Effectiveness of Housekeeping Methodology on Productivity in the Automotive Parts Manufacturing Organisation in South Africa

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Abstract

The majority of South Africans expect greater prosperity that can be accomplished through greater employment and high productivity. Thus, the need for productivity improvement in South Africa should be uppermost in both the public and private sector's agenda. This can be achieved by implementing an effective management system that has a bearing to improved business performance. This sentiment underpins the concept of housekeeping methodology, namely, the 5S. 5S is a housekeeping philosophy represented by the practical approach for sorting, set in order, sanitise, standardise and sustain. As a result, this study evaluates the effectiveness of 5S on productivity in the automotive parts manufacturing companies in South Africa. 5S is an approach designed for achieving overall organisational cleanliness and standardisation at workplace that is motivating and pleasing to all the employees in the organisation. The study was quantitative in design and examined the production and related experiences of the automotive parts manufacturing company that has adopted a 5S strategy. The Ordinary Least Squares (OLS) model, using Statistical Package for Social Sciences (SPSS) was used to analyse data. The company operates in the eThekwini District Municipality in KwaZulu-Natal. The study was achieved by collecting pre- and post-quarterly data for machine downtime and labour production output rate. The results establish that machine downtime has a relationship and statistically significant to productivity. However, productivity has no relationship with both the 5S and labour production output.
This study uncovers the strengths and weaknesses of 5S strategy on productivity in the automotive parts manufacturing organisations in South Africa.

Keywords: *automotive; business performance; cleanliness; housekeeping; machine downtime; organisation; productivity; standardisation; 5S.*

1. Introduction

Productivity performance is one theme that has generated tremendous interest amongst economic scholars for decades. A common thread running through this discourse is a strong affirmation of the central place of productivity enhancement in the precipitation and perpetuation of growth (Venter, 2004). In developing countries, the need to improve productivity performance is particularly useful given the less favourable economic circumstances that confront most developing countries. In the competitive world of manufacturing, organisations face challenging problems such as quality losses, production downfall, material wastage, safety, and employee-related issues (Golroudbary and Zahraee, 2015). These problems weaken their growth. The two significant challenges such as competitiveness and efficiency of firms, have impelled the number of manufacturing organisations to implement innovative management strategies (Zahraee, Hashemi, Abdi, Shahpanah and Rohani, 2014). This includes the housekeeping strategies like 5S.

The 5S principles have emerged from Japanese Toyota Production System (TPS) in the mid-1950s for realising significant improvement in the process performance. Its methodology has emerged as a strategic business process improvement strategy widely deployed by manufacturing, as well as service organisations to enhance their manufacturing performance. 5S philosophy has emerged from five Japanese terms- *Seiri*, *Seiton*, *Seiso*, *Seiketsu* and *Shitsuke* which stand for sorting, set in order, sanitize, standardise and sustain; respectively (Ho, 1997). It is a methodology for creating well-defined organisation, neat and clean, highly efficient, productive and quality workplace. Since its origin, the practice of 5S has been recognised as the base foundation for quality improvement programmes which significantly improve organisational working environment and industrial management processes (Ho, 1999a). Takshi Osada has been envisioned as the pioneer in introducing the concept of 5S in the Japanese organisations as a philosophy of improving lifestyle through the strategy of organisational development, learning and change (Kobayashi, Fisher and Gapp, 2008). Hiroyuki Hirano proclaims an alternative approach of 5S with a practical approach, treating it as a tool of eliminating waste from the workplace to enhance competitive position among other organisations (Khanna and Gupta, 2014). Osada (1991) and Hirano (1996) proclaim their different visions and views regarding the concept of 5S. Takashi Osada's vision about 5S is more of conceptual management philosophy. However, Chapman (2005) describes the housekeeping methodology of 5S as a potential to effectively manage and organise various operational activities for the production of defect free products with less human energy, time, capital, wastage and cost. 5S principles facilitate an organisation to sustain continuous

improvement, with better safety standards throughout the organisations (Ho, 1999a).

Hirano (1995) proclaims that 5S steps are designed to improve efficiency, strengthen performance and provide continuous improvement in virtually all segments of the organisation. These steps involve a structured improvement programme with a series of identifiable steps related to each other in progressive manner. As the words are related to Japanese language, Ho (1999b) has removed the complexity of Japanese words so that it can be easily understood and adopted by various organisations across the globe for realizing significant organisational performance improvements. Some organisations find it hard to imbibe 5S principles and believe that it is only a clean-up process and too busy to implement it (Hirano, 1995). Patten (2006) has emphasised that 5S is much more than clean-up. It is a philosophy for systematically achieving overall organisation cleanliness and standardisation at workplace that is motivating and pleasing to all the employees in the organisation. 5S is a philosophy for reshaping the workplace and providing foundation for significant improvements at workplace. It changes the approach of the employees toward their work, workplaces and improves communication among various business functions and departments. A well-organised workplace provides a safe and efficient production environment, which boosts the employee morale, promotes the feeling of ownership, pride in their work and ownership of their responsibilities. Since its introduction and acceptance by Japanese's firms in Japan, 5S practice has been successfully deployed in many countries around the world. Hence, this study evaluates its effect on productivity. It is guided by the following research questions (RQs):

- RQ1: Is 5S an appropriate methodology for productivity improvement in the automotive parts manufacturing organisations in South Africa?
- RQ2: Is 5S a suitable methodology for the reduction of machine downtime for productivity improvement in the automotive parts manufacturing organisations in South Africa?
- RQ3: Does 5S has the ability to increase labour production output for productivity improvement in the automotive parts manufacturing organisations in South Africa?

2. Problem statement: Low productivity level in South Africa

South Africa experiences a slow productivity growth of -0.4% in 2014 (Zondo, 2018), as well a decline in total factor growth of -3.3% (Conference Board, 2015). Consequently, companies are faced with the challenge of promoting innovation in productivity improvement among employees (Zondo, 2018). Their productivity in the manufacturing sector is low when compared to Korea, the United States of America (USA), Taiwan, Japan, France and the United Kingdom (UK) (Klein, 2012). It is against this background that the study focuses on 5S, given the low productivity levels in the South African manufacturing industries (UNIDO, 2013). Hence, this study investigates whether 5S can increase productivity in the selected automotive parts manufacturing companies. It explores the suitability of 5S as an appropriate tool for productivity improvement.

The rest of the paper discusses the literature that was reviewed in this study, the methodology employed, study results, as well as the discussion of results. In addition, it deliberates on the implications of results for policy and practice, study limitations, conclusion, as well as future research required.

3. Literature review

This section presents an overview of 5S. It discusses the effect of 5S on productivity. The 5S as a strategic tool for business performance concludes the theoretical context of the study.

3.1. Overview of 5S as an improvement tool

5S is an outstanding Japanese philosophy for the development of any type organisation all over the world (Randhawa and Ahuja, 2017). It is a Japanese philosophy that imbibes its cultural and societal values for improving motivation, ethical values of all employees in the organisation. The Japanese principles of Shintoism (cleanliness of mind), Confucianism (Orderliness) and Buddhism (self-discipline) have led to the evolution of 5S philosophy (Dogan, Ozkutuk and Dogan, 2014; Ikuma and Nahmens, 2014). These principles are frequently referred by Shinto (the way of the Gods: Shintoism), do (methodology), butsudo (Buddhism) and (kendo, jyudo, and karatedo) martial arts for training mind and body through discipline (Sugiura and Gillespie, 2002). During 1950-1955, Japanese had pioneered the evolution of first two 2S elements (*Seiri*, *Seiton*), and thereafter TPS facilitated evolution of first 2S to today's 5S elements (*Seiri*, *Seiton*, *Seiso*, *Seiketsu* and *Shitsuke*) and promoted 5S applications to other industries later on (Sawada, 1995). 5S principles are often associated with productivity and quality initiatives is being used to examine each job process in order to eliminate routine and wasteful activities that pose potential safety hazards (Becker, 2001). Some researchers emphasise that 5S concept has its origin from Japanese values and ethics from the times of Samurais and it came into existence after World War II through TPS to attain improved quality, productivity, employee's morale value, safety and delivery goals (Gao and Lowa, 2014). A few researchers also emphasise that the concept of 5S is the fundamental requirement for the operation of TPS (Monden, 1998). Many researchers argue that successful implementation and practice of 5S in any organisations requires a total commitment from top management to bottom level employees of the organisations. They believe that 5S practice must be the integrated part of the management system for every organisation (Hirano, 1996; Ho, 1997; Bicheno, 1998; O'hEocha, 2000). While some authors emphasise on certain other factors bearing significant impact on 5S implementation such as the need to change, evolving organisational goals and objectives, culture, communication among employees, time policy management, the execution of each S in systematic manner by 5S team, leadership, maintaining basic requirements of programme to start and maintenance of 5S system. 5S technique significantly improves the environment, safety and health standard of the organisations (Young, 2014; Srinivasan, Ikuma, Shakouri, Nahmens and Harvey, 2016).

It must be emphasised that 5S is a method to enhance the quality standards of both product and process, cut down operation costs and improve the process performance (Liker and Hoseus, 2008). It helps in providing order and discipline in the organisation with the supervision on even the smallest details of company (Erdal, 2007). 5S initiatives facilitate continuous improvement of the work environment by reducing non-value adding activities for improving the efficiency, safety and better controlled of work area. The effectiveness of 5S implementation depends significantly upon certain human factors like employee commitment, training, competencies and sustainability initiatives (Ebadi, Safari, Habibi, Akbari and Rezapour, 2015). Young (2014) proclaims that 5S encourages streamlined inventories, clutter-free workspaces, and processes to maintain housekeeping standards. Its tool is used in healthcare to reduce inventory, create space, and reduce travel and search times. Khanna and Gupta (2014) have conducted the case studies regarding the effectiveness of 5S and TQM implementation in the Indian organisations. The successful implementation of 5S results into the implementation of TQM which further significantly improved quality, productivity, time delivery, safety, employee's morale values and cost optimisation in the Indian organisations to make them more competitive in the global market. Sanchez, Rodriguez, Maruyama and Salazar (2015) have deployed 5S methodology for improving manufacturing processes at Colombian Small and Medium Enterprises (SMEs). The study

validated the existence of positive relationship between the manufacturing performance factors and implementation of 5S methodology with evidence of improvement in productivity (83% - 68%) and quality (36% - 67%) based on performance measurements, as well as improvement of the organisational climate (18% - 33%). Ishijima, Eliakimu and Mshana (2016) have established that 5S implementation approach has significantly contributed towards reduction of patients' waiting time at outpatient departments (OPDs) of hospitals in Tanzania leading to improved satisfaction of clients for both patients and health workers. The implementation of 5S methodology not only play significant role in the development of manufacturing sector, but it also make remarkable evolution in defence, banking, mining, agriculture, hospitals and construction sector (Randhawa and Ahuja, 2017).

3.2. The effect of 5S on productivity

The operational practices of 5S have been associated with better performance in many studies of world-class manufacturing (Sakakibara, Flynn, Schroeder and Morris, 1997; Shah and Ward, 2003). More particularly, quality management practices also allow organisations to achieve similar improvements in the manufacturing performance (Mann and Kehoe, 1994; Flynn, Schroeder and Sakakibara, 1995; Martı´nez-Lorente, Dewhurst and Gallego Rodriguez, 2000; Merino, 2003). Specifically, 5S implementation helps to organise the work environment, standardise the work flow and assign clear ownership of process to employees. Its implementation yields fast production results. Hirano (1995) in Japan, and Hartmann (1992) and Willmott (1994) in Western companies, showed that some companies have enhanced their competitiveness through the combined application of total productive maintenance and 5S. Kumar, Antony, Shingh, Tiwari and Perry (2006) show that the 5S system helps to increase productivity by reducing idle time in some processes, and also ensured the health and safety of employees. Gapp Fisher and Kobayashi (2008) linked manufacturing improvements to the creation of a better workplace when 5S was implemented.

3.3. 5S as a strategic tool for business performance

5S is the foremost technique required for the superior efficiency in the production and quality of products through waste elimination. This is a main reason behind the practice of 5S at a workplace of any organisations (Pheng and Khoo, 2001). It is the methodology of building the quality work environment with desired standards and strongly support of continuous improvement in the organisations. Due to its effectiveness, it has emerged as a popular practice in the manufacturing and services organisations of Japan and western world (Ho and Cicmil, 1996). As the 5S words are typically related to the Japanese language, different authors have removed the complexity of language for better understanding and applications in the western organisations as depicted in Table 1 (Ho, 1999a).

Japanese language	English language	Meaning	Importance
Seiri	**Sort (organize)**	Sort unneeded items	Effectively manage and utilise space, time, energy, money and other resources
Seiton	**Set in order**	Priority wise orderliness of items	A place for everything and everything in its place
Seiso	**Shine**	Cleanliness of workplace and floors	Provision of neat and clean, healthy environment where all employees enjoy their work
Seiketsu	**Standardise**	Maintenance of organisation, orderliness and cleanliness	Assuring the maintenance of previous 3S and prevention of workplace to become worse again in future
Shitsuke	**Self-discipline**	Constantly following the specified standardised procedures	Develop the proactive change in the behavior of employees for sustained 5S implementation

Table 1. 5S and its importance (Ho, 1999a)

The comparison of 5S frameworks provided by Hirano (1995), and Kobayashi, et al. (2008) has evaluated the differences of thinking process regarding the 5S in Japanese and western organisations. The Japanese organisations recognise 5S as a philosophy in Japan while western organisations take 5S as a technique or tool in the UK and USA. The fundamental fact of 5S is that it minimizes the cost by maximizing the effectiveness, efficiency, and performance through the sustainability of high-quality working environment (Liker and Hoseus, 2008). The implementation of 5S technique needs commitment from the top management and the bottom level employees of the organisations because it is a team-based process improvement tool for error proofing, safe and well-organised culture of the organisation (Brayer and Walsh, 2002).

Some western organisations still have the perception that 5S is just housekeeping practice (Chin and Pun, 2002). But 5S is far more than housekeeping. If it is successfully implemented, it assists to minimise waste, in process inventory, unplanned downtime, and improve the working conditions (Kobayashi et al., 2008). It is a systematic approach for managing the manufacturing operations with less human effort, capital, workspace, and timely delivery of defect free products to their customers (Chapman, 2005). Tice, Ahouse and Larson (2005) have proclaimed that 5S technique significantly contributes to crucial strategic priorities of every manufacturing organisation such as productivity, quality, costs, delivery, safety, and morale. A large number of researchers have proclaimed that 5S has significantly emerged as a support, foundation, starting point, and baseline of various organisational management techniques like lean thinking, ISO 9000, Six Sigma, Kaizen, TPM, ISO 14001, TQM, JIT, and continuous improvement (Hirano, 1996; Imai, 1997; Ho, 1999b; Bamber, Sharp, and Hides, 2000; Suárez-Barraza and Ramis-Pujol, 2012). However, this study investigates whether 5S has the ability to improve productivity in the automotive parts manufacturing sector. It explores the suitability of 5S as an appropriate tool for productivity improvement.

Hypothesis

The study is based on the following assumption:

H1: The implementation of 5S leads to productivity improvement in the automotive parts manufacturing companies.

H1o: The implementation of 5S does not lead to productivity improvement in the automotive parts manufacturing companies.

The following are sub hypothesis:

H2: An increase in machine downtime rate increases company productivity in the automotive parts manufacturing organisation.

H2o: An increase in machine downtime rate decreases company productivity in the automotive parts manufacturing organisation

H3: An increase in labour production output rate increases company productivity in the automotive parts manufacturing organisation.

H3o: An increase in labour production output rate decreases company productivity in the automotive parts manufacturing organisation

4. Methodology

The method for this research will be discussed under the following headings, namely: research design and approach, company that participated in the study, data collection, as well as the measurement and data analysis.

4.1. Research design and approach

This study was quantitative in nature. It examines the relationship of company productivity as a dependent variable to labour production output, as well as machine downtime. Bryman and Bell (2007) explain that the quantitative approach involves the use of statistical procedures to analyse the data collected. Consequently, after the measurements of the relevant variables, the scores were transformed using statistical methods. In addition, the study adopted a panel data analysis. According to Curwin and Slater (2002), panel data analysis is the statistical analysis of data sets consisting of multiple observations on each sampling unit. It contains more degrees of freedom and less multicollinearity than cross sectional data thus improving the efficiency of econometric estimates (Bryman and Bell, 2007). For this study, the pre-and post-5S data that were collected overtime from the automotive parts manufacturing organisation were analysed using the regression model. The study was also conclusive in design. Conclusive studies are meant to provide information that is useful in decision-making (Yin 2008).

4.2. Company that participated in the study

A convenience sample from one large automotive parts manufacturing organisation situated within the eThekwini District Municipality in the province of KwaZulu-Natal in South Africa was used. The company had adopted a 5S strategy and agreed to participate in the study. It had 1307 employees and operates a three-shift system. Table 2 presents a percentage breakdown of employees in terms of their level of activities.

Level of activity		Percentage
1.	Plant management	3.1
2.	Support administration staff	11.0
3.	Team leaders	5.2
4.	Line functional employees	80.7

Table 2. Percentage breakdown of employees in terms of their level of activities
Source: author's own analysis

4.3. Data collection

The collection of data from the company that participated in the study was carried out in two phases, that is, the collection of pre- and post-5S results by the Health and Safety team leader from the operational records relating to housekeeping. The data for labour production output and machine downtime were kept on the System, Applications and Products (SAP) version 6.0 data management programme. The collection of such data over time provided a greater capacity for capturing the complexity of 5S changes than using the one group post-test design that involves the collection of only the post-data after the changes have been implemented, resulting in threats to internal validity (Bryman and Bell, 2007). The validation of data from SAP programme was done by the researcher. This was achieved by comparing data from SAP with the documented data kept on files for accuracy.

This involved the collection of pre-and post-5S results from company records for both labour production output and machine downtime. The pre 5S results were quarterly data reflecting the company's performance over the two-year period prior to 5S implementation. This includes data from the first quarter of 2014 to the final quarter of 2015. The post 5S data reflect the company's performance for two years after 5S was implemented. This includes data from the first quarter of 2016 to the final quarter of 2017.

4.4. Measurement and data analysis

The company's quarterly time series data on labour production output and machine downtime were used. The measurements were based on a total of 64 observations. According to Westland (2010), there is no rule regarding the minimum number of observations for a balanced data panel. However, 50 observations are acceptable but more than 100 is recommended (Bryman and Bell, 2007). The regression model used was of the Ordinary Least Square (OLS) variety. The choice was influenced by data constraints. However, the model provided the statistical method that enabled the researcher to examine the relationship between the variables effectively.

A dummy variable which assumed the value of 0 and 1 to represent the pre and post 5S, respectively, was introduced into the ordinary least squares (OLS) model. The aim was to isolate the pre and post productivity effects. Consequently, if 5S proved to be a useful strategy in raising productivity levels, this would result in a statistically significant coefficient on the dummy variable.

The OLS model used was as follows:
$Productivity = B_o + B_1$ *labour production output* $+ B_2$ *machine downtime* $+ B_3$ *Pre/Post-Dummy.*

Where B_o is the constant
B = coefficient of the independent variables

The above model identifies productivity as a function of labour production output and machine downtime. Data was analysed using Statistical Package for Social Sciences (SPSS) version 25. It enabled the 5S data that was obtained, quarterly, over the multiple period time from the same operational division, to be appropriately analysed. Hence, the results provided the unbiased estimations (Yin, 2008). Furthermore, the OLS was based on the fixed effects model. The fixed effects is a statistical model in which the model parameters are fixed (that is, non-random quantities) (Curwin and Slater, 2002). Consequently, the variables were collected, quarterly, from the first quarter of 2014 to the last quarter of 2017 from the same company.

For the study to achieve its objectives, the normality test was conducted using Kolmogorov-Smirnov and Shapiro-Wilk for the overall score of the constructs. Table 3 present results for normality tests for labour production output and machine downtime.

	Kolmogorov-Smirnov[a]				Shapiro-Wilk		
	Group	Statistic	Df	Sig.	Statistic	df	Sig.
Labour production output	0	0.175	8	0.200*	0.879	8	0.084
	1	0.185	8	0.200*	0.915	8	0.248
Machine downtime	0	0.132	8	0.200*	0.935	8	0.437
	1	0.175	8	0.200*	0.952	8	0.668

*. This is a lower bound of the true significance
a. Lilliefors Significance Correction

Table 3. Normality tests for labour production output and machine downtime

Statistical tests in Table 3 revealed that the data were normally distributed ($p>0.05$). Hence the results were analysed using parametric test. That is, the t-tests.

5. Study results

This section analyses the results for pre-and post-5S means comparison, as well as productivity.

5.1. Pre- and post-5S means comparison

Table 4 compare means (in percentages) for labour production output and machine downtime.

No.	Variable	Pre-5S period (%)	Post-5S period (%)	% mean difference (pre – post)
1.	Labour production output	83.7	82.9	+0.8
2.	Machine downtime	4.3	3.0	+1.3

Table 4. Pre- and post-5S percentage means comparison
Source: author's own analysis

Table 4 indicates that the percentages mean data for pre-5S on labour production output and machine downtime is 83.7% and 4.3%; respectively. In addition, the percentage mean data for post-5S labour production output and machine downtime is 82.9% and 3.0%; respectively. The results shows an increase in mean values for labour production output and a reduction of machine down time mean values from pre-5S mean data to post-5S mean data. This indicates the influence of 5S in the organisation that participated in the study. Consequently, the next section 5.2 assesses productivity results as a consequence of 5S implementation.

5.2. Productivity results

Table 5 presents the results for productivity as a dependent variable to labour production output, machine downtime as well as post-5S dummy.

Regression	Coefficient	t-statistic	Probability
constant (B_0)	1.516	0.791	0.438
Labour production output	0.101	0.401	0.693
Machine downtime	-0.503	-2.162	0.043
5S dummy	-0.291	-1.062	0.301
R-squared	0.195	F-statistics	1.615
Adjusted R^2	0.074	Sum of squares	1.170
Standard Error of regression	0.491	Durbin-Watson stat.	0.650

Table 5. Results for productivity as a dependent variable to labour production, machine downtime, as well as post-5S dummy
Source: author's own analysis

Note: Regression data: 2014-2017 for 64 observations. The following OLS estimation is based on the equation:
Productivity = B_0 + B_1 labour production output + B_2 machine downtime + B_3 Pre/Post-Dummy.

5.2.1. Productivity as a dependent variable to labour production output

The results in Table 5 show that labour production output rate has no relationship to productivity. This is determined by its t-value of 0.401, which is below the critical t-value of 1.960 at the 5% level of significance (Curwin and Slater, 2002).

5.2.2. Productivity as a dependent variable to machine downtime

Results as illustrated in Table 5 show that machine downtime has a relationship and is statistically significant to productivity. This is determined by its t-value of -2.162, which is above the critical t-value of 1.960 at the 5% level of significant. The negative value indicates that an increase in productivity is a result of a decrease in machine downtime.

5.2.3. Productivity as a dependent variable to 5S dummy variable

Results show that 5S has no relationship to productivity. This is determined by its t-value of -1.062 and is below the critical t-value of 1.960 at the 5% level of significance, thus accepting the null hypothesis of relationship between these two variables. It has the adjusted R^2 of 0.074. However, the serial correlation is low at 0.650 when compared to the standard value of 1.73 at the 5% level of significance (Curwin and Slater, 2002).

6. Summary of results: Statistical tests and box plots

This section analyses data using factorial designs. It incorporates box plots to determine whether the factorial ANOVA assumptions of normality and homogeneity of variances have been met. Porkess (2005) explains that the populations represented should be normally distributed (that is, the normality), making the mean an appropriate measure of central tendency. However, the homogeneity of variance indicates that the population from which the data are sampled should have the same variance.

The Bartlett's test were also used to verify whether the variances were equal for all the samples (Curwin and Slater, 2002). The following Figure 1 shows the summary of the results from the Bartlett's test for homogeneity of variances.

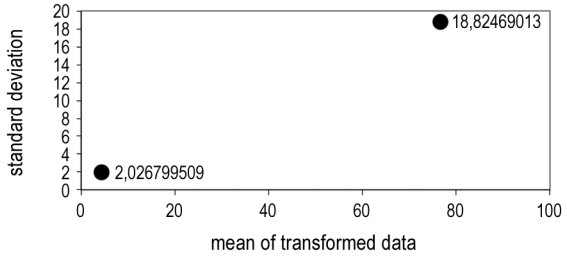

Figure 1. Bartlett's test for homogeneity of variances

Table 6 presents detailed results of Bartlett's test for homogeneity of variances for labour production output and machine downtime.

Variables	Means of transformed data	Standard deviations of transformed data	P-Value
Labour production output	77.231	18.825	2.060
Machine downtime	4.527	2.027	

Table 6. Bartlett's test for homogeneity of variances
Source: author's own analysis

The p-value in the Bartlett's test (at $p>0.05$) shows that the homogeneity of variance is violated. The p-value at 2.060 is above the significant level of 0.05. Therefore, the variances are not equal, given the amount of variability in the variances that can naturally occur in the data. The results are conformed by box plots in Figure 2.

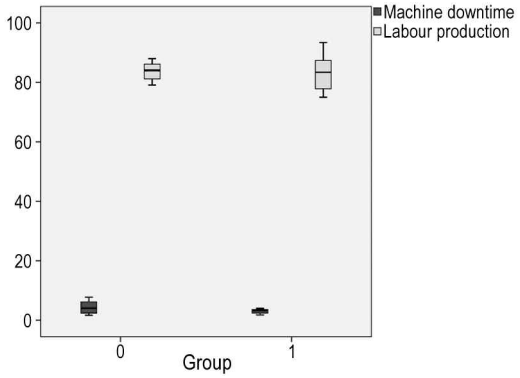

Figure 2. Box plots determining the normality and homogeneity of variance

Figure 2 shows that the mode of change from pre to post 5S period is homogeneous. However, the box plots indicates that the variances for machine downtime and labour production output are not equal. This was confirmed by Bartlett's test results.

7. Discussion

This study investigates the impact of 5S for the improvement of productivity in the automotive parts manufacturing company in South Africa. It examined the production and related experience of the parts manufacturing company that has adopted a 5S strategy within its processes. Quarterly time series data on labour production output and machine downtime were used to analyse data. Results from this study indicate that productivity has no relation to labour production output after the implementation of 5S. However, it revealed the relationship for machine downtime with productivity. Ishijima et al. (2016) indicated that the overall machine effectiveness in an industry requires a proper machine environment. This is achieved by maintaining the 5S systems in the machine surrounding. The availability, performance, quality rate and machine effectiveness of the plant will increment by implementing 5S practices (Randhawa and Ahuja, 2017).

8. Implications of results for policy and practice

Organisations in South Africa should revise their performance management system and develop 5S strategies, policies and practices that help to achieve new productivity goals and support organisational and cultural change (Khanna and Gupta, 2014). Besides the achievement of study objectives, the following conclusions can be made on the 5S philosophy:

1) It is system that assists to minimize waste and improve the working conditions.
2) It is the foremost technique required for the superior efficiency in the production and quality of products through waste elimination.
3) 5S implementation depends significantly upon certain human factors like employee commitment, training, competencies and sustainability initiatives (Ebadi et al., 2015).

9. Study limitations

The study was limited to an automotive parts manufacturing company within the eThekwini District Municipality. The investigation was conducted in a single company that has adopted 5S. As there are 378 registered automotive parts manufacturing companies in South Africa (SAinfo, 2016), the results cannot be extrapolated to other companies within the sector. Secondly, it did not examine the process followed during the 5S implementation including (amongst others) the individuals that participated in the implementation process. It only used quarterly time series data to determine the pre-and post-labour productivity effects resulting from 5S strategy. Lastly, the econometrics model used was of the OLS variety, solely due to data constraints. Future studies ought to use the more advanced Johansen VAR methodology or panel data analysis, both of which rely on large datasets.

10. Conclusion

Since its inception, the practice of 5S has been recognised as the base foundation for quality improvement programmes which significantly improve organisational working environment and industrial management processes (Ho, 1999a). Properly implemented and managed, the system has the ability to minimize waste and improve the working conditions. Consequently, the study revealed the relationship between machine downtime and productivity in the selected automotive parts manufacturing company after the 5S was implemented.

11. Future research required

During the course of this study, issues relating to the long-term survival of a 5S strategy after implementation were not covered. It is recommended that future research should examine the following issues in greater depth:

- when to use and when not to use 5S system;
- the applicability of a 5S approach to other industrial sectors;
- the process followed during the implementation of a 5S system; and
- a more comprehensive investigation should be carried out using a randomised sample of the registered automotive manufacturers that use 5S strategy to see if the results can be generalised.

The study investigated the impact of 5S in the automotive parts manufacturing organisation in South Africa. The pre- and post-5S quarterly data from company records were collected. It established that machine downtime has a relationship and statistically significant to productivity. However, productivity has no relationship with both the 5S and labour production output.

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