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Customer Satisfaction: A South African Case

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Abstract
Customer satisfaction is one of the most important variables when applying the ISO 9000 quality management system. Customer satisfaction forms the basis of quality improvement initiatives and therefore needs to be measured through its dimensions and specifications. For these reasons it is vital for the organisation to develop a plan of action to address and improve customer satisfaction on a continuous basis. The primary objective of this research was to assimilate characteristics that would improve quality and customer satisfaction on an automotive seat cover production line. "Sewing", the organisation is currently experiencing difficulties with regards to the quality of its products. The current high level of customer complaints as well as internal data related to scrap, rework, and quality issues indicate that product quality is a major contributor to this dissatisfaction. The investigation applied the qualitative research methodology using a case-study as the primary instrument for data collection.

Keywords: customer satisfaction, quality, industrial engineering, continuous improvement.

Introduction

The plant is divided into two operating units; Sewing (the unit) which stitches the complete seat cover and Seat Assemblies (the unit) which trim and assemble the complete seat sets as a JIT (Just-in-Time) supplier for a large automotive manufacturer. Customers are very particular about the quality of the product they receive as this automotive manufacturer is on the upper end of the automotive chain. Thus, Sewing has received numerous complaints from the customer on the quality of their products. The industry demands zero defects and tolerance on product manufacture. In view of the operation being a labour intensive one, it places major strain on all operations and operators. Taking into account that the products manufactured by Sewing are extremely labour intensive, it is a challenging task for perfection in all operations. Sewing has recently received various complaints and corrective action requests from customers regarding the quality of supplied product which clearly impacted negatively on customer satisfaction.

Method

The research approach that has been selected for this study is a qualitative research design in conjunction with a case study methodology. The data collection was done through interviews with operators, supervisors, managers and technical personnel through discussions. Applicable literature was reviewed to develop an in-depth understanding into the said phenomenon. The case study methodology enables the researcher to focus on the core issues impacting all operations with a focus on quality. The approach may be considered controversial, but is widely used to gain in-depth explanations regarding the aspects that may impact quality on the product.

Literature Review

Customer satisfaction is measured through the lens of the customer in relation to the experience gained though the utilisation of a product (Goetsch and Davis, 2014; Kaynak; 2003). According to Foster (2015) the customer's experience is based on several characteristics such performance, conformance, reliability, features, serviceability, durability, aesthetics and perceived quality. In addition, product quality is also measured on customer service characteristics in terms of assurance, empathy, tangibles, reliability and responsiveness. Thus, quality management dimensions play a crucial role in customer satisfaction and require measurements on a continuous basis (Kaynak, 2003; Basu and Wright, 2003).

Goetsch and Davis (2015) defined total quality management as a philosophy that was built on a corporate vision focussed on customer satisfaction through corporate engagement on continuous improvement. To achieve this vision an organisation is required to develop systems and processes that strive to perfect customer requirements. The other stakeholders are; employees, suppliers, business partners, society and owners (shareholders). These business goals are also referred to as Critical Success Factors (CSFs). These factors are aligned towards customer and other stakeholders' satisfaction (Brandt, 2008).

Having identified the critical success factors is not enough to continuously improve the satisfaction of customers (and other stakeholders' satisfaction). Measurable goals are formulated in the form of Key Performance Indicators (KPIs). Juran (2014) postulated these as "measurable goals for control subjects".

Juran identified and categorised the control subjects into the following five quality goals:

- Product performance
- Competitive performance
- Quality improvement
- The cost of poor quality
- The performance of macro processes

These control subjects serve the same purpose as the critical success factors discussed above, which is to identify the important goals in achieving the mission of the organisation.

Quality dimensions related to the automotive industry

Curkovic, Vickery & Droge (2000) alluded to seven competitive characteristics. These were product quality, design quality, conformance to specifications, product durability, and product reliability. The service characteristics were pre-sale customer service, product support and customer responsiveness. This approach emphasised that both product quality and service quality are imperative the for automotive supply chain (Baird, Jia Hu, and Reeve, 2011; Cyrne, 2005).

It would seem obvious that seat covers is defined as the product of Sewing, but the following view point should also be considered. Since none of the design and development rights related to these seat covers belong to Sewing, one can argue that the product (seat covers) belong to the customer and Sewing is merely providing a manufacturing service for the customers product. When defining the product of Sewing as a manufacturing service, the quality dimensions are redefined as in table 1. By redefining the product of Sewing as providing a manufacturing service; reliability, durability and product design becomes relevant as service dimensions (Terziovski, 2006; Talib, Rahman, and Qureshi, 2011).

Table 1. Product definition: Provision of Manufacturing Service

Quality dimension	**Description**	**Relevance to Lear Sewing**
Product (or service) reliability	Reduction of manufacturing system failure or malfunction	Relevant
Product (or service) durability	Maximisation of the time to system replacement (or part of the system)	Relevant
Conformance to specifications	Provision of manufacturing services that meet established performance standards.	Relevant
Service Design quality	Provision of cover manufacturing services with superior design quality.	Relevant
Pre-sale (or Pre-launch) customer service	Customer service during the pre-launch phase.	Relevant
Product support	Provide after sale customer service.	Relevant
Responsive to customer	Timely response to needs.	Relevant

The SERVQUAL quality dimension specifically for the organisation is listed in the table 2.

Table 2. Service quality dimensions defined for Sewing

Dimension	**Definition as related to Lear Sewing**
Reliability	Ability to perform the promised cover manufacturing service dependably, accurately and on time without system failures or breakdown in supply.
Assurance	Employees courteous and knowledgeable ability to inspire

	trust and confidence.
Tangibles	Appearance of personnel, physical facilities and equipment.
Conformance to specifications	Manufacture to specifications
Pre-launch customer service	Customer service during the pre-launch phase.
Responsiveness	Timeous response to needs and wants including complaints.

Continuous Improvement Capability

According to Bessant & Francis (1999) Continuous Improvement (CI) can be considered as "dynamic capability". They mention the capability of organisations to harness all the possessed potential to continuously improve all facets. They mention that CI offers mechanisms for rejuvenation in innovation and learning. This relates to "kaizen" and transcends to the "lean" approach (Gryna, 2014). This capability is viewed as a cluster of behavioural routines that can offer a significant competitive potential (Eskildsen and Kristensen, 2007). These behaviour patterns are consume time to institutionalise, and are difficult to transfer. A model developed by Bessant and Francis describe the various levels in the development of CI capability and can be used to position a particular organisation on this journey.

Results and Discussion

Current level of customer satisfaction

Managers responded that they were of the opinion that customer satisfaction was at an acceptable level. Managers described the level of customer satisfaction as; "Satisfactory", "Fairly good," "customer is relatively happy", "No major customer concerns, only minor complaints". One manager mentioned that quality and customer satisfaction comes at a price. He mentioned appraisal costs with regards to inspection and quality control mechanisms that were in place. He also referred to failure costs with regards to scrap and rework that was at a high level.

Factors that impact on customer satisfaction

Managers' response to factors they believed impacted customer satisfaction is listed in table 3 below. The left column lists the factors while the right column indicates the number of managers that responded to the factor.

Table 3. Factors impacting on customer satisfaction – Management

Factors	Number of times mentioned
Delivery on time	6
Product quality (conformance)	6
Cost	2
Responsiveness to customer complaints	1
Re-occurring customer complaints	1

Product quality vs service quality

Managers were asked to differentiate between product and service quality and provide their opinion as to the importance of these two equally important variables in terms of customer satisfaction. This is summarised in the figure below.

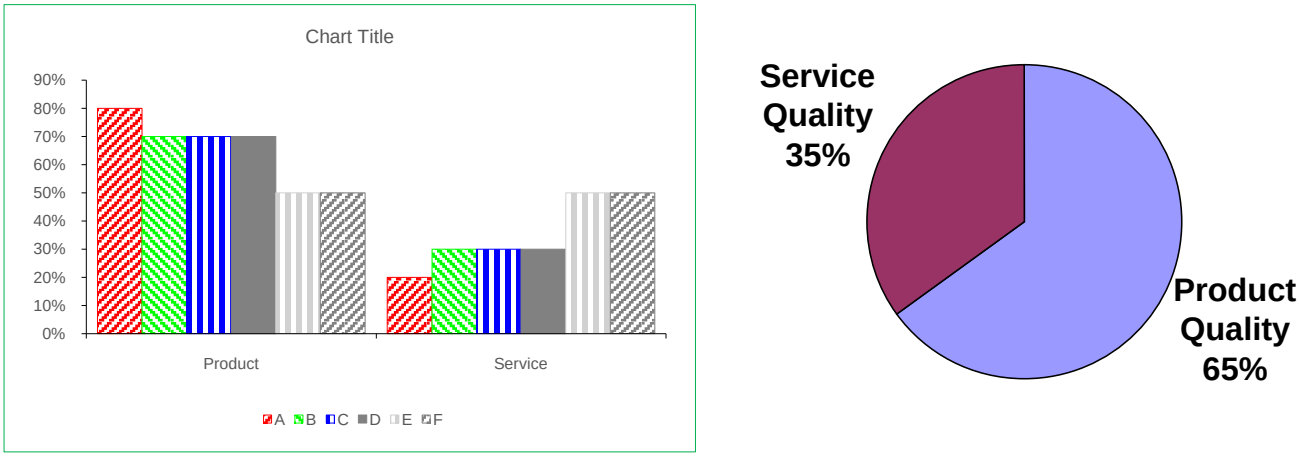

Figure 1. Percentage split between service quality and product quality.

The response was summarised and concluded as a 65/35 split respectively. This seems to be a realistic assumption as product quality dimensions are more diverse and include customer satisfaction as one of the variables. A manager commented that the input into product quality is diverse and difficult to manage if the system is not geared to manage it. Product quality encompasses stringent controls at every stage from raw material evaluation to a completed seat. Service quality requires human interaction and is equally important in ensuring customer satisfaction.

Quality dimensions

Managers were asked to rate the importance of quality dimensions pertaining to the seat production line. In the rating 1 was considered most important while 5 was the least important. The summary is provided in the next table.

Table 4. Quality dimensions – Management rating

Dimension	Managers response						Total
	1	2	3	4	5	6	
Conformance to specifications	3	1	1	2	1	2	10
Reliability	2	4	2	1	2	1	12
Responsiveness	1	2	3	4	3	3	16
Pre-launch customer service	4	6	4	3	4	4	25
Assurance	6	3	5	5	5	6	30
Tangibles	5	4	6	6	6	5	32

As deduced from the table management consider conformance, reliability and responsiveness (in this order) as the most important quality variables while tangibles, assurance pre-launch customer service were of lesser importance.

Product Quality

Product quality is determined by customers. Managers were tasked to evaluate the current level of product quality and to identify opportunities for improvement. The majority of managers mentioned that there was room for improvement, although product quality was at an acceptable level. Managers detailed a list of improvement initiatives that could be implemented.

- Extraction and analysis of data regarding defects
- Quality cycle approach on defects
- Team approach on the resolution of problems
- Scrap area to be relocated to a more visible area on the production line..
- Evaluation of supplier quality
- Evaluation of operator skills
- Continuous operator training and multi-skilling
- Evaluation of absenteeism
- Discipline on production lines to be improved.
- Root cause analysis to eliminate quality problems
- Stabilisation of machines and operators
- Maintenance schedule for all machines (Gregory, 2008).

Service Quality

Managers mentioned that responsiveness and reaction time required improvement. In addition a quality satisfaction survey was to be implemented to receive comments from customers. All information required screening and documentation to prevent re-occurrence (Gayriel, 2006; Green, 2006).

Continuous Improvement

Managers were asked to respond regarding their perception of the current continuous improvement strategy in all areas relating to product and service quality improvement. Managers complained about available resources, skills and training of operators, discipline in the department and the amount of waste in the organisation. They re-iterated that they were currently touching the surface and much more needs to be done on product and service quality.

Employee survey

The total staff compliment of Sewing at the time of the survey was 33 employees. Of the 33 employees, 24 responded to the survey. This equates to a response rate of 73%. The results of the individual surveys was tabled and captured in an excel spreadsheet. The average response to each of the statements (both the agreement rating and importance rating) was calculated. These average response values were then plotted on a scatter chart to give a graphical presentation of the results (Figure 2). The agreement responses, which represent the perceived values, were plotted on the vertical axis and the importance values which represent the expected values

were plotted on the horizontal axis. The diagonal line indicates the area on the scatter gram where the perceived value is equal to the expected value. Should the responses to a statement fall on this line, it would indicate that for the relevant statement, the perceived level of deployment for the approach equals the level that is expected for that approach. The distance between where a statement is plotted on the scatter chart and the diagonal line, indicates the difference between the perception and expectation ratings. If the statement is plotted above the diagonal line, it is an indication that the perception related to that statement is higher than the expectation. When plotted below the diagonal line it is an indication that the perception regarding the statement is below the expectation.

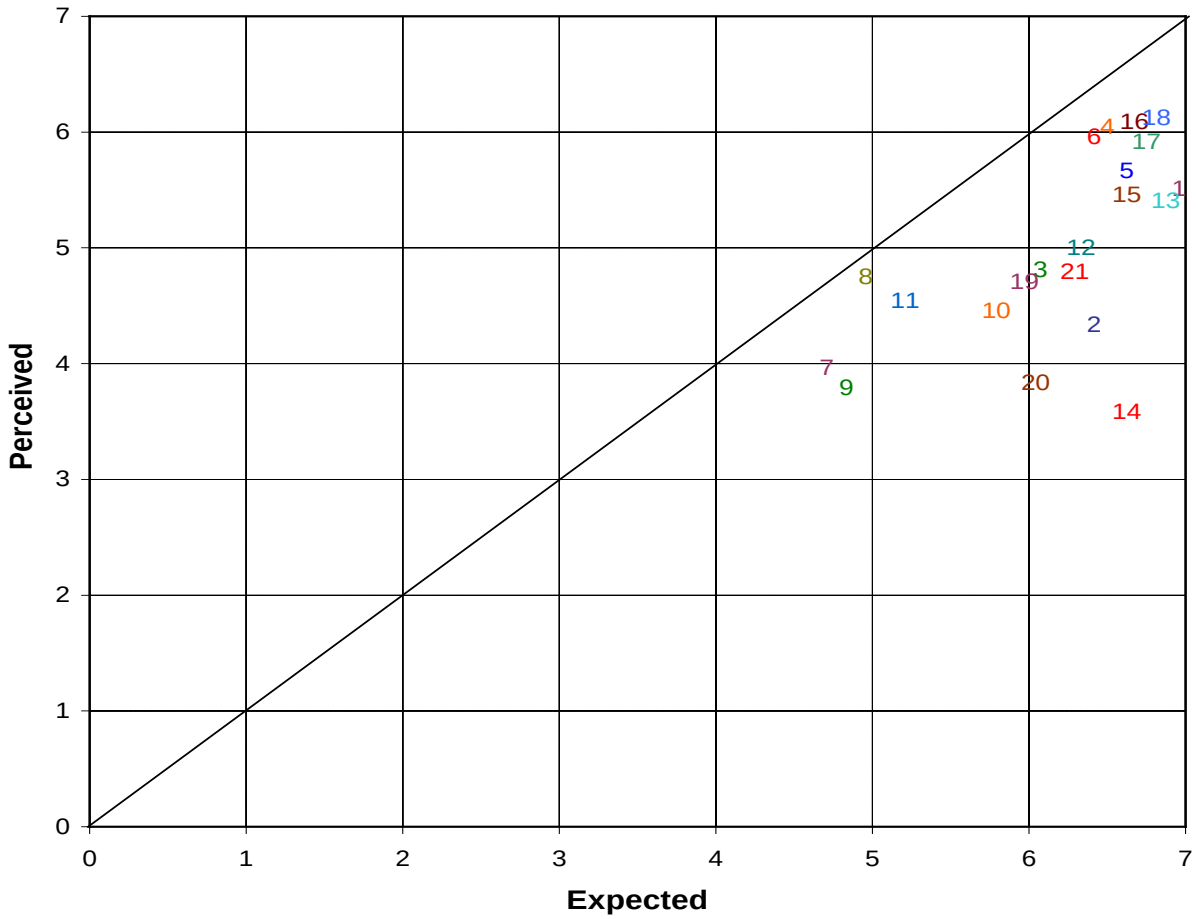

Figure 2. Scatter Chart of Employee Survey Results

The response to statement number eight, which stated that Sewing's physical facility is very appealing, is the closest to the diagonal line. This means that the level of agreement to this statement (perception) as it relates to Sewing is very close to the importance (or expectation) for this statement. The actual average importance rating for this statement is 4.95, which indicate that the importance of this statement as it relates to customer satisfaction was not very high. The average agreement rating to this statement is 4.75, which indicated a slight but not high agreement to the statement. This is fairly close to the expectation value. On the other extreme, statement number 14, this stated that the reject rate of Sewing covers at the customer is exceptionally low, is the furthest away from the diagonal line. The expectation

rating for this statement is 6.63, which indicates that Sewing employees believe that this statement is of very high importance to customer satisfaction, thus the expectation regarding the statement is very high. The actual perception rating for this statement is 3.58, which indicate a slight disagreement to the statement. The difference between this perceived value of 3.58 and the expected value of 6.63 indicates the gap that exists between the expectation and actual perception.

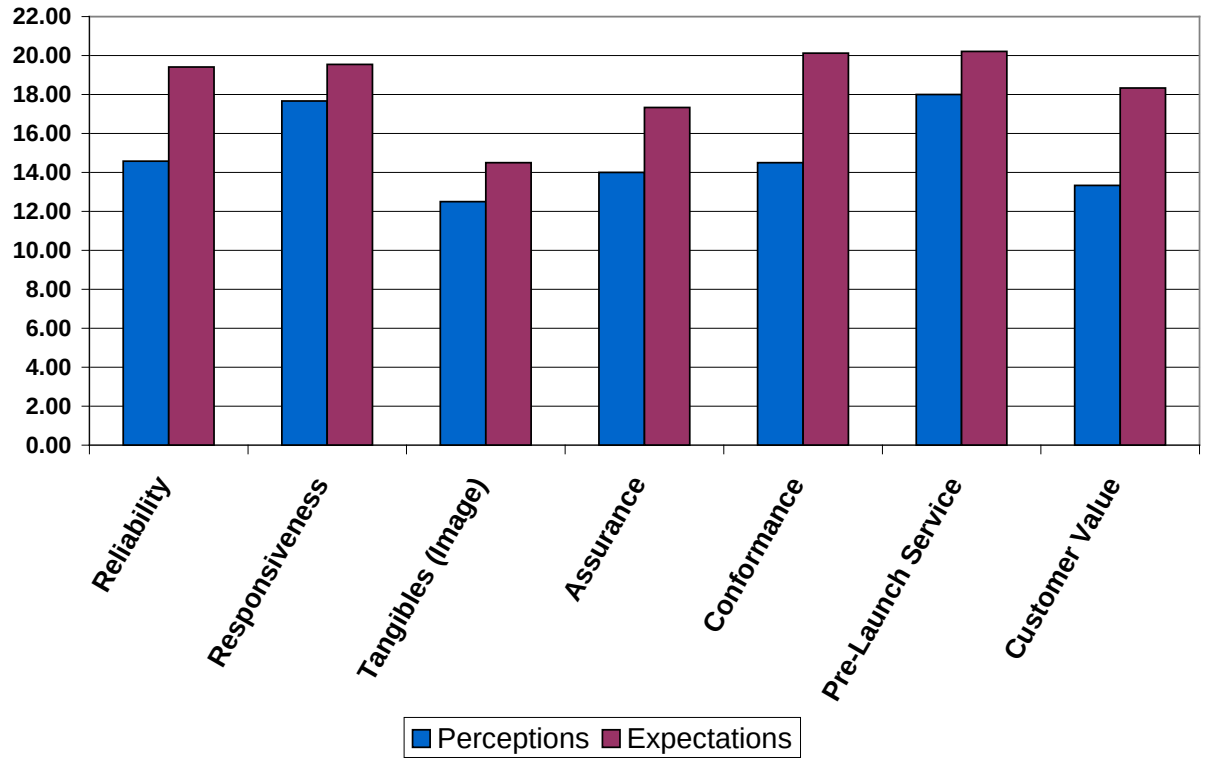

Figure 3. Perception/Expectation Histogram per Quality dimension

The importance or expectation rating indicated by the maroon coloured bars in the figure 3 indicate that Sewing employees' consider conformance, pre-launch customer service, responsiveness and reliability almost equally important with regards to customer satisfaction. The quality dimensions assurance and tangibles are rated as the least important quality dimensions.

For these quality dimension ratings the perception rating was again subtracted from the perception rating to illustrate the gap between the employees' perception and expected ratings for the relevant quality dimension. This is illustrated in figure 4.

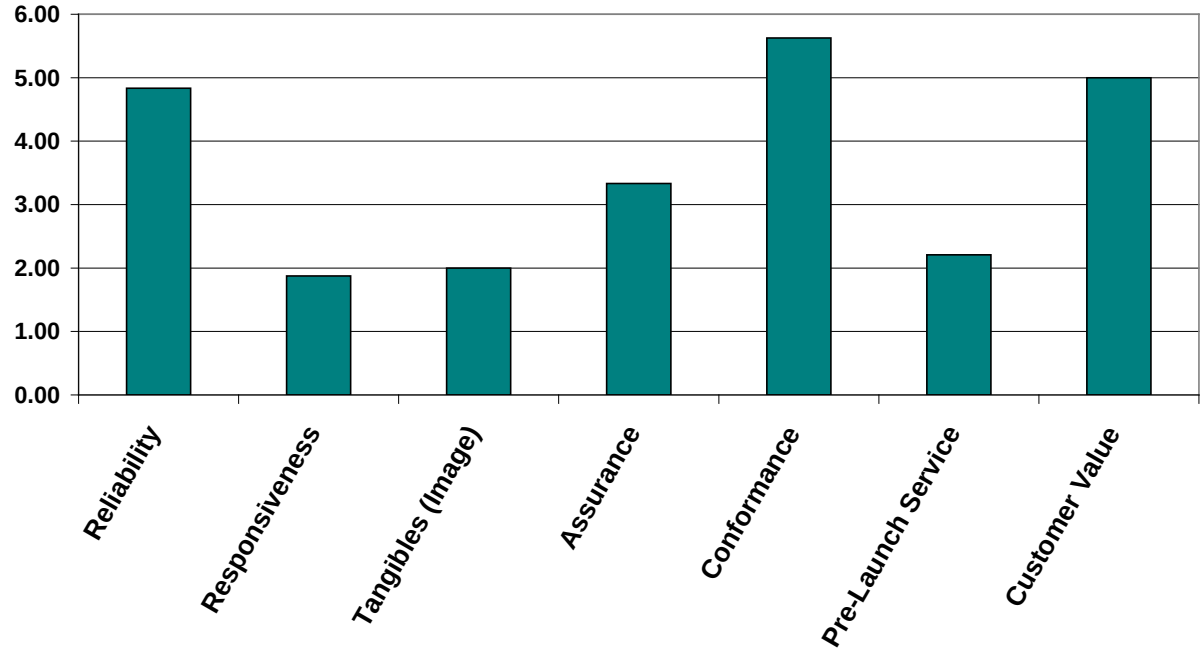

Figure 4. Gap Analysis Histogram per Quality dimension

This graph indicates that the employees of Sewing identify conformance, reliability, and customer value (in this order) as the areas where the biggest gaps exist between expectation and perception. The three quality dimensions; responsiveness, tangibles and pre-launch customer service are the quality dimensions perceived to be the closest to their respective expectations. This indicates that the biggest impact on customer satisfaction can be made by focusing on product conformance, reliability and customer value.

Focus groups

Supervisor focus group

The main issues that were raised during the supervisor focus group discussion as per the main focus points given in paragraph 5.4.1 are summarized below:

The first point for discussion was related to the feedback supervisors receive from the quality department regarding the quality of production. According to the supervisors their main source of feedback is directly from the final inspectors, as they always have up to date information available and they can enquire about the data at any time during their shift. Final inspectors would also alert the supervisors to major or re-occurring quality problems. Other feedback that they receive from quality is a weekly overview of the defects per operator, which is used to identify operators that need to be counselled or disciplined. Operators who exceed a certain amount of defects in a week are issued with a disciplinary warning. The overall perception of the supervisors is that the feedback they receive from the quality department is effective and that it does give a clear indication of the quality problems on the lines.

The next point of discussion was the action that is taken on reported quality data and whether supervisors believe that these actions are sufficient. Supervisors admit that they themselves do not do enough to address the issues recorded by the inspectors. When machine breakdowns or supply problems occur they need to focus their attention on these problems, and once these are resolved they need to switch their focus to achieving the target, as these problems leave them with less time to do so. Supervisors claim that they do however address the major quality problems, as and when they are highlighted by the inspectors. Supervisors are also of the opinion that some inspectors do not always bring major or re-occurring problems as detected at final inspection to their attention. Quality problems are not only pointed out by inspectors, but also by the operators themselves. According to the supervisors a large amount of quality problems is related to machine settings which require theirs or a mechanics immediate attention, as most of the operators do not have the skills or knowledge to adjust and correct machine settings.

Supervisors were asked to give their opinions on the support they receive from their managers and other departments in solving quality problems. Supervisors indicated that their major frustrations in this regard are the lack of support from their managers and some of the maintenance staff. Supervisors expect their managers to assist them with major quality problems and expect the managers to involve other departments to assist with problems when required. They believe that their managers are not always interested in listening to their explanation or concerns regarding problems and believe that managers are more interested to know what disciplinary action was taken with regards to quality problems. For this reason supervisors would often contact other departments directly for assistance (the engineering department was mentioned as an example).
Supervisors also indicated that other departments such as cutting, logistics and maintenance do not share their sense of urgency regarding time, and a lack of timely service from these department often impact on the time available to achieve target. Supervisors also believe that there are employees in the company (with special problem solving skills) who could offer more assistance with regard to their quality related problems. The supervisors high-lighted a recent event where a large number of front backrest covers was rejected. In this instance they expected to see more support and involvement from other departments, including the continuous improvement department, in a team effort to solve the quality problems.

Another topic during the supervisor function group discussion was the problems and obstacles supervisors face with regards to addressing quality problems. In this regard supervisors mentioned machine problems. Some of the machines on the lines are fairly old and constantly cause quality problems. Incorrect machine settings, even on new machines, are another obstacle that the supervisors face. Even supervisors struggle to correct settings on some machines and have to rely on mechanics to adjust settings. Another frustration mentioned here was that some mechanics do not give feedback to the operator or to them as to what they have done to correct the problem. The efforts of one of the mechanics who usually explain to

operators what he is doing while setting the machine was however appreciated by supervisors. Supervisors believe that if other mechanics share this approach their operators would become more knowledgeable regarding machine settings and rely less on mechanics over time. The combination of absenteeism and a lack of multi skilled operators pose another problem, as supervisors find it difficult to get suitable replacement for key operations. These situations impact negatively on quality and the ability of the line to reach target. Another problem mentioned was the supply of mixed parts from logistics (two product variants supplied in the same bundle). The cause of mixed parts is usually disputed between production and logistics. However the problem is mostly only picked up in the sewing line while parts are being sewed together, and as there is no proof that suggests otherwise, it is assumed that parts were mixed on the line and rejects get recorded against the operators.

The supervisors were asked about their opinions regarding the level of self-inspection done by operators. The supervisors believe that their operators do put in the effort to inspect their own work as properly as time would allow. They pointed out that due to the uneven spread of work load on the line; some operators don't have the same amount of available time to do proper self-inspection as others. When unforeseen delays occur, these operators are put under even more pressure and the thoroughness of their self inspection could suffer as a result.

The last point of the discussion focused on the effectiveness of our current corrective action system. Supervisors are of the opinion that not all required parties are involved in the corrective action procedure and that this procedure does not resemble a team effort. When a corrective action is issued to production they believe it is often only handled as merely a paper exercise without real investigation into causes and solutions. The impression supervisors get when instructed to carry out activities related to corrective actions is that managers are only interested to get the paper work done and that there seam to be little focus on the actual problem, other than demanding disciplinary action.

Focus Group – Quality staff

The focus group conducted with the staff of the quality department focused on some of the same issues that have been addressed with inspectors and supervisors. The purpose of this is to look at similarities and difference in opinions from different view-points. The quality personnel were asked to give their opinion as to the effectiveness of the current method of data recording and analysis. Quality personnel commented that they believe the current system is generally effective and that it does give a good indication of what the quality situation is, but that errors do occur. Incidents where inspectors have to be asked to correct mistakes on forms and clear up issues on their recording sheets often occur. Incomplete information on data recording forms, such as the date, name of inspector, production line or shift causes major frustration when data is captured from these sheets. Quality staff is also of the opinion that inspectors sometimes neglect to record all the defect data, which leads to data never being captured or reported. The statement was also made that inspectors sometimes record defects under the wrong defect category. For example

an inspector might record a defect as caused by bad cutting, when the defect was in fact caused by misalignment or other operator related issue. The reason for this could be lack of experience or lack of proper investigation into the problem causing the defect.

Quality staff was asked to comment on the noticeable response to the reported data and whether they believe that this response is sufficient. The general consensus reached by the group is that the response to data is very limited. The reporting of information every morning has become a routine exercise with no follow-up action. It was also noted that the reported data is captured twice onto separate spreadsheet, for different purposes. Firstly the previous day's data get recorded from the inspector's record sheets onto a spreadsheet to report the daily scrap and rework figures by line (not operator or defect type specific). Later in the week the same record sheets are used again for capturing the weekly defect figures which then include the defects per operator and defect type. A lot of effort is put into generating these two reports. The data that is recorded for the daily scrap report is captured by a quality technician, who works overtime every morning in order to capture data before the daily morning meeting. The data capturing for the weekly report is usually done during the weekend (also on overtime) in order to have it complete by the following Monday. The weekly report with defect per operator is then solely used by the managers to identify the operators who have reached their pre-set reject limit and who as a result, will forfeit their production bonuses. Other than for the purpose described above, no further action seems to be taken on the recorded data. As this data is not broken down into specific variants, it is also not possible to use this data to statistically prove the effect on some change. This problem was observed by the author, when asked to investigate what effect a recent change on a specific variant of a component had on the reported defects.

The last discussion point dealt with the effectiveness in which customer complaints are being handled. The quality team are of the opinion that response to customer complaints is generally very good and that quick action is usually taken to address these complaints. Further comments were that they believe that their problem containment actions, problem awareness and problem solving methods are effective and that problems are usually resolved quickly. However the concern is that the effects of these actions are usually short lived. It seems like once the problem is brought under everyone's attention quality alerts have been posted where required and awareness training was done, the problem seem to be resolved for a while, but as the focus shift away again to other issues the discipline to uphold the actions that were put in place seem to fade. Thus the re-occurrence of customer complaints is mostly attributed to the lack of self-discipline. This lack of self-discipline is not only applicable to the operators and inspectors, but to all involved in keeping the proposed actions and procedures in place including management.

Operator and Inspector Interviews

Final Inspector Interviews
The response received from the final Inspectors are summarised below:

Two of the six inspectors interviewed indicated that the current list of defects are sufficient for the defects they encounter. The other four inspectors all named or described defects they are not able to classify under any of the current defect categories. The unlisted defects described by the inspectors are listed below:

- Defects related to piping (a design seam on some variants)
- Defects related to the isofix label (An isofix label indicate the positioning of a Child seat bracket, which get sewn into the cover.)
- Foreign objects (When particles get stuck between material layers or seams)
- Wrong identification label sewn onto cover.
- Mixed panels (For example when a panel from a sport cover is sewn into a standard cover)

It was also observed that some of the defects that is currently listed on the current defect listing are not used at all. These are defects that were relevant to previous projects, but due to the nature of the current components have become irrelevant.

The second question is related to the effectiveness and user-friendly layout of the recording sheet. The recording sheet is split into a top and bottom section (reworks and scrap). The top section is used for recording of defects that can be reworked and is split into two horizontal halves. On the left side inspectors tally the defects next to the specific defect that is listed on the form and on the right side they record the operator number with the defect code. The bottom section is a mirror image of the top section, but here the defects, resulting in a cover being scrapped, are recorded in the same way as for reworks.

The general response of all inspectors was that this recording form was effective and easy to use. It was however noted that the inspectors had to write very small in order to fit the information in the narrow lines provided. This is because the defect listing of 40 items appear twice on the sheet (scrap and rework sections) which result in eighty lines that are spaced very narrowly on an A4 sheet. As one of the inspectors explained how they write the operator number of the defect code on one side and then tick of the defect on the left side, she realised that she neglected to complete the left side for the previous recorded defect. Another issue that is related to the first interview question, was that inspectors indicated that they sometimes have to tipex or scratch out a description on the defect listing that is not used to write a description for a defect that is not listed in order to the record that defect. This presents a problem to the accuracy of the reported data, because this is not done consistently by the various inspectors, and when quality technicians record the defects into the system for further reporting they use the defect code (and not the description) to identify the defect type.

The third question relates to the inspectors opinion of the level of self inspection done by the operators. The author received mixed responses to this question. Two of the inspectors interviewed are of the opinion that operators on their lines are careless and that they generally neglect to do self inspection. One inspector responded that she believed operators generally do put in an effort to do self inspection due to the fact that their clock numbers get recorded and that they could loose their production bonus or even receive a disciplinary warning for high rejects. The other three inspectors also indicated that they believe that here is a noticeable degree of effort from operators to do self inspection, but not yet sufficient.

The fourth question addresses the re-occurrence of defects. One of the inspectors replied that she noticed a random occurrence of various types of defects and could not single out major re-occurring defects. The other inspectors all indicated that there are a number of defects that they can single out as occurring more often than others. These defects as high-lighted by some of the inspectors, are given in below:

- Needle holes (usually associated with a bad rework)
- Seam width not to specification
- Backtacks not in order
- Loose hanging threads
- Skew seams
- Edge trimming problems

The purpose of the last question was to determine if inspectors believed that sufficient action is being taken on the data they collect. Two of the inspectors responded that they believe sufficient action is being taken on the reported problems. The observed response or action is supervisors addressing the quality problems with the individual operators. The other four inspectors were of the opinion that problems are not addressed sufficiently. A statement made by one of the inspectors was that they only see action taken on the lines when issues are raised by the customer. The perception of another inspector was that, no action will be taken, even if she recorded a relatively high number of defect incidents.

Operator Interviews

The response to the operator interviews is summarised below:

All operators interviewed claim that they know the specifications for their operations. Ninety percent of operators referred to their start-up check sheets with hand written specifications, when asked about the availability of these specifications. According to most of these operators these specifications originated from the work instruction. It was observed that hand written information gets copied weekly from one start-up form to the next.

Three of the operators indicated that they receive feedback regarding the quality of their production lines. The other 17 operators indicated that they do not receive feedback regarding performance of the group line) on a regular basis. Individual

problems are generally dealt with each operator separately. Only major quality problems are discussed in a group setup.

Eight out of the twenty operators indicated that there are times when they have to use their machines even when they are not functioning properly, and could impact on the quality of their work. This occurs when they are waiting for a mechanic to change settings, or when a mechanic is waiting for an ordered part. The other sixty percent of operators indicated that they will not work on a machine unless it is functioning properly. Machine problems thus affects their ability to reach target but not their ability to produce quality work.

All operators interviewed indicated that they do proper self inspection. Only two out of the 20 operators indicated that time pressure could sometimes affect their ability to do proper self inspection. The remaining operators indicated that they have enough time to do self-inspection. The table below summarises defect listing of seat covers at Sewing.

Table 6. Defect Listing for W204 Seat Covers

1	THREAD TENSION / LOOSE SEAM	21	DIRTY, MARKED, STAINED
2	DAMAGED	22	CUTTING (SIZE / SHAPE / NIPS)
3	LISTING (LENGTH, TWISTED, NARROW)	23	COLOUR SHADING
4	BACKTACK N.O.K.	24	NO CLOCK NUMBER
5	SEWN IN PLEATS	25	REINFORCEMENT TAPE
6	DROPPED STITCHES	26	COTTON PROBLEMS(BREAK,TWIST,STUCK))
7	NOTCH ALIGNMENT N.O.K.	27	SEAM BURST
8	STITCH LENGTH N.O.K.	28	CREASES
9	NEEDLE HOLES	29	SEAM PARAMETER
10	SEAM WIDTH	30	MISSING PANELS
11	TOP STITCH N.O.K. - ALIGNMENT TO CENTRE	31	LOOSE LAMINATION
12	STITCH TENSION	32	MISSING PROFILES
13	AIRBAG LABEL	33	EDGE TRIMMING
14	AIRBAG SEAM / JOINING	34	PROFILE WRONG WAY ROUND
15	MIXED BATCH NUMBERS	35	SEAM MISSING
16	JOINING ALIGNMENT	36	HOLES MISSING/HOLES BOTH SIDES
17	LOOSE HANGING THREADS	37	PNA
18	OVERLAPPING N.O.K.	38	BAD REWORKS
19	LEATHER DEFECTS	39	CLOSED SEAM
20	FABRIC DEFECT	40	SKEW SEAM

The main objective or goal identified for this project is the improvement of quality and customer satisfaction. The purpose of the conclusion is to present a framework

for an improvement plan and its deployment, which can be used to address these factors and causes.

Conclusion

Improvement Plan for Sewing

The main elements of the proposed plan for Sewing is based on the PDCA approach discussed in the following sections.

The analysis of the set of causes related to quality and customer satisfaction within Sewing has been done during the empirical study discussed. The next step of the process would be to establish the goals of the improvement plan. These goals should address those critical success factors highlighted during the empirical study. Critical success factors was discussed as part of the literature review. These critical success factors should be established and agreed upon by management. However based on the preceding empirical study, critical success factors for Sewing should for example include, amongst others, at least the following three critical success factors:

- Conformance: Continually improve on product quality (improve on conformance and reduce defects)
- Reliability: Improve the reliability of the manufacturing system
- Customer value: Improve the effectiveness of cost reduction initiatives and aim to continuously add value to the customer.

Out of the seven quality dimensions studied during the employee survey, the above 3 dimensions demonstrated the biggest gap between the level of expectation and the current perception. In order to address the critical success factors, measurable goals or key performance indicators should be established. Measurable goals are required to be established by the management team under direction of the CI department and should be based on a thorough analysis of the current state within the organisation.

The next step is the establishment of the plan which entail the development of improvement projects that would lead to the goals. Each of these improvement projects would have its own measurable goals which when put together will lead to achieving the organisational goals established above. A measurement system should be put in place in order for the plan to be measured against the set goals. This plan should follow the continuous PDCA cycle as illustrated in figure 4 to continuously improve on the effectiveness of the plan. The outline of what is discussed here and the rest of the deployment process is summarised in the following section.

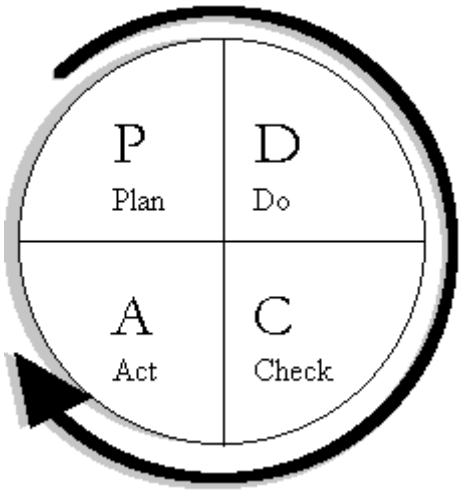

Figure 4. The PDCA Deming Wheel (Plan – Do – Check – Act)

Deployment of the plan and the PDCA-cycle

Policy deployment (also referred to as Hoshin Kanri) is the process whereby the goals of the organisation are put into action through an action plan. This is also described as the process of deploying the goals and initiatives of corporate top-level management down to the lower levels of the corporate hierarchy. Dahlgaard & Dahlgaard (2002) stated that the policy deployment process is about a cause-effect relationship and proposed that the policy deployment process be implemented in a rotational PDCA cycle. The process they proposed is as follows:

Plan

1. Analyse the set of causes
2. Establish the goals
3. Establish a plan (the hypothesis), which is expected to lead to the goals.
4. Establish a measurement system

Do

5. Plan for the implementation and measurements system
6. Implement the plan (a test of the hypothesis about cause and effect relationship)

Check

7. Compare goals and results
8. Identify gaps (positive as well as negative gaps)
9. Analyse the cause for significant positive as well as negative gaps

Action

10. For Good results (positive gaps as well as expected results): standardize the causes that had a good effect
11. For Bad result (negative gaps): improve the plan and rotate the PDCA cycle again

Another process for policy deployment proposed by Nanda (2003) is developed around the FAIR model and also involves the PDCA approach for project execution.

FAIR is an acronym which stands for: focus, alignment, integration, and responsiveness.

Continuous improvement & policy deployment

Sewing currently has access to various resources related to Lean manufacturing and Six Sigma through the CI department. However based on the negative feedback received from management and staff interviews as well as the feedback received from the employee survey, the evolution of CI within Sewing currently would be rated between level 1 and 2 when using the model developed by Bessant & Francis. This negative perception of continuous improvement within Sewing can be partly attributed to the seemingly isolated way in which the CI department seems to function. Statements used to describe level 1 & 2 according to the model by Bessant & Francis that resembles the current CI situation within Sewing for example, are as follow:

- CI happens as a result of the learning curve (level 1)
- effects are associated with a particular new process but then fades out again (level1)
- Formal attempts to create and sustain CI (Level 2)
- Structured and systematic CI (Level2)
- However effects are often short lived and localised (Level 1)
- Training started in basic CI tools, e.g. Kaizen Team work (Level 2)
- Dominant mode of problem-solving is by specialists (Level 1)

In order to move Sewing to higher levels in the evolution of CI, improvement projects that are aligned with the overall goals and objectives of the organisation must be identified and conducted, there should be an increased focus on employee training, the levels of experimentation must be increased (for example incorporating design of experiments) and everyone must get actively involved.

Other Issues raised by Sewing employees

Some of the main concerns that were raised during interviews with management and staff are summarised below.

- Problems associated with gathering, feedback, analysis and reliability of quality data.
- The lack of a team approach in addressing quality issues and continuous improvement initiatives.
- Perceptions that some staff members have of management as to the lack of interest and seriousness that they show in solving quality problems.
- Negative perception of staff and management as to the effectiveness of the current continuous improvement and waste (including cost) reduction strategies.
- Short lived solutions to quality problems resulting in re-occurrence of the same problems.
- Absenteeism and the lack of multi skilled operators to alleviate the problem.
- The overall reliability of the manufacturing system and equipment.

Recommendations

One of the first steps in addressing the improvement of quality at Sewing should include a review of the methods used to collect, analyse and report quality data. The introduction of a computerised data collection system involving scanning of covers at inspection stations is proposed. This method is already in use at various other automotive sewing plants, and speed up the collection, analyses and reporting of quality data, with less risk of errors. This method also allows for more detailed analysis of quality data due to the detailed product information that is recorded via scanning. Another major benefit of this system would be that quality technicians would need to spend less time on data capturing activities and can focus more of their time on addressing quality issues on the production floor.

It is recommended that the improvement plan discussed should follow the project-by-project approach where project teams address the measurable goals of the plan. To further the achievement of this goal and to emphasise the team approach. Sewing should adopt the matrix organisation structure to launch continuous quality improvement and cost & waste reduction projects. This structure should give the continuous improvement managers and appointed project leaders an equal level authority over their project team members as the functional managers. This team approach will also address the negative perceptions as to the effectiveness of continuous improvement strategies and would improve confidence in management's earnestness to address and resolve quality issues. The team approach should also be emphasised on the production floor through the effective use of the quality circle (or green area) approach, where feedback is given and supervisors and operators can discuss problems and issues on a daily bases. This approach should also aim to address the following points listed by Deming; create a constancy of purpose, adopt a new philosophy, break down barriers between departments, put everybody to work and institute education and self-improvement.

The current situation regarding machine down time, the employee survey, as well as comments by staff during interviews, all indicate that Sewing does not resemble an organisation with a proper preventive maintenance system. The limitation of the current preventative system was also high-lighted during a recent internal audit. Although a computerised system is in place, there seems to be limited knowledge amongst maintenance personal regarding the full functionality of the system. A proposal is that a proper investigation should be done to improve the current preventative maintenance ability at Sewing. At another sewing plant in Rosslyn, maintenance activities have effectively been incorporated with the company's Information System (XPPS – System) which allows for better down time tracking, maintenance scheduling and problem identification. The proposed investigation should include a benchmarking exercise with this Sewing Plant in Rosslyn.

As recommendations for further research, it is recommended that separate detailed studies be conducted for each of the other two quality dimensions that showed the largest negative gaps in this study, namely Reliability and Customer Value. A study to improve the reliability of the organisation should focus on improving

preventative maintenance and improve the effectiveness of the maintenance team at Sewing. The proposed study to improve Customer Value should specifically focus on improving the cost and waste reduction initiatives at Sewing to increase the overall value that Sewing can provide to their customer. The Kaizen team-worker recently adopted by the Corporation can play a major part in addressing the overall objective of increasing customer value.

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