

Improve Productivity in a Tyre Industry “A Case Study”

¹Anjali Sharma, ²Prof.Kamalesh kushwaha

^{1,2}Dept. of Mechanical Engg, Maharana Pratap Collage of Technology Gwalior, By RGPV Bhopal.

Abstract – Management of quality and productivity as key performance areas in automotive industry is important for the success of companies in the industry. Conflict that is left unmanaged between quality and production departments can lead to overall deterioration of objectives and failure to protect the interests of investors. This study uses data from an automotive components manufacturing company to determine the nature and strength of a relationship between quality and productivity. Product recalls from customers and warranty costs are an embodiment of this conflict and costly to all involved. Results obtained show a positive relationship between the two variables: quality and productivity. Feedback obtained from interviews support the data analysis results and make recommendations for improvements to both variables.

Keywords: Automotive industry, quality, Productivity, Conflict.

I. INTRODUCTION

Continued existence of many companies within the automotive industry is threatened by poor quality and productivity. Recent airbag recall that is still affecting customers throughout the world with a confirmed estimation of 34 million units is proof to this [19]. Managers are tasked to ensure that quality, productivity, and costs targets are reached in order to achieve returns on investments (ROI) and profits necessary for reinvestments. Edward Deming [1] discourages management of key performance areas in “silos” in principle 8 of his 14 Quality Management (QM) principles, stated “break down barriers between departments.” This QM principle acknowledges the fact that a collaborative effort has to be achieved among custodians of various key performance areas within organizations, the focus of this paper being on quality and productivity. A notion that when quality improves, productivity is also improved is explored [2]. This idea

is supported by the value stream approach, which promotes management on supply chain as a homogeneous unit.

Many authors have devoted attention to quality and productivity as separate topics, with only a few addressing the relationship between the two [3]. The apparent unhealthy relationship between quality and production departments in automotive industries is a concern for professionals in this key sector of the economy [16]. Whereas production department has a role to ensure that products are assembled and ready for delivery/collection to/by the customer, quality department has a duty to assure that those products meet, and will continue to meet customer expectations. During the course of implementing their mandates, quality personnel often interrupt production processes when it is felt customer satisfaction might be compromised. This interruption of processes threatens the objectives of production department, i.e. productivity targets, (measured as a ratio of output to inputs) and becomes a source of conflict in many organizations.

With an adoption of ISO/TS16949 management system [4] for the automotive industry, more emphasis is placed on customer satisfaction. Companies certified to this standard are required to demonstrate continued efforts towards achieving and maintaining satisfaction of their customers. This sense of responsibility could be a contributing factor towards the apparent conflict between those tasked with championing quality and those responsible for productivity. This paper seeks to analyze literature views about the relationship and look at the gaps on which further research can be conducted.

II. LITERATURE REVIEW

Industrial Engineering field has an abundance of literature on quality and productivity as separate topics

but runs short of exploring the relationship between the two concepts in its endeavor to promote systems thinking as an engineering discipline. Only a few empirical studies are available to the exploration of this relationship in the automotive manufacturing industry. In a similar study in the hospitality sector by Benavides-Chicón and Ortega [3], an attempt is made by the authors to fill a gap “given that there are few empirical studies explicitly addressing the relationship between the two variables.” Before unpacking the dynamics of the relationship under review, it is important that key contributions made in the definitions of the two variables are explored in order to deduce a meaningful relationship.

Shortage of literature materials produced in the past 5 years on this topic is also a matter of concern; lack of explicit material developed for the automotive industry is noted. Iqbal carried out a similar study in 2012 [12] using data from 269 Pakistani companies who responded to his questionnaire. Evidence from his study proved that companies were achieving high quality and high productivity due to relatively improved and efficient adoption and implementation of different tools of quality management.

Quality

ISO9000 [4] has documented the definition of quality as “the degree to which a set of inherent characteristics fulfills requirements.” The definition implies that a product/service needs to satisfy intended and implied requirements of its users. Although many definitions have been defined, the ISO definition is accepted as an international definition and shall be used for this study. From the stated definition of quality, it is true that quality does not just happen, but a result of a management system geared towards customer satisfaction as informed by Oakland [1] in what is termed a quality management system (QMS). Quality Professionals expand the QMS philosophy to include a need to continuously improve and sustain quality products and processes by capitalizing on the involvement of all stakeholders within an organization – employees, management, customers, and suppliers, in order to meet or exceed customer satisfaction [5]. This latest philosophy of QMS is termed Total Quality Management (TQM) because it encompasses all

stakeholders within and outside an organization; it puts QM responsibility directly in the hands of everyone involved in a company. Although Cua et al. presents TQM as a manufacturing system, many authors argue that it is equally relevant to service industries/companies [1], [6]. Some of the literature available suggests a strong relationship between strategic decision to implement TQM and reduction in manufacturing process variations, elimination of rework and scrap, and an improvement in quality performance [7]. This direct and positive relationship is a focus of this study and it can be a topic for further exploration in the automotive industry, considering the quality challenges the sector has experienced, e.g. recall actions due to poor quality of products resulting in safety problems and lawsuits – Takata airbag recalls for over 34 million vehicles worldwide.

Productivity

Productivity is widely accepted as the ratio of outputs to inputs. Various mathematical equations have been formulated and are in use but Bernolak [8] takes a step beyond mathematical definition by stating, “... productivity means how much and how well we produce from the resources used.” Management and shareholders of manufacturing companies view this key performance indicator with high level of importance, as it is an indicator of sustainability. Shareholders have a reason to put pressure on organizations to improve productivity but efforts spent need to be balanced against resources used to determine effectiveness and efficiency [8]. Companies, which use more resources to produce equal or lesser outputs, are considered to be a risk and are not lucrative for investors.

The relationship

Many researchers have devoted time to unpacking the nature of relationship between quality (TQM) and productivity (performance) with conflicting views presented – some authors finding a positive link, others failing to find a significant link, while others argue that TQM is a management fad and could not have any significant link to performance [10-11]. In his literature review, Terziowski makes reference to a list of researchers who applied “generally accepted standards of methodological rigor” to test the relationship quality

management practice and organizational performance. Out of their work, the empirical evidence produced suggests that quality management brings about an increase in product/service quality and productivity, along with improved customer and employee satisfaction. In expansion of his 14 quality management principles, Deming advocates that quality and productivity are not incompatible but are mutually related concepts. His view, as supported by Mitra [2] is that productivity increases as quality improves, because there is less rework and waste is reduced. Their view is that defects (poor quality) that get into the hands of the customers cost a market share that leads to job losses. Mitra [2] argues that a quality control system reduces costs by removing scrap and rework, thus increasing the number of usable products and the efforts required to produce them. The importance of his argument to the study of a relationship between quality and productivity is in the statement, “quality control reduces efforts required to produce usable products,” which is core to the definition of productivity. Elimination of scrap and rework is important for automotive manufacturing industry that has been tarnished by major recall actions where customers are both inconvenienced for having to bring their products in for “rework” at the auto-dealers and also physically harmed due to defective sub-components.

Frustration raised by many automotive Original Equipment Manufacturers (OEM) who require their suppliers to adopt a quality management system and certify it to an international standard such as ISO/TS16949, is that such a system does not result in customer satisfaction [17]. OEMs, auditors and consultants within the industry argue that the number of customer complaints continue to rise even when adopted quality management systems are fully implemented and certified. It is this frustration that the study seeks to explore.

Al-Darrab [13] carried out a study looking at the relationship between productivity, efficiency, utilization, and quality. In his study, he outlined that an entity producing goods and/or services has measures of effectiveness and/or performance and focused his work on two measures of performance, i.e. quality and productivity. He adopted a unifying method for performance measures by using a formula (1) that

incorporates productivity, quality, utilization, and efficiency. Figure 1 depicts a pictorial relationship under review [15]. The flows how cause-and-effect relationship where better quality ultimately results in “minimum total cost of production.”



Figure-1: Correlation between quality and productivity

Mohanty and Yadav [14] brings a humanistic view to the relationship between quality and productivity by referring to the two concepts as twins. They argue that the recent changes in global economic environment lead to a requirement for the establishment of an initiative that allows a simultaneous address of these two important concepts, and further propose the adoption of TQM as a unifying philosophy. The Corredor & Goñi [10] argue that perhaps relationship between quality management is not so obvious and has to be understood from differing organizational perspectives. Their study casts doubt on previous research findings that suggest implementation of QMS invariably leads to performance gains. With the gap identified, it was necessary to validate if this gap currently exists at Bosch.

III. METHODOLOGY

This is a quantitative study; data from a South African engine component manufacturing company was used to test if there is a relationship between quality and productivity. Random sampling technique was used and data sample of 50 days production days (April – May 2015) was used and the results of this data were validated by the interview session with 10 Production Department and 5 Quality Department personnel. The sampled respondents were interviewed to draw conclusion of the current relationship between quality and production with the aim to improve productivity. Further face-to-face interviews were carried out in a

similar organization in India (sister company used above).

Regression analysis study was applied to data collected. Results of this study using the ANOVA method are shown in table 1.

IV. RESULTS AND DISCUSSION

SUMMARY OUTPUT								
<i>Regression Statistics</i>								
Multiple R	0.186510985							
R Square	0.034786347							
Adjusted R Square	0.01467773							
Standard Error	0.164216357							
Observations	50							
<i>ANOVA</i>								
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>			
Regression	1	0.046650836	0.046650836	1.729922352	0.194669407			
Residual	48	1.294416565	0.026967012					
Total	49	1.341067401						
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	0.893593259	0.036081946	24.76566139	5.42461E-29	0.821045644	0.966140874	0.821045644	0.966140874
X Variable 1	2.295711284	1.745436139	1.315265126	0.194669407	-1.213723284	5.805145852	-1.213723284	5.805145852

Table-1: Regression Analysis Results

Table-1 presents the descriptive statistics using regression analyses is method where quality (percentage of rejected parts) is an independent variable and productivity is the dependent variable according to a simple Linear regression formula (2) [18]: $Y = a + bX$ Where a is the calculated d effect level; b is the intercept; X is the scope of the regression line; Y is 0 productivity 1levels; and e is a random error.

According to the results, a positive correlation coefficient, (2.296) exists between the two variables- a factor suggesting a strong relationship in this study, i.e. when scrap is reduced (meaning quality is improved, productivity rise s. The coefficient of determination was, however, calculated at 0.035, much less than an idea l value of 1 that indicates a strong relationship between variables. The results obtained support the bulk of literature materials and opinions raised by OEM’s. Data and results obtained in this study were validated through unstructured interviews with production and quality departments’ person 1. Summary of key inputs from the interviews is given in table 2.

Production Department	Quality Epartment
1. Quality is important but not treated as a priority by shop-floor management.	1. Productivity has to be balanced against quality performance – current status Favours’ productivity.
2. Quality is often a lip service, only enjoying attention before and during audits/visits.	
3. Machine Operators are not empowered to take a stand against production of defective parts.	2. Production and Quality departments need to work more as a team rather than in competition.
4. Training is only aimed at skilling persons on how to produce parts; little/no attempts is given to understanding the impact of scrap/defects.	3. Training of shop-floor leadership has to be improved to cater for changing customer requirements.
5. General victimization of those who take a stand against bad quality.	

<p>6. Quality incentives (bonu) not Structured to motivate.</p> <p>7. Visibility/support from quality Department is insufficient.</p>	<p>4. Management support required across the company for quality objectives to be reached by all.</p>
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Table-2: Summary: Interview Results

Feedback obtained in the interview s supported data analysis results and majority of literature review. Views expressed, b y personnel from both departments on the dynamics of relationship between quality and productivity within the plant were similar, and almost all agreeing that a negative quality performance has a negative impact on productivity. Others went on to reposed potential improvement points to ad dress the problems identified, among others being compulsory training in quality management systems, adoption of quality tools such as six-sigma, and promotion of lean manufacturing philosophies. Discussion on challenges in the automotive industry the automotive industry has seen challenges of quality and productivity. Figures 1 – 2 summarize these potential cases of these challenges in an Ishikawa method. These causes’ effects are only some of the general factors contributing top or quality and productivity in the automotive manufacturing industry. Differences in the factors will be seen from one region to another, based on level of technological advances, skills, labor laws, and government support.

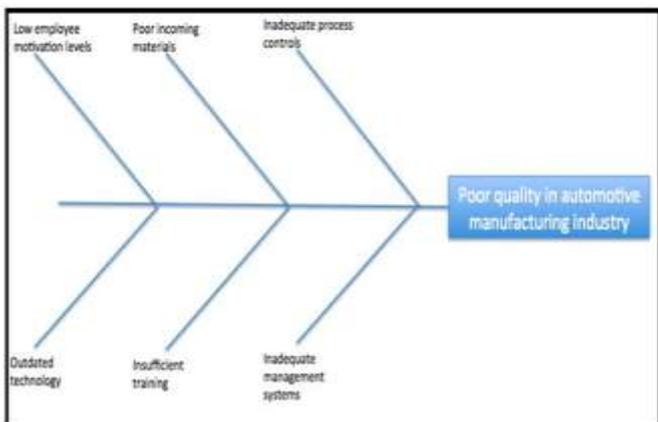


Figure-2: Cause-and-effect: Poor quality in automotive industry

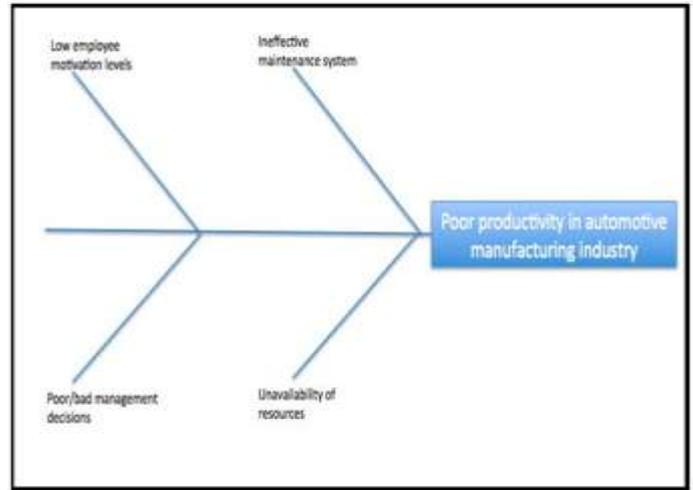


Figure-3: Cause-and-effect: Poor productivity in automotive industry

Although quality and productivity performance related data in automotive industry is mainly protected information, it i of public knowledge that an apparent conflict exists between those responsible for quality and those responsible for production as highlighted by Mitra [2] and supported by data analysis and interview results from this study. n two medium-sized engine components manufacturing plants used for this study in South Africa and India, constant battle i fought between keeping quality of output s to a standard that will satisfy customers and reaching daily production targets. Those responsible for productivity, mostly production departments, Are acc used of no taking I to consideration Quality requirements by not readily volunteering to halt Manufacturing processes when excessive Quality defects are realized. Similarly, those championing quality, mostly from quality departments are accused for being petty and over-exercise their authority b y interrupting operations for even minor quality concerns that might not lead to customer complaints. For many years, the manufacturing plant from which stud y data was obtained has seen this conflict playing itself out on a frequent basis. The same conflict is a representation of power dynamics between quality and productivity in most other automotive companies. This stud y seeks to find possible causes of the conflict and open a discourse for further studies into this area. As this conflict folds in the plants, internal And external quality targets are not reached – scrap/rework (measured as a percentage of

total manufacturing costs) and parts failing at customers (measured in parts per million) continue to trouble management and other stakeholders. Productivity targets are also threatened and reliance on overtime and special productions shifts becomes a permanent but costly intervention to catch up on lost time.

Although many factors can be attributed to poor productivity and quality, as seen in Figures 1 – 2 with some being similar for both, the impact of poor quality on productivity as seen in the data analysis results in this study remains part of the discourse in the industry. Causes of the conflict herein stated has to be determined and addressed for a harmonious relationship that supports overall objectives of the company. Breaking down the barriers between quality and production departments is but one of measures proposed by quality gurus (Deming's Quality Management principle 5 of 14). The assertion is supported by some of the interviewees who stated, "Production and quality departments need to work more as a team rather than in competition".

V. CONCLUSION

The significance of automotive manufacturing companies to economic growth puts them at a strategic position in many countries. 51% of the global automotive sales in 2010 were in emerging markets and the trend was expected to accelerate [16]. Foreign Direct Investments amounted to \$74 billion in USA in 2014. With such an important sector of the economy, investors take interest in ensuring returns and those interests have to be protected by those tasked to do so – managers taking the lead. Conflict between those responsible for productivity and those championing quality has to be managed to protect the interests of those investing, employed, and using products from the industry. Managers have to be aware of the conflict and manage it by adopting relevant strategies available to them. Similarly, companies have to be aware that no one strategy is perfectly suitable to all companies and circumstances. This study sought to determine the dynamics of a relationship between quality and productivity in the automotive manufacturing industry. The results of the study supported our hypothesis that there is a strong relationship between productivity and quality in the industry by using a regression analysis

model and interviews with personnel from production and quality departments. The results from this study complement and extend the available literature on the subject and call for more research in the industry. Researchers should devote time to study causes of quality/productivity conflict in the industry and propose possible measures on how to manage it, and expand on work completed on the impact of TQM on performance. Observations in an Indian plant suggest that a Value Stream Ownership (Management) strategy is vital to managing conflicts herein stated. With this strategy and as compared to functional/departmental common practice, managers are given similar key performance indicators and for this, it becomes difficult for a conflict to manifest. This practice has not been well documented and also becomes a potential for investigation in the industry. Nature and extent of recent automotive recalls is financially exhausting for the companies affected, but equally troubling for the customers affected. With this acknowledgement, any conflict between quality and production has to be addressed.

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REFERENCES

- [1] J. S. Oakland, Total Quality Management, 2nd Edition. *Butterworth Heinemann*, pp. 362, 2000.
- [2] Mitra, Fundamentals of Quality Control and Improvement, 3rd Edition. *New Jersey: John Wiley and Sons*, pp. 33 – 35, 2000.
- [3] G. Benavides- Chicón, B. Ortega, The impact of quality management on productivity in the hospitality sector. *International Journal of Hospitality Management*. 42, 165 – 173, 2014.
- [4] International Standards Organization, ISO900:2005 Quality Management Systems – *Fundamentals and Vocabulary, 2005*.
- [5] K. Cua, K. McKone, R. Schroeder, Relationships between implementation of TQM,

- JIT, and TPM and manufacturing performance. *Journal of Operations Management* (19) 675 – 694, 2001.
- [6] V. Vrtiprah, B. Ban, Productivity and quality in the hotel industry. *Ekonomiska Misao I Praska* 9 (2), 175 – 187, 2000.
- [7] V.K. Chong, M.J. Rundus, Total quality management, market competition, and organizational performance. *The British Accounting Review* (36), 155 – 172, 2004.
- [8] Bernolak, Productivity: the basis of competitive and world prosperity. *International Journal of Production Economics*, 52 (1-2), 203 – 2013, 1997.
- [9] T. Nenzhelele, Factors influencing the productivity of small and medium enterprises (SMEs) in South Africa. M. Tech Dissertation – *Tshwane University of South Africa*, 2009
- [10] P. Corredor, S. Goñi, TQM and performance: Is the relationship so obvious? *Journal of Business Research* 64, 830 – 838, 2010.
- [11] M. Terziovski, Quality management practices and their relationship with customer satisfaction and productivity improvement. *Management Research News* 29(7), 414 – 424, 2006.
- [12] T. Iqbal, Investigating the role of quality management and productivity: An analysis of quality and productivity in Pakistani manufacturing companies. PhD Thesis at *School of Management University of Bradford*, 2012.
- [13] I.A. Al-Darrab, Relationship between productivity, efficiency, utilization, and quality. *Work Study* 49 (3), 97 – 104, 2010.
- [14] R.P. Mohanty, O.P. Yadav, Linking the quality and productivity movements. *Work Study* 43 (8), 21 – 22, 1994.
- [15] S. Kumari, Anurhadha, S.K. Sharma, How quality affects productivity and price in manufacturing industries. *International Journal of Application or Innovation in Engineering & Management*, 2013.
- [16] Automotive Industry – Wikipedia. https://en.wikipedia.org/wiki/Automotive_industry#Economy, Accessed 31 May 2015.
- [17] David, D. Stables, Study on the effectiveness of the application of ISO/TS16949:2009 within the South African Automotive Industry. *United Nations Industrial Development Organization*, 2015.
- [18] Render, R. M. Stair Jr, M. E. Hanna, and Quantitative Analysis for Management 10th Edition. Upper Saddle River: *Pearson International Edition*, 2009.
- [19] United Nation Senate, Danger behind the wheel: The Takata Airbag Crisis and How to Fix Our Broken Auto Recall Process. *Committee on Science, Commerce, and Transportation*, 2015.

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