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Impact of Quality Management Systems and After-sales Key Performance Indicators on Automotive Industry: A Literature Review

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Abstract

The automotive industry is experiencing a significant inclination in global market volumes accompanied with recent declination in profit margins and prolonged life span of a new car. Therefore, automakers have switched their attention to after sales business which proves to be a recession- resistance business, especially after the world financial crisis in 2008. Consequently the after sales business has become increasingly important and is one of the main revenue and customer loyalty contributors. This paper review focuses on the automotive after sales key performance indicators and their pertinent developed models in conjunction with considering the quality management systems which are implemented in automotive manufacturers. The purpose of this paper is to address the link between quality management system and after sales services in automotive industry. It is articulated in a manner to review the reported literature in automotive key performance indicators definition and importance. This is followed by a discussion on the contemporary quality management systems in automotive industry and its impact on customer satisfaction. Next, the author brings to focus the reported literature on warranty service and the relevant developed model. Finally, the paper concludes with the updated developments in the after sales business and the latest technologies utilized in this domain. The literature findings form the input to guide the author in his future research to bridge the gap between certain types of automotive quality managements systems and after sales key performance indicators.

Keywords: automotive; quality management; after-sales service; customer satisfaction

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1. Introduction

The automotive industry forms a main pillar to the global economy, as it is one of the current profitable and feasible industries, especially after its recovery from the world financial crisis in 2008. Consequently, practitioners have forecasted the annual car sales to incline from 75 million in 2010 to 207 million and then 326 million in 2050 and 2100 respectively (Associates and Horizon, 2013). However, the auto sales business has been experiencing a profit margin shrinkage in line with the continuously prolonged product lifespan and this is motivating auto makers to adjust their focus to the after-sales business as it is becoming a remarkable profit source for both the manufacturers and the dealers (Aboltins and Rivza, 2014). For instance, the current after-sales market is up to five times larger than the new product market (Bundschuh and Dezvane, 2003), whilst the turnover of the original purchase can be tripled during the product lifespan by investing in after-sales services (Wise and Baumgartner, 1999).

Vandermerwe and Rada (1989) introduced the term *servitization* to improve the product value sold to customers by providing a package of services (e.g. technical support, self-service and knowledge), these additional services assure better functionality and reliability of the product. In this regard, after sales service is one cluster of services (e.g. maintenance, repair, warranty, etc.) offered to customers to optimise the utilization of the product in its middle and end life cycle (Patelli et al., 2004), besides, after sales services form an independent business module as the management has to fulfil financial targets (Cost, profit, RON, cash flow) and benchmarking criteria (market share, customer satisfaction and loyalty). Consequently, these figures are continuously measured and evaluated by means of key performance indicators KPI (Goffin, 1999) . The after sales services are classified into four categories

1- Selling product services: they deal with all required documents and procedures for completing the selling process (e.g. ownership transferring, training, insurance, maintenance contract and warranty extension)
2- Product usage services: they focus on the requirements of using the product efficiently (e.g. product check-up, customer care, preventive maintenance, training)
3- Product recovery services: they are concerned about all the technical activities performed to recover and to keep the product functioning (e.g. failed parts replacement, regular maintenance)
4- End of life product services: they deal with the regulations of disposing off the product (Legnani et al., 2013).

Nevertheless, after-sales services play a significant role in bonding customers with the brand, namely "customer retention", rather than enhancing the brand image by paying more attention on customer satisfaction, which presents a feasible marketing channel (Alexander et al., 2002; Saccani et al., 2007). Furthermore, after-sales services unveil the customers' needs and expectations that form the main indicator for customer retention and loyalty (Gallagher et al., 2005). Hence, automotive companies have started to measure the value of their customers for the sake of increasing their profit (Hawkes, 2000; Kim et al., 2006; Verhoef and Donkers, 2001), while the customer value has been described as the difference between the benefits acquired from targeted customers for the sake of the enterprise and the burden costs in attracting and serving customers (Juehling et al., 2010; Kotler, 2000). As a result, establishing continuous and developing connections with customers will be positively cultivated in the return of investment, customer retention and even enhancing the brand image. In this regard, accomplishing high customer satisfaction level requires producing high quality of products (Hendricks and Singhal, 1997)

This paper reports a review of literature to analyse the information on automotive after-sales key performance indicators (KPI) and the correlation with automotive quality management systems at the production phase to be matched with customer quality expectations. The relevant reported literature is limited in the manner in which it focuses only on the relation between one key performance indicator and the quality system or study two different after-sales key performance indicators with their relevant quality management system. Thus, the future research will scrutinize the impact of quality management systems on the whole elements of key performance indicators as one set to generalize the link and evaluate the performance of the after-sales department precisely.

2. Automotive after-sales Key Performance Indicators (KPIs)

Despite the limitation in reporting on automotive after-sales KPIs in literature, certain empirical researches have been conducted that scrutinize the automotive key performance paradigm and the related frameworks with the goal

of bringing new designs for the service mixed with the supply chain and accommodating the price list. For example, an empirical model has been provided in the Turkish automotive industry that proves the positive influence of technological innovations (product and process innovation) on the enterprise performance, but no evidence has been detected on the relation between non-technological innovations and enterprise achievement (Atalaya et al., 2013). Table 1 shows the most relevant articles, including their findings and limitations.

Table 1. Automotive after-sales studies.

Author	Empirical Research	Main Topic	Findings
Aboltins and Rivza (2014)	Case study	The car after-sales market development	1- Continuous growing of After-sales service costs and market volume 2- Trend of replacement of modules instead of separate car spare parts 3- Maintenance is not as profitable as in the past
Chougule et al., (2011)	Case study	Effective service and repair in the automotive sector	1- Improved service and repair in the automotive industry 2- Capability of identifying anomalies 3- Improvement to repairs, first-time fix and avoidance of unnecessary repairs
Juehling et al., (2010)	Technology road-mapping	Integration of automotive service and technology strategies	1- Visualizes the interdependencies among products, services and car workshop technologies 2- The vehicle technology/after-sales service works as a manageable tool to facilitate the process of exchange
Khare and Chougule (2012)	Case study	Decision support for improved service effectiveness	1- Identifies the repairs performed in the field for a given symptom
Saccani et al., (2007)	Case study	The after-sales service supply chain	1- Addresses the configuration of the after-sales supply chain 2- No "one best way" exists

Since the after-sales service has been in operation, there has been a necessity to consider the key performance aspects to enable the decision makers to choose the right strategic plan for running the business; therefore, the need arises to bridge the gap in after-sales services by performing a research oriented towards developing theories and an empirical framework scrutinizing the key performance indicators from a one-sided point of view.

3. Quality and customer satisfaction

3.1. Quality management system strategy

The number of recall campaigns has been inclining in a remarkable way, exerting huge pressure on auto manufacturers to improve their product quality and to optimize the quality management systems that they implement (Rugman and Collison, 2004). These entail the implementation of developed monitoring and controlling systems, not only in the production lines, but also in the tier 1 and tier 2 suppliers. A case study by Iwaarden et al., (2006), performed in three European automotive companies, confirmed that there is a developing move in quality management systems from the diagnostic plan to a more interactive strategy. This shift can deal with the increasing number of car segments and features on the one hand, and with shortening the product life span on the other hand. Table 2 lists the relevant papers and their findings.

Table 2. Automotive industry quality and production management.

Author	Empirical Research	Main Topics		Findings
Yadav and Goel (2008)	Interview and survey	Customer satisfaction and quality improvement in the automotive industry	1-	New methodology linking corporate decision making and engineering decision making
Salleh et al., (2012)	Survey	Green lean total quality in Malaysian automotive companies	1-	Green LTQIM practices have generated more revenues
			2-	Company age doesn't play a role in adopting new initiatives
Wuest et al., (2014)	Case study	Supporting quality management in automotive production	1-	Develops a stage gate model for product and process quality improvement
			2-	Success relies on the right adaptation, taking the individual requirements, limitations and boundaries into consideration
			3-	Allows companies to avoid unnecessary investment in faulty products and rework and supports the identification of the causes of defects during the production
Alejandro et al., (2011)	Survey	The quality and loyalty relationship and the impact on company performance	1-	Indirect relation between Quality relationship with account managers
			2-	The consistency perception doesn't interfere the link between quality and account managers
Anand et al., (2010)	Survey	Six Sigma and process improvement projects	1-	Develop a conceptual model for predicting the success of process improvement projects
			2-	Knowledge creation practices influence the success of process improvement projects
Delbridge et al., (1995)	Survey	Productivity and lean quality management	1-	The superiority in productivity and quality between Japanese and Western car plants lies in the former's use of "lean production" techniques

The interpretation of the relation between customer satisfaction and the quality management can be done by conducting surveys and interviews or by conducting case studies in order to collect the required data.

3.2. Customer satisfaction evolution

Customer satisfaction is usually determined through surveys conducted by automotive firms, and the task can also be assigned to specialized organizations, (e.g. J.D. Power Association, Consumer Reports); in this line, Power and McGrow, (2007) proved that quality and reliability form 40% of the whole customer satisfaction assessment whereas the remaining percentage is set aside for vehicle appeal, vehicle performance, price and service. Furthermore, Power and Associates performed a study named Initial Quality Study (IQS); this study measures the vehicle quality in the first 90 days of ownership by observing any quality-related problems detected by the car owner, where the calculation part of IQS is based on the number of claimed problems per 100 vehicles (PP100). Obviously, the lower the score, the higher the quality (Power and McGraw Hill Financial, 2014). The results revealed that 66% of the claimed problems in the 90-day interval were prone to vehicle design, whereas 34% were attributed to component malfunction. Moreover, the study concluded that the fewer the problems claimed by the owners, the higher their loyalty to the brand. In this regard, the latest IQS report concerning the Malaysian auto market released in November 2014, presented the improvement in the initial quality total score for 5 consecutive years, as shown in Figure 1. The report measured the complained failures in vehicle gadgets in the first six months of ownership. Furthermore, it classified the most related problems and prioritised them according to the number of repetitions (Power Asia Pacific, 2014). Certainly, the customer satisfaction index survey complied with the IQS report and showed that Japanese car brands dominate the highest CSI and IQS as well, as shown in Figure 2.
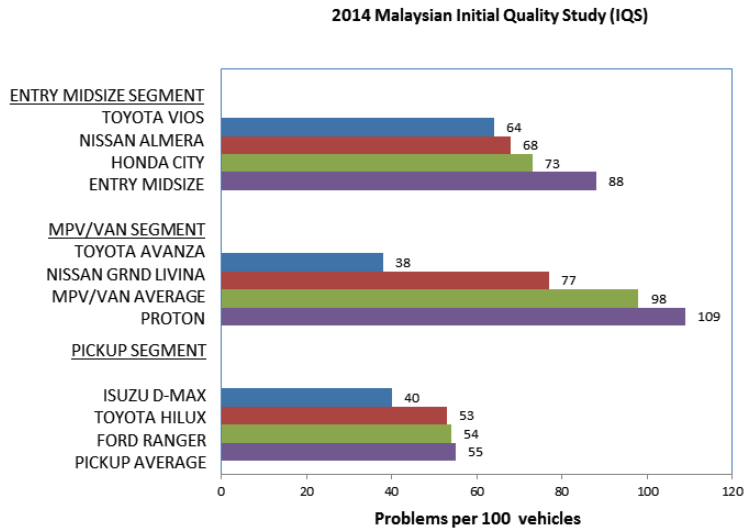
2014 Malaysian Initial Quality Study (IQS)

Fig. 1. 2014 Malaysian Initial Quality Study (J.D Power Asia Pacific, 2014).

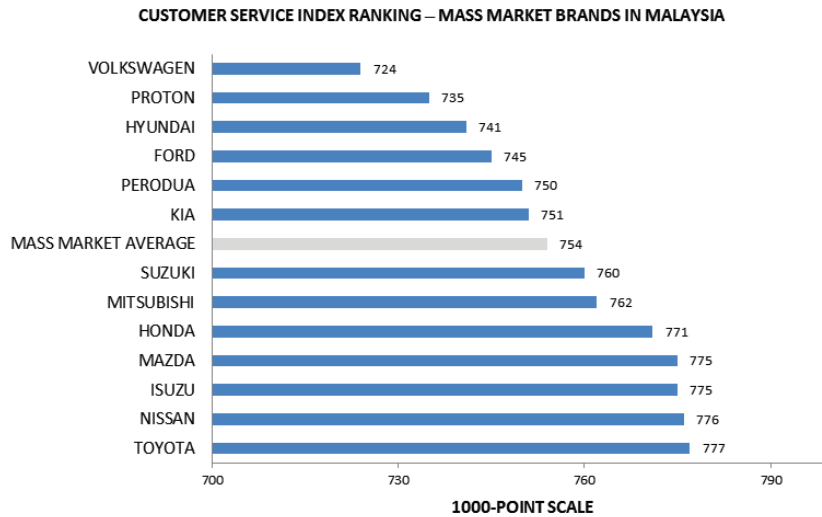**CUSTOMER SERVICE INDEX RANKING – MASS MARKET BRANDS IN MALAYSIA**

Fig. 2. 2014 Malaysia's Customer Satisfaction Index (J.D Power Asia Pacific, 2014).

Consequently, quality and reliability play a significant role in determining customer satisfaction evaluation and this assures the necessity to introduce a quantifiable approach that measures CS from the quality point of view (Chougule et al., 2013). In reported literature, to define quality in terms of customer satisfaction, several conceptual models have been developed. Hernon and Whitman, (2001) investigated satisfaction as a sense of contentment that initiates from a practical experience in relation to an expected experience, whereas CS measures the subjective experience of the customer related to both product and service. Two concepts for measuring CS have been detected in the literature (Andreassen, 2001; Boulding et al., 1993; Oliver, 1993): first, the transaction-specific concept, which relies on a single experience; and second, cumulative satisfaction, which is based on the customer's

experience with both product and service (Fornell et al., 1996). Furthermore, Yadav and Goel, (2008) presented an original framework describing CS as a driving force for quality improvements in the product development phase. This created a link between best-practice decision-making and structuring technical engineering activities, which was investigated in a model connecting CS with component-level design targets to lead the quality improvement effort. Another model links quality and reliability CS, Chougule et al., (2013) presented a model by implementing the fuzzy logic methodology whereby the quality satisfaction modelling is considered to be based on the number of failures. On the other hand, the reliability satisfaction model is based on the number of visits to the dealer and the intervals between these visits. Liang (2010) developed a benchmark market strategic model for measuring customer value by distinguishing between customer consumption style and customer psychological needs. Consequently, the overall CS is determined by combining both the quality and the reliability sides, which insures a new understanding of the conventional CS index, allowing OEMs to specify the root cause of customer dissatisfaction. The majority of companies rely on three pillars for the perspective of utilizing and controlling a high-quality system: the bonding relation with customers (with suppliers), reducing the variation in processes and implementing the Kaizen principle for continually improving the products. In other words, the QMS measures the customer satisfaction, the reduction of process variation and gradual continual improvement (Iwaarden et al., 2006).

4. Issues and challenges

4.1. Automotive after-sales feasibility

Recent studies concerned with the automobile industry have indicated that the production volume of passenger and commercial vehicles has crossed the 80 million level and this number will increase proportionally to 1 billion in 100 years (Associates and Horizon, 2013). Therefore, the trend line of produced vehicles is inclining sharply, and car volume will increase from 1 billion in 2010 to 2 billion and then 3 billion in 2041 and 2097, respectively. Nevertheless, the after-sales services domain will not witness the same positive indications as the sales department due to the developed technology integrated into the vehicle building process, which extends the maintenance intervals and simultaneously creates a new philosophy that purchase is better than repair (Connet et al., 2008).

4.2. New technologies

New types of engine lubricants can run for 100,000 km rather than new car models which are provided with high-quality spare parts and sophisticated safety systems; all these factors play a remarkable role in discouraging car owners from performing regular services for their car in short intervals of time (Aboltins and Rivza, 2014). A survey conducted by the international consultation company KPMG indicated that the current after-sales service is no longer as profitable as in the past; nevertheless, despite the existence of after-sales service being an inevitable issue for dealers, this opens the doors to discuss the feasibility of after-sales service, which is being a controversial topic (Aboltins and Rivza, 2014). In this line, certain empirical models have been developed to optimize the service offered in the after-sales sector. Khare and Chougule, (2012) developed a model that detects the anomalies between the repair manual instructions and the related decisions made by a technician. Another approach visualizes the relation and interdependencies between vehicle technology in after-sales service objectives and car workshop technologies, raising the significant question of how to design an efficient service development process to enable high-quality service processes (Juehling et al., 2010).

5. Recommendation and concluding remarks

The automotive after-sales market shows a promising and high potential blooming business with the increasing demand for high-quality products. In this review paper, the authors highlight certain frameworks and optimization models that prove the robustness of the automotive production systems implemented from the quality perspective and simulate the manufacturer quality system in relation to one or two of the after-sales key performance indicators. Apparently, the majority of papers have described the relation between the quality paradigm and one or two of the after-sales key performance indicators (KPIs), while tackling other elements of KPIs with quality being still a

feasible area in which to analyze and develop models. Accordingly, bridging the gap between quality management systems and after-sales KPIs can be discussed in future research from different aspects, modeling productivity with quality, revenue with quality, warranty and customer satisfaction, warranty and revenue and other key performance indicators; nevertheless, the question remains of how authors can acquire the KPI figures as the methodology of such research will fall into the survey and interview category, which represents the main source of data. Some automotive dealerships still believe that these figures are confidential; hence, the main obstacle to future research is the data collection; despite that, the research's contribution will provide mutual benefits for customers and automotive dealers.

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