7.1 INTRODUCTION

This chapter discusses the results of the customer complaints, customer survey and the comparisons made to cull in chapters 4, 5 and 6 respectively in relation to the objectives and hypothesis indicated in chapter 1.

The nature of customer complaints was investigated to identify problem areas at the mills, as the first objective. The categories of customer complaints for each of the mills were compared using chi-squared test to show differences. The largest contributors to customer complaints were further probed to identify the problem areas in manufacturing that contribute to customer dissatisfaction.

The second objective involved indentifying the customer needs from which a QFD matrix was constructed using the customer needs and the technical characteristics of fluting-paper. Ratings to construct the QFD matrix were obtained during customer survey interviews. The technical characteristics were compared to the technical specifications and gaps between the two were identified.

Cull is compared to the technical specifications to determine if the company’s technical specifications are in sync with the manufacturing process to satisfy the third objective.

The fourth objective was to determine the reasons for the customers’ differing perceptions and claims of inconsistent quality. These answers emanated from the
results of research performed from the first three objectives, and comparison of these results to each other.

The customer complaints, and customer needs were also compared to cull and to the technical specifications to determine if the company produces fluting paper according to technical specifications that meets the customer needs. These systematic relations allowed the investigation of the hypothesis, the company’s mills produces fluting-paper consistently according to technical specifications that meet the customer needs.

7.2 OBJECTIVE 1

*Investigate the nature of customer complaints of fluting-paper to identify problem areas*

The three categories for customer complaints investigated were technical, logistics and financial. Results of the analysis using the chi-square test (refer to Table 4.4) show that individual comparisons of the observed and expected values of customer complaints are small signifying negligible differences. The overall chi-square values were larger than the critical value and this articulates that there was a difference between the different categories of customer complaints at the mills.

Table 4.4 also shows that the customer complaints for all of the categories were highest at mill X. The high number (almost double that for mill Y and Z) of customer complaints at mill X suggests problems with quality and handling of customer complaints at the mill. The complaint management system as suggested by Behrens et al (2007) takes into consideration eight disciplines starting from building a team to handle complaints to planning and taking corrective action to prevent reoccurrence of the fault. They indicate that an important part of this system is the standardization of process improvement to all products that may be subjected to the same issue. The large reoccurrence of similar problems at mill X suggests that corrective action implementation may be lacking there.
The technical category of customer complaints showed the most number of complaints with “out of specification” paper and moisture being the largest contributors to customer complaints. The customer complaints shown as “out of specification” could suggest poor systems and quality control. This category should ideally be further investigated to identify the reasons that paper that should not have passed the quality assurance checks were sent to the customer.

Problems experienced by customers (cracking and glueability) are also large contributors to customer complaints, together with problems at the finishing stage such as technical core related problems, winding and loose edges. Cracking and glueability are customer needs with strong correlations to the technical characteristics and specifications of grammage, moisture and porosity. It is however noted that some mills (X and Y) do not cull paper for porosity and mill X does not cull paper for moisture. Should these properties have been controlled and culled, customer complaints relating to these technical characteristics will not be high as seen in these results. The complaint management system and methodology suggested above by Behrens et al (2007) which addresses process control and process improvement activities may assist in reducing the technical customer complaints noted here for these problems.

7.3 **OBJECTIVE 2**

*Identify and relate the customer needs of fluting-paper to the technical specifications defined by the company, of fluting-paper*

**7.3.1 Identification of Customer Needs**

The customer needs were identified using the survey method. Consistent moisture, consistent weight and low grit content were identified as new needs during the customer surveys. Customers have a problem with the weight of the fluting-paper fluctuating. Customers also requested that the moisture content of the fluting-paper is consistent, as this is also seen to fluctuate from the specifications. The fluctuating moisture content has two implications. The first is
that higher moisture content means a lower mass of paper, this therefore relates back to the weight of the paper. The second is that the paper moisture content affects the runnability of the corrugator. The corrugator machine settings which are complex to change, are different for different moistures, thus it is easier for the customer if the moisture is consistent.

Problems relating to varying moisture and weight could be due to the tolerances on the grammage specifications (five percent) being too high. Another issue could be that the moisture content is not varying between batches of fluting-paper but perhaps is inconsistent in the sheet. This is a problem that needs to be addressed in a process improvement forum.

Two customers requested that the fluting-paper have low grit content. Grit is often found in fluting-paper and causes excessive wear and tear on the customer’s corrugator machinery. It is therefore undesirable. The general perception is that fluting-paper is sandwiched betweenliners and therefore aesthetics, dirt and grit are not important. The effect of this on customer machinery and equipment has been neglected.

The customers’ most important needs (refer to Table 5.2) were strength, consistent moisture and consistent weight. The importance that customers place on moisture and weight indicates that the problems with varying moisture and weight deserve attention. Strength is critical in the runnability of the corrugator and performance of the fluting in the construction of the corrugated boxes and therefore the importance placed on strength is understood and justified.

The ratings of the customers for the customer needs show large variability. Various reasons could contribute to this variability in data noted. Possible explanations are given below:

1. The capability and operability of the corrugating machinery of customers differ and therefore result in one customer being able to control properties such as the flute tip formation to a better degree. These capabilities result in
customers having differing needs.

2. The customer’s need of moisture resistance is related to the end-use of the box and although all boxes studied here are intended for the agricultural market, the type of fruit packaged differs. For example, bananas are packaged wet; however avocados are typically dry when packed into boxes.

3. The two needs added in the pilot study viz. flute tip formation and moisture resistance show the most variation in ratings responses. It is possible that these are not well comprehended by customers as they are unfamiliar customer needs.

4. Four of Garvin’s (1987, p43) dimensions of quality were not considered in this investigation. The dimensions investigated were performance, convertibility and durability. The dimensions not considered were aesthetics, extra features, serviceability and other perceptions. Symons (1991, p87) indicates that not all of Garvin’s dimensions will be equally applicable and that those that best describe the desired customer needs should be worked on. It is however believed that these dimensions of quality could contribute to some customers being unhappy while others are not. The dimensions not studied are discussed next in context with observations noted in this study.

a. Aesthetics, which were excluded in the pilot study, may also be important to the customer. Fluting-paper is sandwiched between liners but the appearance may still be important to the corrugators although not the end user. Grit content is indicative of the performance of the product at the converter and is important to the customer. Grit content also contributes to the aesthetics of the product, and has a propensity towards the statement that aesthetics is in fact important.

b. Moisture resistance which was indicated as important to certain customers can also be considered as an extra feature in addition to the dimension of durability in which it was considered here.

c. Serviceability is akin to maintaining good customer relationships, and
providing the customer with good technical and procurement services. The company is seen to be a leader in technical expertise, and has good testing facilities. The technical capabilities of the company are therefore not questionable; however other factors that may affect serviceability, such as billing and logistics, may be important to the customers and affect the relationships.

d. “Other perception” is the last of Garvin’s (1987, p43) dimension of quality spanning a large range of topics. This could range from the customers perception of the company’s brand name, advertising and other soft issues. These also need to be investigated to determine if these criteria are important to customers.

7.3.2 Relationship between Customer Needs and Technical Specifications

The customer needs were related to the technical characteristics in Table 5.6, using QFD. The entire range of customer needs investigated, except grit content, have more than three technical characteristics that describe them. This indicates that there are sufficient technical characteristics to measure and control the characteristics of the product. These technical characteristics are therefore capable of describing the customer needs of the product. There is only one new customer need; viz. grit content that does not have any technical characteristics to describe it.

There are nine technical specifications for fluting. Technical characteristics found in literature used for this study, but which were not part of the technical specifications of fluting-paper, were stiffness and tear. These do not show any strong correlations to any of the customer needs. It is therefore justified in not being included as part of the technical specifications. All other technical characteristics, except grit content have technical specifications. It is seen that all of the customer needs except grit content have technical specifications to define them.
7.4 Objective 3

Relate the technical specifications to measures of the process of producing fluting-paper

The empirical data of cull is first discussed before the comparison of cull to the technical specifications in the subsequent paragraphs. From the empirical cull data recorded by the mills, it was noted that mill Z does not show problems in any particular area for cull, except during start-up, while mill X clearly experiences problems with thickness, water flotation, winding, start up and aesthetics. Mill Y experiences problems with winding, start up and aesthetics. This noticeably indicates that mill Z which is a bigger newer mill is much more capable of producing paper in specification. So, although the volumes of cull for mill Z looks high, the relation to gross production points out that these are small in comparison to the total amount of paper produced, and the mill shows no particular problems areas with cull. Mill X on the other hand is a small mill that has problems in controlling the quality of the paper or producing paper according to technical specifications.

The reasons for cull were compared to the technical specifications of fluting-paper in Table 6.4. It was noted from this table that mills cull paper for all of the technical specifications except tensile strength, tear and porosity. This could mean that mills are controlling these properties well, as there were no customer complaints relating to these technical specifications. The “out of specification paper” customer complaints could however be covering these technical specifications. “Other” as a reason for cull is also a wide term that could be covering some other technical specifications of paper. This term could hide many of the problems and phenomenon that could be explained if more detailed descriptions of the reasons for cull were recorded.

Start-up refers to the starting up of the papermachine and therefore does not have a technical specification; there are large volumes of paper that is culled during this time with mill Y showing the largest percentage in relation to gross production
and mill Z showing the smallest. Start-up is dependant on the design of the machine and the operator capabilities and training. With the new technology used by mill Z come lower losses of paper to cull. Well trained operators also contribute to lower start up times and losses. Paris (2002) indicates that training and incentivising employees, benefits the company. He explains that profitability, increases as worker productivity increases and a lower number of careless mistakes, rejects, rework and scrap is suffered.

Culling paper for winding is due to poor operating practices, and could ultimately be related to poor equipment and incapable operators who have not been properly trained on the winding equipment. The cull for winding also shows high for mill Y. Technical core related problems of customer complaints are also due to poor winding operations and are seen to be highest at mill X. While mill X and Y have received customer complaints for winding, mill Z did not. Winding operations at mill Z are therefore good, while mill X and Y need attention. Operator training and process improvement could therefore benefit mills X and Y.

7.5 **Objective 4**

*Determine the reasons (if any) for the customers' differing perceptions and claims of inconsistent quality*

There are various reasons for the customers differing perceptions and claims of inconsistency that emanated from the analysis conducted on the customer, and the process. These reasons are explained below.

Customers receive fluting-paper from many mills depending on the production scheduling and order flows. The orders for all mills are controlled independent of the mills from a centralized order system. The delighted customers and unhappy customers all receive fluting-paper from the same mills. However one mill producing poor quality paper that perhaps does not meet the porosity or moisture specifications, could be responsible for creating unhappy customers. The
customer’s perception could therefore be largely due to the variation in supply seen from products emanating from the different mills. Although the customers are receiving product that should meet the same specification from all mills, there could also be product “slipping through the cracks” at certain mills.

Some mills also control quality on technical characteristics that are not controlled at other mills. For example mill Z culls paper for cracking (refer to Table 6.1) while other mills do not. Mills Y and Z cull large volumes of paper due to aesthetics, although this is not a technical specification. Mill X does not cull paper for aesthetics. Aesthetics (colour variations, streak marks and dirt which could be grit content) emerged as one of the dimensions of quality which were important to fluting-paper in the customer survey. It may therefore be that aesthetics did not feature as a customer complaint possibly because customers felt they did not have grounds to complain it about since aesthetics is not a technical specification. Aesthetics which is treated differently by mills in terms of cull could be contributing to varying customer perceptions of the quality of fluting-paper and customer dissatisfaction. On the other hand the mill could also be culling paper unnecessarily and contributing to increased costs. The customers need relating to this reason for cull needs to be explored further.

Moisture, which was indicated as one of the customers’ most important needs, is not a reason for culling paper at mill X. This could mean that the mill is capable of controlling the moisture well or that the specifications for moisture were not being adhered to. Mill X experiences a high number (ten and two times that of mill Y and Z respectively) of complaints (refer to Table 4.2) relating to moisture. Since moisture was indicated as one of the most important customers needs (refer to Table 5.2), not culling paper for moisture could contribute to this high number of customer complaint seen for moisture and for some of the customer dissatisfaction.

Cull was also compared to the customer complaints. From these comparisons it was seen that there are five (glueability, creasing, loose edges, technical core
related problems and paper breaks) customer complaints that have not resulted in paper being culled. Loose edges, creasing and technical core related problems are also due to poor equipment and operator practices on the winding operations. Glueability is a function of other technical properties of the paper such as grammage, moisture and porosity as shown in Table 5.6. While grammage and moisture are reasons for cull at most mills, porosity is not. These gaps here between the customer complaints and reasons for culling paper at the mills, could also contribute to the problems experienced by the customers. In other word some of the customer needs are not well encompassed or catered for in the process of producing fluting-paper.

There could also be other customer needs based on factors such as Garvin’s (1987, p43) dimensions of aesthetics, durability, other perceptions and serviceability, not investigated in this study. With respect to the quality dimension of serviceability, there are different marketing personnel or customer managers that are responsible for different customers. These five customers therefore have all different customer managers that provide service to them. These personnel are therefore the “face” of the company and are responsible for the relationships with the customers.

This objective, investigating the reasons for the customers’ differing perceptions of the company was stemmed from the three prior investigations into customer complaints, the customer research and the comparisons made with cull. All four objectives are further assessed collectively to draw conclusions on the hypothesis. The conclusions drawn on these objectives and on the hypothesis is made in the next chapter.
7.6 LIMITATIONS

Customer complaints analysed would show better meaning if the monetary value associated with these complaints were available for interpretation.

When conducting the customer research to determine the customer requirements, the most critical customers that account for largest volumes were surveyed. It would be worthwhile to also interview persons that were not current customers. This would provide information to understand ways to attract potential customers, a further twenty percent of volumes in the market.

The majority of the fluting-paper purchased by the customers studied here is used to manufacture containerboard used to make boxes for the agricultural sector. This is a major limitation, as the end-use of the boxes will have an impact on the customer needs. For example, customers using the containerboard to protect and transport electronic equipment housed in dry areas will have different needs to the farmers using the boxes to contain fruit.

Although cull provides meaningful data for comparison to the customer needs and determining gaps between the manufacturing system and the customer needs, other data sets could have also been useful. Other meaningful data could include tracking of data from quality assurance testing and relating these back to process operations and customer needs.