	SHC TEST BACKEND	KLM END-OF-LINE
a)	In-line V/Mechanical Gate Performed by production operators (RVSI operator)	Off-line VM Gate by dedicated QAs
b)	No rework (no lead conditioner).	Use lead conditioner quite extensively
c)	Trays are strapped almost immediately after RVSI using a mini strapper and bake-able strap	Trays strapped using velcro strap manually
d)	Main roles of the QAs are Process Audit and OFI gate (5 QAs/shift X 3 permanent shift).	QAs performed V/M gate, OFI Gate and IPQA (10 QAs/shift)
e)	RAP is pulled at Test area.	RAP pulled at EOL V/M gate
f)	Test summary and Shop Order Audit for the Test portion is performed by Test operators.	Test Summary and Shop Order Audit still performed by EOL QAs
g)	Labels are visually inspected at QA OFI	Labels are scanned 100% using the TELXON verifier by QAs at OFI gate

3.4.2 Proposed Method

After analysing the above data from both the Work Study and the benchmark, three proposed improvements were identified and the first two were evaluated i.e.:

1. Eliminate or reduce the QA Stamp on the bar code labels as it is a non-value added activity that does not matter much now.
2. Combine the process of scanning the bag labels with the box labels
3. Delegate the bar code scanning process to production operators and relieving the more skilled QA specialist for more value added tasks.

The proposed flow is shown in Figure 3.5 with the elimination of a few process steps.

Flow process chart - Average										
Chart No. 5 Sheet No. 1 of 1				Summary						
Subject charted:	Activity			Present			Proposed			Saving
Pack and Label	Operation			11			10			1
	Transport			1			1			0
Activity:	Delay			5			4			1
Labeling, sealing, inspection, straping & packing	Inspection			8			7			1
	Storage			1			1			0
Method: **Proposed**	Distance (m)									
Location: ***Packing Area***	Time (work-h)			232			178.3			53.7
Operative(s):	Cost									
B and C shift			Labour	5			5			0
Prepared by: YH Chia Date:04Jan2001			Material	-			-			-
	Total									

Description	Quantity	Ave-rage (min/ unit)	Time (min)	Process Symbol					Remarks
Print and paste labels on bags & boxes				X					
Wait for bag sealing						X			
Arrange/strap tube/trays per requirement				X					
Vacuum seal bags and place in boxes				X					
Wait for QA Drypack audit	1	18.75	18.8			X			
QA check S/Order and dry pack quality	120	0.134	16				X		
Program Telxon portable scanner for bag labels	1	5	5	X					
Scan bag labels 100%	120	0.168	20.2				X		
Re-Program Telxon portable scanner for box	1	3	3	X					
Scan box labels 100%	120	0.178	21.3				X		
QA check bag labels vs. box labels	120	0.116	13.9				X		
QA stamp on all the boxes' labels	120	0.071	8.48	X					
QA go to terminal and End lot at Genesis	1	5.75	5.75	X					
Seal boxes and strap				X					
Go to terminal and print DSF				X					
Stage for QA final audit	1	23.75	23.8			X			
QA pick up the DSF and verify lot numbers	1	7.27	7.27				X		
Count number of boxes on the trolley	120	0.151	18.1				X		
Check for QA Stamp on the box label	120	0.114	13.7				X		
QA stamp on the DSF	1	3	3	X					
Wait for transport to warehouse						X			
Push lot to drop ship					X				
Staged for orders at drop ship								X	
Total			178	10	1	4	7	1	

Figure 3.5: Pack and Label Process Flow Chart - Proposed Method

3.5 Evaluating the New Alternative Methods

A trial run was made with the new proposed flow and the time study results were compared with the present method. Collection of data was made

similar to recording the present method. Individual observations were made and recorded in Appendix C. An average was then made to allow an "apple-to-apple" comparison between the present and proposed method. Besides the timesaving, there are other factors that also need to be considered e.g. the practicality of performing the task and the operators' acceptance. Inputs were also gathered from the operators and some refinement of the method was made e.g. placing bags on the table for bag label verification for those lots with many bags. This is due to the difficulty of scanning bag labels once it is placed inside the box.

Figure 3.5 shows the average time performance with the proposed method. The results did show an overall cycle time improvement of 53 minutes or 23% in average cycle time improvement. Thus the proposed method will be chosen and defined properly in the next step. The first two alternatives were considered minor changes and were easily evaluated. The third alternative however requires a further evaluation separately.

3.6 Defining and documenting the Improved Method

With the encouraging results, a detail step by step procedure is defined and documented as part of the QA Procedures. Below is an extract of the procedure related to this portion of the new QA work method with some refinements after considering inputs from the QA specialists:

QA OFI Gate Procedure

1. Check Shop Order to ensure the correct lot number and quantity.
2. Program the TELXON portable scanner
3. Scan bar code labels on the bags
4. Check dry pack quality

5. Re-program TELXON portable scanner for box labels
6. Scan box labels
7. Check bag labels vs. box labels
8. Place QA stamp on all the boxes' labels
9. Start/End lot at Genesis

QA Pre-warehouse Audit Procedure

1. Check DSF for lot information
2. Match lot number on trolley with DSF
3. Check correct number of boxes on the trolley
4. Check for QA Stamp on the box label
5. Place QA stamp on the DSF

3.7 Implementing the Improved Method

The implementation of the new method is done in 2 stages i.e. eliminating the QA Stamp on the Bags was implemented first as it is the easiest to implement. As this will affect the next operations i.e. drop ship/ warehouse, a Temporary Instruction Notice was issued to communicate this change to both the internal operation and the next operation. The next change of combining the bag label audit with the box label audit was done in a more detailed manner.

It is important to gain the acceptance of the QA specialist during the implementation. That is why the QA specialists are involved during the trial run and given the opportunity to give their feedback. For example, they felt that handling the empty bags in the original method was much easier than scanning the labels when the bags were sealed and placed inside the boxes.

Their suggestions were considered and implemented. E.g. for large number of bags, the sealed bags can be scanned earlier before being placed inside the box. The results of the trial run were shared with the QA specialist to show the buy-back of the new method and hopefully gain their acceptance.

Training is then conducted to ensure everyone understands the new method. After which a date is chosen to officially implement the new method.

3.8 Maintaining the New Method

To ensure the new method is maintained, a close follow-up was made during the implementation period with all the shifts. After which a constant review and audit is conducted to ensure things are being done per what was defined earlier. As part of the Quality System, a half-yearly Specification Conformance Audit is also performed to gage if the procedure is adhered to.