LEAN AND SIX SIGMA IMPROVEMENT CONCEPT: AUTOMOBILE AFTER-SALES SERVICE DELAYS ON CUSTOMER SATISFACTION IN GHANA

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Abstract

Lean and six sigma are continuous improvement methodologies that have evolved from collections of techniques to comprehensive management systems and popularized by several high-profile companies. Both methodologies strive to improve customer service leading to sustained organizational success and both require a supporting organizational culture. The success and complementary nature of these methodologies have led to their combination into a single methodology, commonly called Lean Six Sigma. This research employed a case study approach to gather data on service quality dimension, completion time, time allocation in the service process, and returned jobs. The study recognizes in broad scope the major quality challenges that most service garages are faced with. The research approach took different perspectives through questionnaire administration, direct observations, interview, and data analysis. The questionnaire administration and direct observations confirmed that customers were dissatisfied with the after-sales service delivery. Delay and poor quality repair works have been identified as major issues contributing to customer dissatisfaction in the automobile repair service garages in Ghana. The DMAIC approach was followed to identify, measure, and analyze the potential causes of delay and poor quality. The improve and control phases of DMAIC, lean six sigma tools and techniques were subsequently developed and recommended to achieve a better after-sales service. The paper recommended that the after-sales service process could run more efficiently and effectively if sources of delay in completing repair works can be identified and eliminated.

Keywords: Lean Six Sigma, Service Delivery Delays, Cause and Effect, Customer Satisfaction

INTRODUCTION

In the automobile industry, specifically with after-sales service, quality of repair service makes the difference between a firm's overall success and failure. Profit generated by after-sales services is often higher than the one obtained with sales; the service market can be four or five times larger than the market for products and it may generate at least three times the turnover of the original purchase during a given product's life-cycle (Bundschuh and Dezvane, 2003). Van Iwaarden et al., (2008) are of the view that, the main factor behind Motorola creating the concept of Six Sigma in the mid-1980s is that, its development was

continuous improvement in the manufacture of complex devices involving a large number of parts with a high probability of defects in the end product.

Anderson and Kovach, (2014) make a good observation in the construction industry and conclude that successful project completion leads to customer satisfaction. They went ahead to assert that, schedule delays, however, may be caused by unexpected downtime due to rework/repair. In the automobile service industry, what customers want is the speed of service delivery by their respective dealership centre. Besides being a long-term potential revenue source, the after-sales service constitutes a mean to uncover customer needs and a strategic driver for customer retention. It represents, in fact, one of the few constant connections that customers have with a brand influencing customer satisfaction and loyalty (Gallagher et al., 2005). When poor service is experienced, both the firm and customer are negatively impacted, the customer receives poor service and the firm loses future potential sales. The quality of a service and repair works have become even more important in this time of economic recovery through strengthening customer relationships, attracting customers lost and renewing their confidence in the firm by means of effective service recovery strategies. The perception of after-sales as a source of competitive advantage and business opportunity requires a shift from a traditional product-centric view, in which after-sales is considered a 'necessary evil', to a customer-centric view (Lele, 1997).

The vision statement of most auto dealership garage is to be the market leader in the auto industry by achieving the biggest market share in the transport provision industry. Visions play an important role in the improvement work for a company. The vision explains the question: what do we want to become? A vision should contain a clear picture of the direction of a company's striving, and when the goal is reached. According to George (2002), the slow rate of corporate improvement is not due to lack of knowledge of six sigma methodology or lean technique, but rather the transition from theory to implementation. The significance of this paper is for an automobile dealership to improve and maintain world class after sales service levels. Failure to do so can lead to lower customer satisfaction, patronage and loyalty.

The environment for most of the automobile dealerships is very challenging these days under the massive global market competition, therefore companies are looking for systematic ways to cut operation cost, improving workflow rate and repair work quality. In an attempt to address the challenges confronting the auto service industry, many dealership garages have resorted to application of quality improvement tools. Tanik and Sen (2012) in their introductory statement in their paper mentioned that, "As quality management approaches evolved, six sigma as a methodology has become the most commonly accepted tool of quality improvement at present. It takes into consideration many aspects of problem-solving techniques with a project-based perspective" (p342). The production and distribution of products and services to satisfy customer needs, wants and expectations enable a business to achieve its primary objective. The quality of after sales service provided by automobile dealerships has a major influence on customer satisfaction. With the aim of sustaining long term relationships with their customers, many businesses have changed their strategic focus to emphasize customer retention (Peng and Wang, 2006). Preserving their long term customer

relationships requires that these businesses both measure and appropriately adjust the quality of their service.

Crouse, and Anglin (1996) are of the view that if the job is not done well the first time it would lead to shop-come-back. However, there are a number of issues that could lead to shop-come-back. This could include delay in completing repair works and poor quality work. However an increased number of returned jobs in a repair garage could lead to lower sales and consequently affect the centre. The consequences of not satisfying customers in the competitive automobile environment can be severe. Hoyer and MacInnis (2001), indicate that dissatisfied customers can decide to discontinue purchasing the good or service and further complain to the company as well as to a third party and perhaps return the product. They are of the view that a dissatisfied customer will engage in negative word-of-mouth communication. Abdul Aziz et al., (2013) assert that customer satisfaction is a measure of how products and services supplied by a company meet or surpass customer expectation. They further defined customer satisfaction as the number of customers or percentage of total customers, whose reported experience with a firm, its products, or its services (ratings) exceeds specified satisfaction goals. It is against this background that deployment and implementation of lean six sigma methodology would be crucial to improving after sales service in the automobile industry.

The paper aims at examining the automobile After-Sales service delays on Customer satisfaction in Ghana auto service and repair garages. The paper seeks to find out about the root causes of delay and poor quality works in the automobile dealership service workshops. Again to establish how service delivery delays influence lean six sigma deployment and implementation at the auto service workshops. The focus of the paper is to answer questions like "What are the root causes of delay and poor quality works in the automobile dealership service workshops?", "How can service delivery delay, influence lean six sigma quality methodology implementation on after-sales service in the automobile industry"?

The Concept of Quality and Lean Six Sigma

Historically, quality has been given many different definitions by a lot of writers. Orbak (2012) explain that the main initiative of lean thinking is to maximize customer value while eliminating waste. According to Orbak, the critical objective is to offer perfect value to the customer through a perfect 'value creation' process that produces no waste. Six Sigma quoted by Kamran and Sajid (2010) in their paper indicate that "it is an improvement methodology in the field of Total Quality Management (TQM)" (p745). According to them, it is defined as 'a methodology for pursuing continuous improvement in customer satisfaction and profit that goes beyond defect reduction and emphasizes business process improvement in general. In line with what Kamran and Sajid indicated in their paper, Grima et al., (2014) attest to the fact that six sigma has proven to be a powerful system for improving quality and productivity. It worth to note that quality practice should focus on today and future customer. The fact that the quality concept should originate from the needs and wants of the customers was something that post-war Japanese managers soon became aware of (Bergman and Klefsjö, 2003). Bergman and Klefsjö (2003) define quality as a wider concept where quality is to satisfy, and preferably exceed, the needs and expectations of the customers. The wider

definitions can be interpreted as including internal customers, which can be different departments within the organization, the co-workers as a group, or the co-workers as individuals.

Cause and Effect Diagram: A cause and effect diagram is used to identify and analyze a problem in a team setting. Teams brainstorm to generate categories such as materials, machines, personnel, environment, etc. Within each category, the team identifies causes that contribute to the effect (the problem). A cause and effect diagram visually displays these causes, and helps the team to locate the most significant causes that lead to the problem.

RESEARCH METHODOLOGY

Different techniques such as observation, structured questionnaires and secondary data were applied in the process for data collection. The case study is selected for this research because it is the preferred method when attempting to answer "how?" and "what?" research questions about modern events over which the researcher has no control (Yin, 2003). The research question in this effort is "How can lean six sigma quality methodology help improve customer satisfaction on After-Sales-Service in the automobile industry?" Data was collected from a dealership service garage. Cause and effect diagram also known as the Fish Bone diagram were used to establish the major root cause to service delays and their effect on customers. DMAIC framework and a descriptive statistics including mean scores of the Likert scale were also employed for the study. The standard time for completing routine maintenance service used for the purpose of the study was 3.00hours

RESULTS AND DISCUSSION
After Sales Service Processes in Auto Service Garage

The key element in determining the level of service quality is customer satisfaction or dissatisfaction. In this process, the service advisor plays an important role in ensuring that the customers leave the dealership satisfied. The process begins with service appointment which helps reduce waiting time during greeting and consulting section. It ensures that the job is scheduled and completed on the requested date and time. During greeting and consulting, customers (either cash or credit) submit a repair order and the order is received and processed.

The Service Advisor acknowledges the customer with a smile immediately upon arrival and listens carefully to the customer's needs and prepares the job card based on exactly what the customer has said. When the job card is prepared, the job scheduler or controller assigns the job to a technician for execution of the repair work after performing diagnosis. Spare parts requisition is a prerequisite for all preventive maintenance and repair jobs. A request for parts is forwarded to parts department by the technician for processing. After completion of the repair job, the quality control officer inspects the repair work and road tests the vehicle for final quality checks. When the repair work is certified by the testing officer, the job card is closed and given to service advisors for bill processing. The vehicle is then driven to the washing bay for cleaning. After the billing process is completed, the customer is informed about the bill and collection. During vehicle delivery, the Service Advisor explains the services and repairs performed in words to the customer for him or her to understand and

shows the customer the total charges for labour, the total for parts and the grand total. Delivery takes place when the customer signs for the repair job and takes delivery of the vehicle. After vehicle delivery, the customer is contacted within three days to confirm that the work was performed to the customer's satisfaction. This is done to respond to any concerns or complaints as a top priority to ensure an ongoing relationship.

Sources of Delay
Figure 1 displays the percentages of responses to question on delay in completing the repair works. The questions were aimed at establishing the degree to which the technicians and supervisors agreed or disagreed that some service processes cause delay in completing the repair work. Figure 1 indicates that 58% of the respondents strongly agreed that parts supply causes delay; 42% just agreed to the statement. This shows that 100% agreed that delay was caused by parts supply. Other areas which contributed significantly to delay were vehicle delivery and road testing. The remaining areas which did not affect delivery time were job allocation, bill processing, and receipt issue. Generally, the graph suggests that most of the delays are caused by parts supply, vehicle delivery, road testing, diagnosis and vehicle washing.
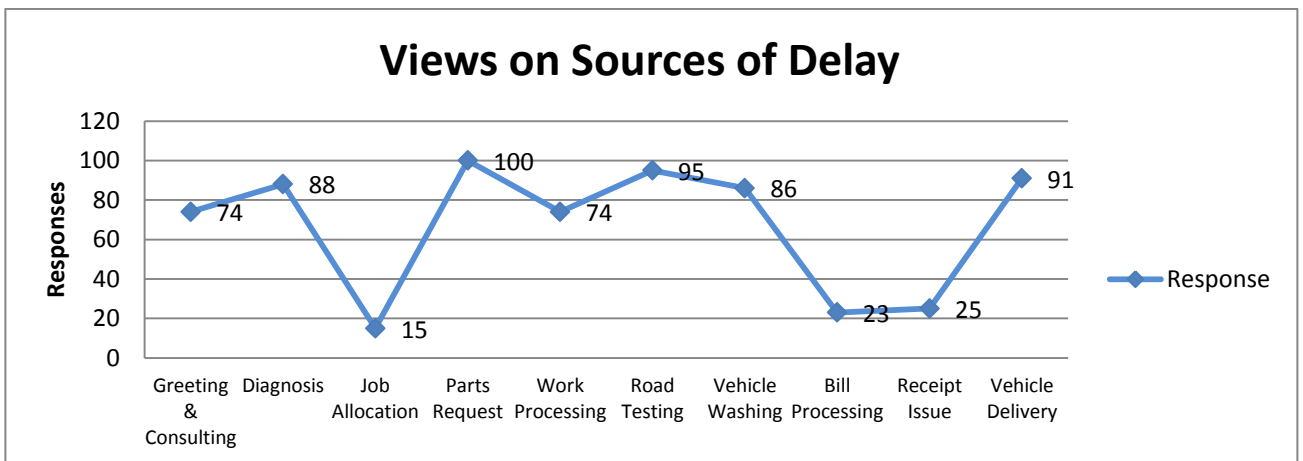

Figure 1:Views on Sources of Delay

Completion Time
In order to confirm the sources of delay in completing routine maintenance service, data on completion time for 200 vehicles was collected. Ideally, a service process flat rate time of approximately 180 minutes for up to 60,000 km routine service was used for the purpose of this study. Figure 2 showed data on completion time for two hundred vehicles at the express section and time allocation for each step in the service process.
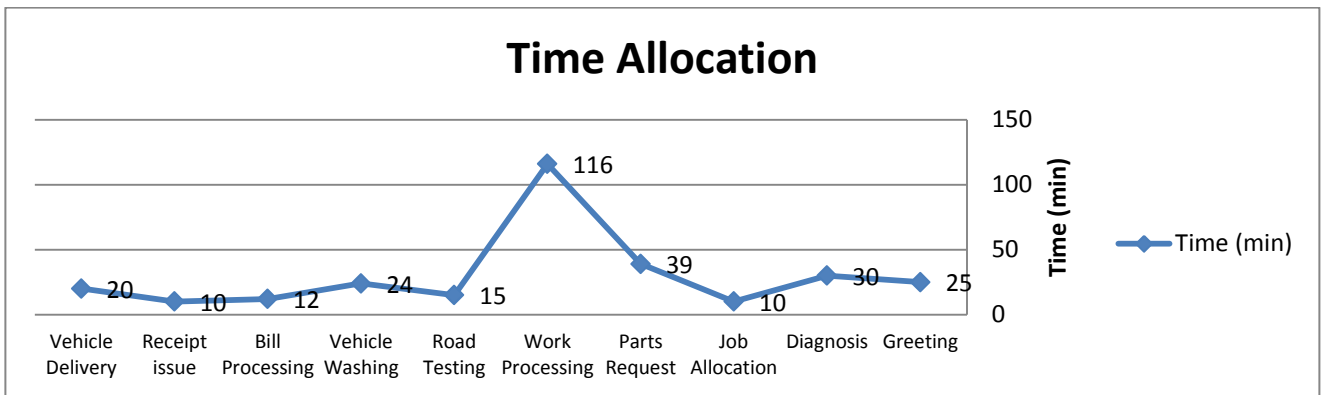
Figure 2 Time Allocation

The graph showed in figure 2 represents time allocation for each service process. Work processing registered a maximum time of 116 minutes, while parts supply recorded 39 minutes. Job allocation and receipt issue accounted for 10 minutes each, while the remaining 25 minutes, 30 minutes, 15 minutes, 24 minutes, 12 minutes and 20 minutes for greeting, diagnosis, road testing, vehicle washing, bill processing and vehicle delivery respectively.

Returned Jobs

The quality of repair jobs in automobile dealerships significantly affects customer satisfaction and retention. Returned jobs are repair works brought back for rework because of poor workmanship. The study attempted to determine the sigma level of the service garage by collecting data on returned jobs from January through to November. In all 5976 jobs were received and a total of 313 were reported as return jobs representing 5.24 %. Figure 3 showed the number of returned jobs (rework) for a period of 11 months. Returned jobs were compared with total vehicle received for the period under consideration and the percentage of jobs calculated against the total number of vehicles received.
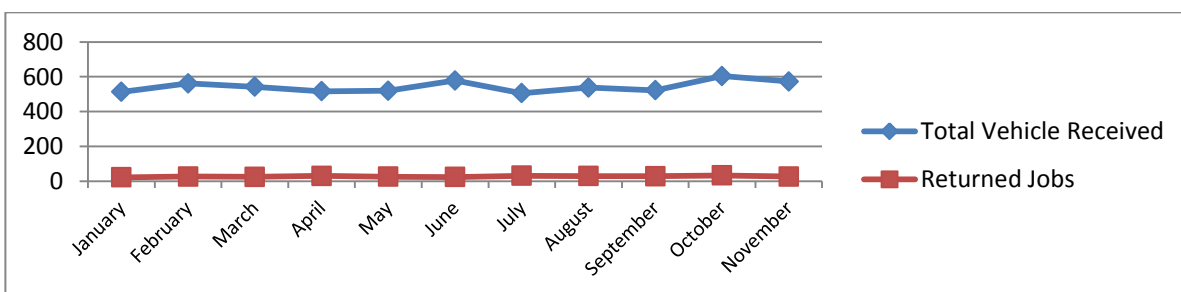
Figure 3: Returned Jobs vrs Total Vehicle Received

The Analyze Phase

The third phase of the DMAIC framework is the analyze phase. After gathering data and establishing the time taken for a technician to complete a routine maintenance service and the number of returned jobs, the root causes of the delay and poor quality would be determined.

For this case, Cause-and-Effect Diagram was used to identify and determine the effects of the potential causes to the problems.

Analysis of Completion Time
The data on completion time for two hundred vehicles was reviewed and analysed to determine the mean and standard deviation using statistical method. The results showed that the mean delivery time for completing routine maintenance service is 5.00 hours and standard deviation of 0.97.

Table 1:Data on Completion Time

Class Interval	Frequency	Class Mid-point (X)	fx	Deviation, d = (X-Xm)	fd^2
3.5 - 3.7	21	3.6	75.6	-1.4145	42.01701525
3.8 - 4.0	19	3.9	74.1	-1.1145	23.60009475
4.1 - 4.3	20	4.2	84	-0.8145	13.268205
4.4 - 4.6	16	4.5	72	-0.5145	4.235364
4.7 - 4.9	26	4.8	124.8	-0.2145	1.1962665
5.0 - 5.2	19	5.1	96.9	0.0855	0.13889475
5.3 - 5.5	21	5.4	113.4	0.3855	3.12081525
5.6 - 5.8	15	5.7	85.5	0.6855	7.04865375
5.9 - 6.1	12	6	72	0.9855	11.654523
6.2 - 6.4	9	6.3	56.7	1.2855	14.87259225
6.5 - 6.7	13	6.6	85.8	1.5855	32.67953325
6.8 - 7.0	9	6.9	62.1	1.8855	31.99599225
	$\sum$f=200		$\sum$fx=1002.9		$\sum$fd^2=185.82795

Source: field work 2015

Mean, $Xm = \sum fx \Big/ \sum f$

   Xm = 1002.9/200

   Xm = 5.0145

   Xm = 5.00 hours

Standard deviation, $\sigma = \sqrt{\{\sum fd^2 / (N-1)\}}$

$$\sigma = \sqrt{(185.82795/199)}$$

$$\sigma = 0.97$$

The service process mean is 5.00 ± 0.97 which is outside the stated promised time of 3.00 hours stated in the flat rate time for completion of routine maintenance service.

Analysis of Returned Jobs

To tackle the problem of returned job, data on returned jobs was collected as shown in Table 2. Analysis of the data gave an average of $5.25 \pm 0.6\%$ returned job in each month. Relative to the 6-sigma quality standard of 3.4 Defect per Million Opportunities, the high returned job rate of 52500 per 1000000 opportunities gave a six sigma value of 3.13, which is an indication of the poor quality service of the garages after sales service operation.

Table 2: Analysis of Data on Returned Jobs

| Month	Total Vehicle Received	Returned Jobs	Percentage of Returned Jobs	Deviation, d = X-Xm	d^2
January	513	23	4.483430799	-0.766569	0.587628
February	562	28	4.982206406	-0.267794	0.071713
March	543	26	4.788213628	-0.461786	0.213247
April	517	31	5.996131528	0.7461315	0.556712
May	520	27	5.192307692	-0.057692	0.003328
June	578	25	4.325259516	-0.92474	0.855145
July	506	32	6.324110672	1.0741107	1.153714
August	538	30	5.576208178	0.3262082	0.106412
September	522	29	5.555555556	0.3055556	0.093364
October	604	34	5.629139073	0.3791391	0.143746
November	573	28	4.886561955	-0.363438	0.132087
			$\sum X = 57.74$		$\sum d^2 = 3.92$

Source: field work 2015

Mean, $Xm = \sum X/N$

$$Xm = 57.74/11$$
$$Xm = 5.25$$

Standard deviation, $\sigma = \sqrt{\{\sum fd^2/N\}}$

$$\sigma = \sqrt{(3.92/11)} \qquad \sigma = 0.6$$

Cause-and-Effect Analysis: The cause-and-effect diagrams have been developed based on observations and responses from technicians and supervisors on sources of delay in figure 1 and time allocation in figure 2. The Cause-and-Effect diagrams for delay and poor quality are shown in figure 4 and figure 5, respectively. In conducting the analysis for delay, five main categories were created, including Equipment, Spare parts, Diagnosis, road testing and washing. Also, four categories were created for poor quality work as policies, methods, people and equipment. Generated under each of the categories were causes that contributed to the problems.
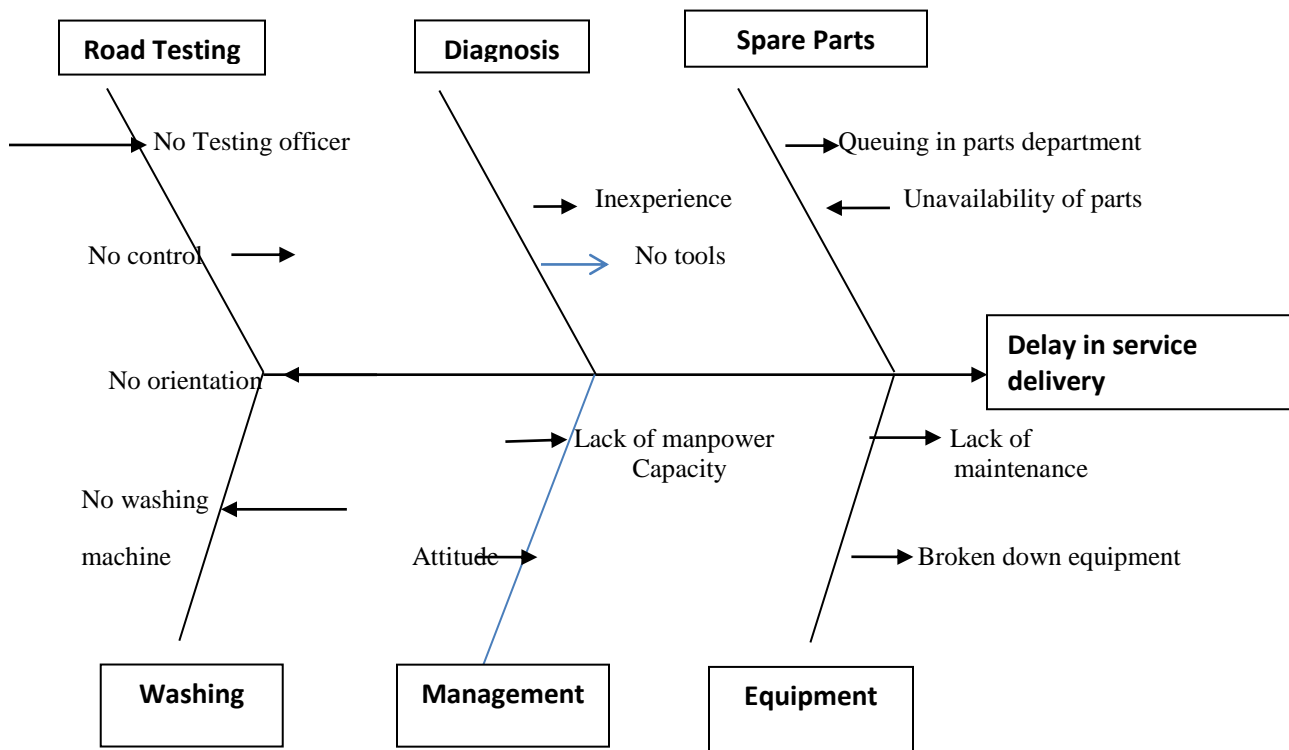
Figure 4 Cause-and-effect diagrams for Delay
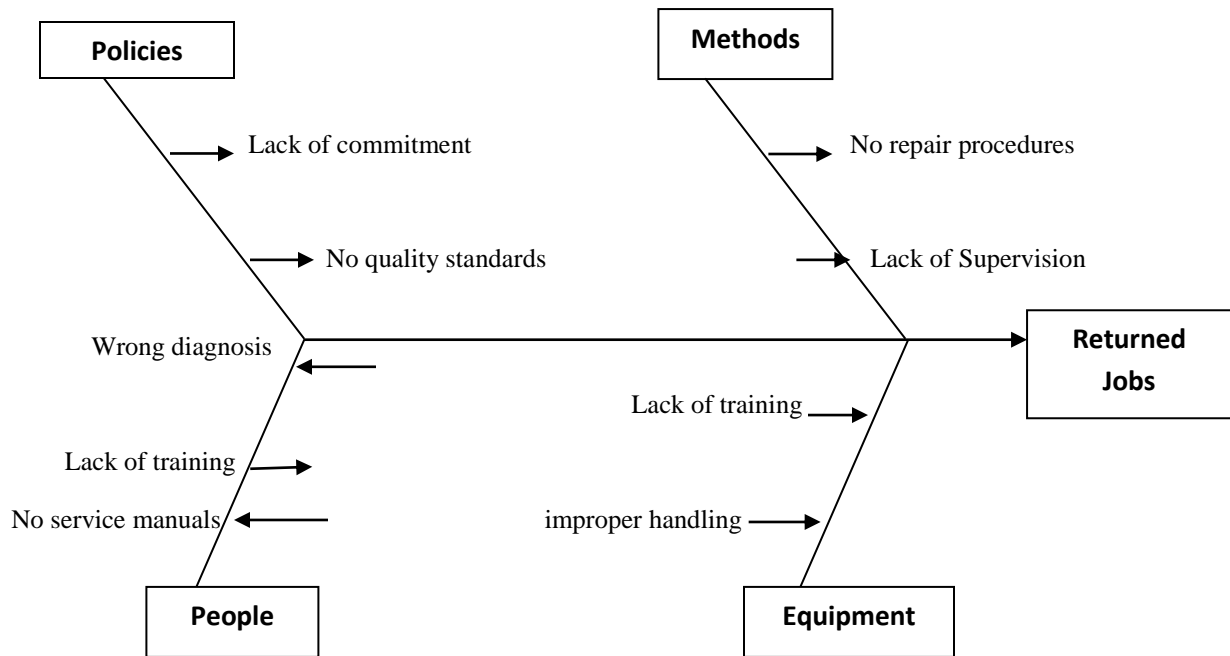
Figure 5 Cause-and-effect diagrams for Poor Quality

Management Commitment*:* Management must show commitment to Lean Six Sigma improvement methodology and go beyond slogans, banners, or motivational speeches. The management team must convey constancy of purpose and with discipline to realize the implementation of the lean six sigma methodology. According to Maleyeff (2007), the management team must be made responsible and accountable for both managing the dealership and improving its effectiveness.

Service Appointment: Creating an efficient appointments system for customers is an essential activity of most customer-oriented organisations. An effective appointment system allows customers to schedule and book a specific service date and time with the dealership. The benefits of service appointment are as follows:

- Customers can reduce waiting time at the service reception
- Service needs can be addressed in relaxed atmosphere
- The service workshop can minimize fluctuation of customer traffic, and
- The service advisors can have quality time to talk to customers and develop good relation with them.

Promoting service appointments will help the dealership to communicate their personalized and caring philosophy. It also generates customer enthusiasm and satisfaction with the dealership, and this leads to repeat and referral business. A well-organized appointment control system should be in place to properly handle service appointments and the dealership should ensure that 80/20 percent ratio of appointment customers to walk-in customers is achieved.

Customer Reception: Analysis of the questionnaires showed that most customers were not satisfied with the customer service care during their interaction with the dealership. Also, the customers complained about the limited parking lots which forced some of them to park their vehicles on the road. For the dealership to get its customers satisfied, the service advisors must be trained to provide good customer service. A good customer service will allow the dealership to build a competitive advantage, create a brand name, and obtain loyalty in their customer base. Therefore, retaining new customers comes from stealing them away from the competition. The dealership must provide its customers with proper parking lots as the parking lots give first impression of the dealership.

Quality of Repair Work: Much waste has been created in the dealership because quality was not right the first time. Some customers complained of poor quality work and unnecessary waiting to solve their problem. An Analysis of data on returned jobs at the Dealership showed that over 5 percent of the repair works were not done right the first time leading to customer dissatisfaction. The dealership was, of course, pleased that demand for after-sales servicing with the Centre was strong and did not want to miss the opportunity to achieve great financial gains. In an effort to generate enough sales to meet this demand, Management had chosen to place emphasis on the service target, not quality. Because of this, the quality of the repair works suffered, leading to a high number of returned jobs. To solve the quality issues with repair works, the dealership has to employ final quality inspectors and provide Quality Control Bay with required tools to perform the final quality checks before the vehicle is tested. The technicians should follow standard work procedures and carry out proper diagnosis before carrying out repair works. The dealership should include test drive in the final inspection if the repair involves drivability, noises, vibration or other problems that are difficult to determine.

Workshop Loading: An observation showed that there is serious congestion in the dealership thereby impeding smooth flow of work. This is because service advisors received a lot of cars in a day without taking into account the workshop capacity. To achieve an efficient work flow, job progress control system must be well organized to ensure that all work is completed on schedule and the vehicle is returned to the customer at the promised delivery time. A monitoring and feedback system should also be in place to continually monitor the job progress and report any signs of work delay which may affect the promised delivery time.

Reliable Equipment: An interview with the technicians in the service department showed that the tools and equipment used in the workshop are not of high quality as evidenced by frequent breakdowns. However, given that the dealership is a service industry where repair jobs are required to be completed on time, one would have assumed that the dealership will used state-of-the-art equipment to support its service operations. Based on this fact, the dealership should procure quality tools and equipment and employ a maintenance officer or train some of the Technicians to carry out preventive maintenance works. Also, standard operating procedures for the tools and equipment must be clearly displayed for all technicians to follow.

Employee Training: Many dealerships neglect their staffs as they expend their energy on achieving lean process. The employees are drivers of the lean process and the problem

solvers. Without the employees, transition to lean approach cannot be achieved. The employees must, therefore, be properly trained to become leaders in the lean six sigma initiative. It is recommended, therefore, that the dealership provides training for both service advisors and technicians.

Spare Parts Supply: From the measure phase, it was found that the parts department used 39 minutes to supply parts to the workshop. This fact strongly suggests that the parts department has to improve their supply system. To achieve an improvement in the parts supply system, the service department must be provided with a transit spare parts store to minimize unnecessary movement and waiting by the technicians. The parts department can also adopt a parts kit system for service intervals of 5000km – 100,000km to minimize the waiting time. Deployment of lean six sigma cannot be achieved unless the parts department is efficient, since the parts department has to be as capable as the service department at delivering excellent-quality service just in time.

Vehicle Washing: The importance of quality car wash is often overlooked by many automobile dealerships. As the vehicle plies the road, dirt and debris are constantly collected on the vehicle's paint, frame and body. The accumulations of these matters often take a toll on the paint, weakening and eventually making it look dull. An observation at the dealership showed that most of the vehicles serviced were either not washed or improperly washed. For the dealership to solve the problem of car washing, a professional should be employed to beef-up the manpower at the washing bay and an automatic car washing equipment be procured to enhance quality of car washing.

Vehicle Delivery: Vehicle delivery is an important point in the service delivery process. This means that the vehicle must be ready for the customer at the promised time and all necessary arrangements made in advance to ensure that the customer is satisfied. Most at times, customers get dissatisfied because they have to wait at the Cashier's counter for payment. It is imperative that service advisors ensure quality delivery so that the customer is completely satisfied with all repair work done as this will help to instill confidence in the customer.

Customer Follow-up: An effective follow-up system helps ensure that dissatisfied customers are given the proper attention they require right away. Follow-up contact should be made to every customer after each service visit to find out whether the customer is satisfied with the service provided and, at the same time, to show proper customer care. It is important that an appropriate person with a sociable personality be assigned to be responsible for customer follow-up, preferably on a full time basis.

CONCLUSION

Delivery time was considered as the main determinant of customer satisfaction. The study showed that 82% of the customers were dissatisfied with delivery time. Analysis of data on completion time for routine maintenance service indicated a delivery time of 5.00 ± 0.97 hours. The percentage of returned jobs in a month gave an average value of $5.25 \pm 0.6\%$. Relative to six sigma quality standards, the average rate of returned job gave a six sigma value of 3.13. Findings suggest that delay in completing the repair work depends mainly on spare

parts supply, broken-down equipment, road testing, and vehicle washing. Additionally, the empirical study established that the high rate of returned jobs was caused mainly by wrong diagnosis.

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