Available online www.jsaer.com

***Journal of Scientific and Engineering Research*, 2021, 8(9):207-215**

Research Article

ISSN: 2394-2630
CODEN(USA): JSERBR

The Factors that Affect Productivity: A Case of Soft Drinks' Bottling Companies

Ifeyinwa Faith Ogbodo[1], Charles Chikwendu Okpala[2], Emmanuel Utochukwu Ogbodo[3], Somkenechi Chinwe Okpala[4]

[1,2]Department of Industrial/Production Engineering, [4]Department of Electronic and Computer Engineering, Nnamdi Azikiwe University, P.M.B. 5025 Awka, Anambra State – Nigeria; [3]University of Nigeria Teaching Hospital, Ituku-Ozalla, Enugu State – Nigeria
Emails: if.ogbodo@unizik.edu.ng; cc.okpala@unizik.edu.ng; emma.ogbodo@unizik.edu.ng; somkene82@yahoo.com

Abstract The need for improved productivity in any business or organisation is very vital as it leads to growth and increased profitability. The paper examined the factors that affect productivity in detail, and observed that while some factors that affect productivity have positive outcomes, others have negative outcomes. Five years production data collected for analysis from two soft drinks bottling companies in Nigeria were analysed using SPSS, and later validated with Matrix laboratory (Matlab). The results revealed that productivity was affected by using average scale of productivity each month from PI01-PI01, for 5years time series from 2016 to 2020. It was observed that while some of these factors have great impact on productivity, others can restrain productivity improvement. In conclusion, the paper pointed out that manufacturing companies should carefully analyse and prioritize the different strategies of improved productivity with regards to a company's conditions and peculiarities before selection and implementation of the productivity factors.

Keywords productivity, input, output, efficiency, production, manufacturing, raw materials, capital, energy, personnel

Introduction

The aim of all organisations is to attain their desired goals and objectives; productivity which is defined as the average measure of production's efficiency, and expressed as the output per unit of input, plays a very important task on how a firm attempts to accomplish their aim. As a measure of how identified assets are handled, to timely achieve goals both in quantity and quality, productivity is a basic component for success in establishments, as the ability to determine the factors that affect productivity is a requirement for the enhancement of performance.

Sreekumar, Chhabra, and Yadav [1], explained that productivity is the measure of the total efficiency or integrated efficiency of a company's staff, machines, equipment, type of raw material inputs, management's performance, as well as the efficiency of the entire system of production. They pointed out that it can be "computed and expressed as the ratio of average acceptable output per period by the total costs incurred through various resources (Labour, Input material, consumables, power utilized, capital, energy, material, personnel) consumed in that period."

Productivity can also be defined as the optimization of resources in an establishment for the attainment of the desired outcomes. These resources include capital, human resources, energy, land, machineries, etc. According to Afsharian et al [2], productivity "is making the best use of resources, labor, and materials in a scientific way

to reduce costs and satisfy the personnel, managers, and consumers." They explained that it is like a culture whose objective is to make activities more systematic, and also an attempt to maximize profit from labor, land, capital, equipment, etc. to improve social well-being.

Also defined as the optimization of resources like personnel, capital, equipment, land etc., productivity is computed by the division of the average output over a period by the total resources or expenditures expended within the stipulated time. Commenting on the need for in productivity by manufacturing companies, Okpala [3], pointed out that manufacturers cannot be able to enhance productivity in today's market without first improving their efficiency and productivity in order to have competitive advantage over their competitors.

Productivity can also be explained as the objective for maximization in a manufacturing process, and a gauge for the determination of overall efficiency of a production process which should be optimized for enhanced output. The need for the improvement of productivity in today's manufacturing sector cannot be over-emphasized as Okpala, Anozie, and Mgbemena [4], opined that in the present day manufacturing, that efforts have shifted from achieving the customer's requirements to exceeding his expectations.

The Factors that Affect Productivity

Low productivity does not only retard progress in organizations, but it also has dire consequences like the inability to meet up with objectives, huge financial consequences, low output, loss of customers, retardation, and most importantly revenue reduction. Okpala et al [5], pointed out that the improvement of a manufacturing firm's productivity leads to a significantenhancement in its production, and also enables the aggregate supply curve to move towards the right hand side. They explained that as increase in productivity is the major determining factor over a long period in a firm's per capita income, ithelps the company to manufacture its products at reduced cost, thereby leading to profit maximization.

It has been observed that while some factors that affect productivity have positive outcomes, others have negative outcomes. According to Cresnar and Nedelko [6], productivity factors with positive outcomes include creativity and identity processes, while those with negative outcomes entail low turnover and cooperation, absenteeism, as well as administrative inefficiencies.

Some of the factors that affect productivity are depicted in figure 2.

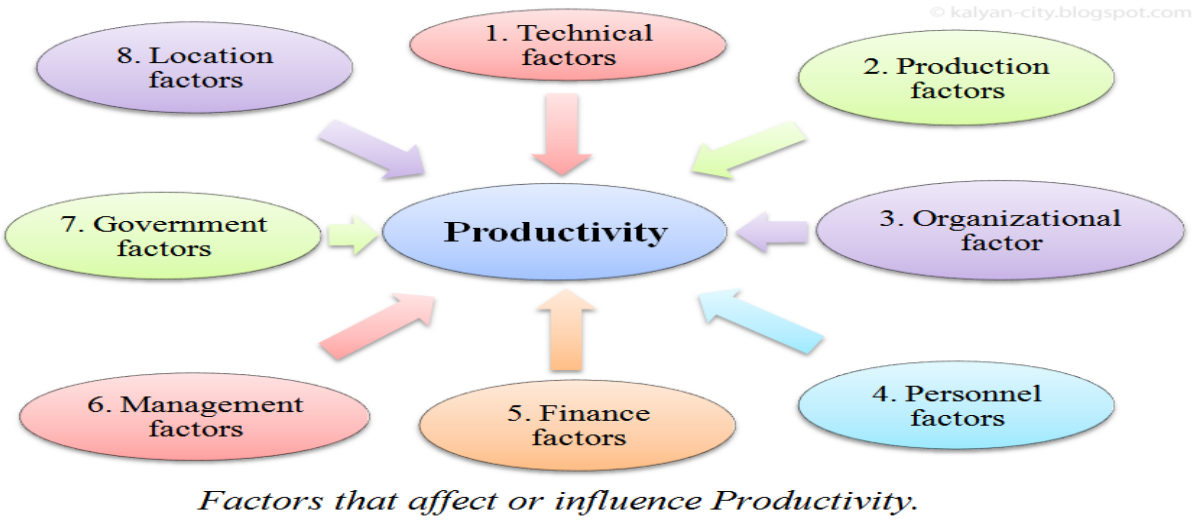

Figure 2: Factors that affect productivity [7]

Technical Factors

The enhancement of technology in a workplace greatly improves its productivity as an organization with the right computerization and automation, appreciable degree of mechanization, proper location and shop floor layout, as well as improved production processes will experience a better productivity.

Martin [8], observed that it is quite pertinent to note that technological change is very important for enhancing the level of productivity, as increasing technical factors enables an organisation to do more with less and also tremendously increase their productivity growth.

Production Factors

To improve productivity, organizations should ensure that production in all its units flow seamlessly through adequate synchronization, control, scheduling, and management. This will enhance productiveness as adequate inventory will be utilized in the production processes.

Organizational Factors

Specialization and division of labour in an organization promotes its productivity as it leads to the reduction and management of misunderstandings and conflicts.

Personnel Factors

The greatest assets that any organisation has are its human resources, productivity will therefore be highly improved when capable people are recruited and posted to the relevant positions. The need for the boosting of a firm's staff morale through motivation cannot be over-emphasized, as it enhances productivity. Afsharian et al [2], explained that experience has proved that the success of a firm lies mainly in its staff, asfarsighted companies always underscore the need for the enhancement of the quality of their personnel. They noted that such attitudes contribute immensely "to reduction of waste, improvement of quality, and consequently increased productivity."

Finance Factors

As finance is the life-blood of any organization which enables it to run effectively, the management of every firm should ensure appropriate financial planning in order to enhance productivity.

Management Factors

The productivity of every organisation hinges so much on the management factors, this is because a resourceful management is a very crucial factor in the well-being of any firm, as the production inputs like money, materials, manpower, and machinery cannot guarantee an organisational success without effective management. The management of organisations should therefore ensure that they embark on effective utilisation of available resources to achieve optimal output at the lowest cost. According to Ngige [9], the management factor's efficiency can be enhanced by training and developing the executives of an organization, as there is a definite relationship between the competence and performance of management and the facilities for developing managerial resources.

Government Factors

The government plays a very important role in the development and productivity of any nation, as their programmes and policies like institutional practices, education, strategic planning, legislation, economic policy, training, regulations, and fiscal policy have direct positive or negative effects on organisations in the country. Because productivity depends so much on government, proactive management should endeavour to have a sound understanding of the government's policies and laws, and also strive to maintain a good relationship with the government.

Location Factors

Location is another important factor that has direct impact in the productivity of any organisation, as productivity is also dependent on a firm's proximity to market and sources of raw materials, as well as the established law and order, and the availability of skilled workforce. A detailed list of factors that affect productivity is depicted in Table 1.

Table 1: A comprehensive list of factors that affect productivity [2]

Environmental Factors	Group Factors	Individual Factors
Labour market characteristics	Group structure or composition	Level of academic / technical education /
Economic situation	Individual skills within the group	Past training
Safety and job security	Overall skills of the group	Past experience / age
Minimum wages, salary payments	nature of work / assignment	Overall competence and skills
Use of technology / level of mechanization	Demography of team / nationalities	Motivation and morale
Climate and weather conditions	Cultural differences	Individual culture / attitude
Client requirements / project specific requirements	Language barriers	Individuals creativity
Site layout	Frequency of changes	Absenteeism
Political situation		Overall job satisfaction
		Overall communal feeling / belongingness
		Overall appreciation

Organizational factors	
Work timings / working hours	Reward schemes
Discipline / hierarchy order	Attainable goals and targets
Policies and procedures, method statements	Overtime
Management involvement, accountability, transparency	instant cash award schemes
	Contract system of work
Availability of materials / tools and equipment	Fair treatment of employees
Construction work complexity	Fulfillment of promises
Interruptions of work	Appraisal / feedback schemes
Competencies of supervisors	Freedom of expression and grievances
Leadership skills	Experience is valued
Systematic delegation	Welfare schemes
Level of communication	Camp conditions
Brand name of company	Lunch breaks / packets
	Recreation

Data Analysis

Productivity data from two soft drinks bottling companies in Nigeria were collected for analysis. Matrix Laboratory (MatLab) software was applied for the analysis of the primary data from the establishments. The results revealed that the firms' productivity was affected by using average scale of productivity each month from PI01-PI01, for 5years' time series from 2016 to 2020. It was observed that some of these factors have great impact on productivity, while others restrained productivity improvement.

This study proposes a new conceptual framework for examining the reasons that manufacturing firms decide to invest on reduction of idle staff and the acquisition of new machinery in order to improve their productivity. The research shows the impact of Automatics (machine and equipment) and worker's efficiency on firm's performance and productivity.

MATLAB Time Series for Productivity Impact of Company A (CA) and Company B (CB), on scale PI01-PI10.

CA & CB Year, JA 2016, FE 2016, MA 2016, AP 2016, MY 2016, JN 2016, JY 2016. AG2016, SP 2016, OC 2016, NO 2016, DE 2016.

TF_A 4, 4, 4, 3, 3, 3, 3, 4, 4, 4, 4, 4

TF_B 8, 8, 8, 8, 7, 6, 6, 6, 9, 9, 9, 9

PF_A 7, 7, 7, 7, 7, 7, 7, 7, 8, 8, 8, 8,

PF_B 6, 6, 6, 6, 6, 6, 6, 6, 7, 6, 6, 6,

PAW_A 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4,

PIW_A 8, 8, 8, 8, 8, 8, 8, 8, 8, 8, 8, 8,

PAW_B 8, 8, 8, 8, 8, 8, 8, 8, 8, 8, 8, 8,

PIW_B 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4,

FF_A 8, 8, 8, 8, 8, 8, 7, 7, 7, 7, 7, 7,

FF_B 8, 8, 8, 8, 8, 8, 7, 7, 7, 7, 7, 7,
CA & CB Year, JA 2017, FE 2017, MA 2017, AP 2017, MY 2017, JN 2017, JY 2017. AG2017, SP 2017, OC 2017, NO 2017, DE 2017.
TF_A 8, 7, 7, 7, 8, 8, 7, 6, 6, 6, 6, 7
TF_B 7, 7, 7, 7, 7, 6, 6, 6, 9, 9, 9, 9
PF_A 7, 7, 7, 7, 7, 7, 7, 7, 8, 8, 8, 8,
PF_B 7, 7, 7, 7, 6, 6, 6, 6, 7, 6, 6, 6,
PAW_A 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3,
PIW_A 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7,
PAW_B 8, 8, 8, 8, 8, 8, 8, 8, 8, 8, 8, 8,
PIW_B 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3,
FF_A 8, 8, 8, 8, 8, 8, 7, 7, 7, 7, 7, 7,
FF_B 8, 8, 8, 8, 8, 8, 7, 7, 7, 7, 7, 7,
CA & CB Year, JA 2018, FE 2018, MA 2018, AP 2018, MY 2018, JN 2018, JY 2018. AG2018, SP 2018, OC 2018, NO 2018, DE 2018.
TF_A 7, 7, 7, 6, 6, 6, 6, 8, 8, 6, 6, 6
TF_B 9, 9, 9, 9, 7, 7, 7, 7, 8, 8, 8, 8
PF_A 7, 7, 7, 7, 7, 7, 7, 7, 8, 8, 8, 8,
PF_B 6, 6, 5, 5, 5, 5, 5, 7, 7, 6, 6, 6,
PAW_A 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4,
PIW_A 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7,
PAW_B 8, 8, 8, 8, 8, 8, 8, 8, 8, 8, 8, 8,
PIW_B 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3,
FF_A 6, 6, 6, 6, 6, 6, 7, 7, 7, 5, 5, 5,
FF_B 9, 9, 9, 8, 8, 8, 7, 7, 7, 7, 8, 8,
CA & CB Year, JA 2019, FE 2019, MA 2019, AP 2019, MY 2019, JN 2019, JY 2019. AG2019, SP 2019, OC 2019, NO 2019, DE 2019.
TF_A 7, 7, 7, 7, 8, 8, 8, 8, 7, 7, 7, 7
TF_B 9, 9, 9, 9, 7, 7, 7, 7, 8, 8, 8, 8
PF_A 6, 6, 6, 6, 6, 6, 6, 6, 7, 7, 7, 7,
PF_B 5, 5, 5, 5, 5, 5, 7, 7, 7, 5, 5, 5,
PAW_A 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2,
PIW_A 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6,
PAW_B 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7,
PIW_B 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
FF_A 6, 6, 6, 6, 6, 6, 5, 5, 5, 5, 5, 5,
FF_B 7, 7, 7, 7, 7, 7, 6, 6, 6, 6, 6, 6,
CA & CB Year, JA 2020, FE 2020, MA 2020, AP 2020, MY 2020, JN 2020, JY 2020. AG2020, SP 2020, OC 2020, NO 2020, DE 2020.
TF_A 6, 6, 6, 5, 5, 5, 6, 6, 6, 7, 7, 7
TF_B 6, 6, 6, 6, 5, 5, 6, 6, 6, 8, 8, 8
PF_A 5, 5, 5, 5, 5, 5, 5, 5, 7, 7, 7, 7,
PF_B 4, 4, 4, 4, 4, 4, 4, 4, 5, 5, 5, 5,
PAW_A 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
PIW_A 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6,
PAW_B 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6,
PIW_B 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
FF_A 6, 6, 6, 6, 6, 6, 6, 5, 5, 5, 5, 5,
FF_B 6, 6, 6, 6, 6, 6, 6, 5, 5, 5, 5, 5,

Where Technical Factor is TF, Production Factors is PF, Personnel Factors (Active Workers and Idle Workers) and Finance Factors is FF, for companies A & B respectively.
The analysis of the two soft drinks bottling companies in the year 2006 is depicted in figure 3.

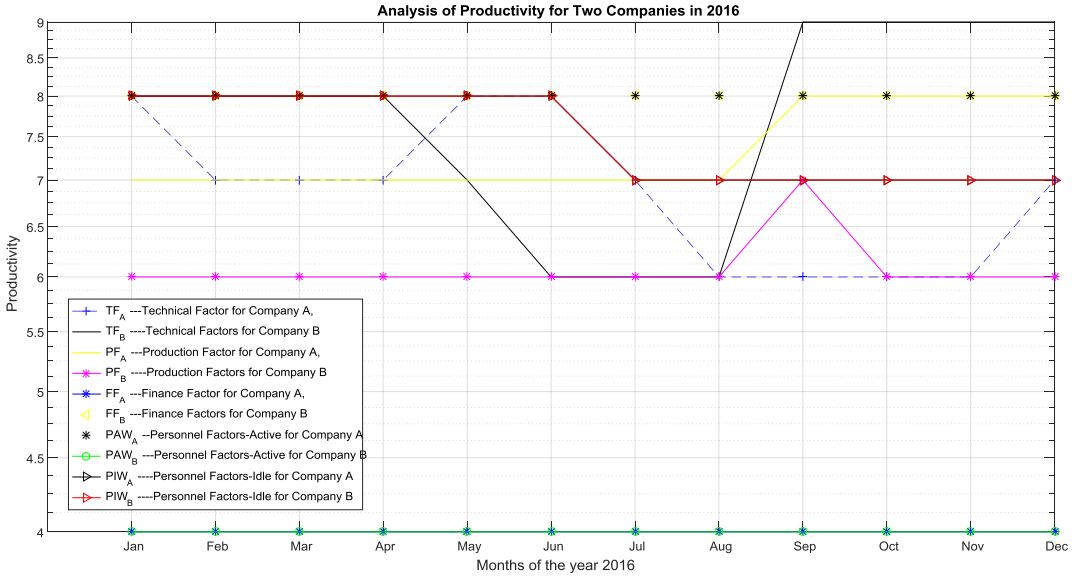

Figure 3: Analysis of Productivity for the Two Companies in 2016

Figure3 shows that Technical Factor and Active workers in the two companies have increasing impact on productivity, while idle workers leads to reduced productivity.

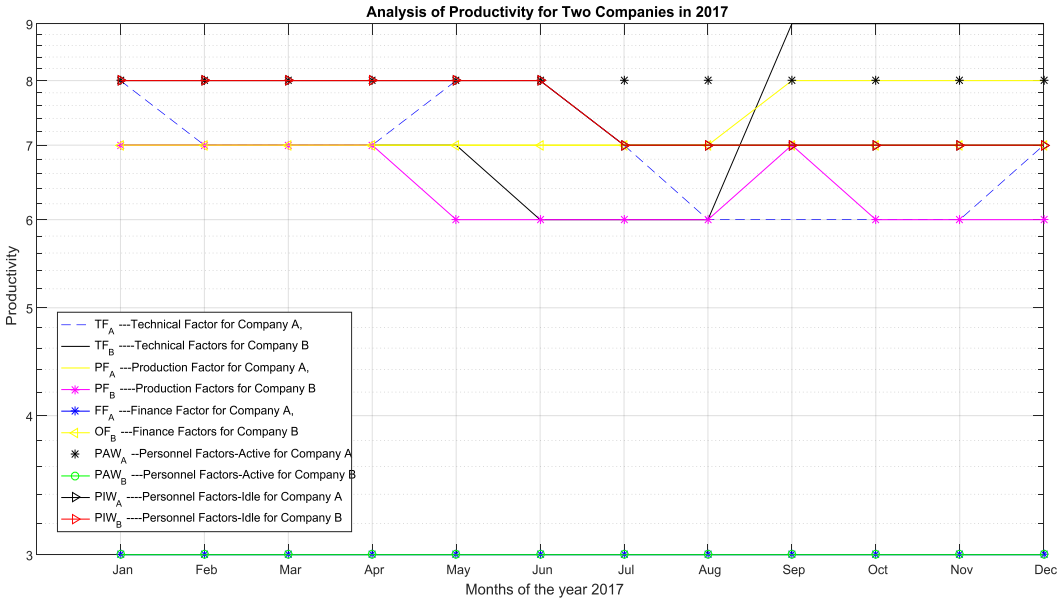

Figure 4: Analysis of Productivity for the Two Companies in 2017

As shown in Figure 4, increase in Idle staff leads to reduction in productivity of CA, while productivity in CB increased. The application of Automation in the manufacturing process also shows productivity from the graph in CB.

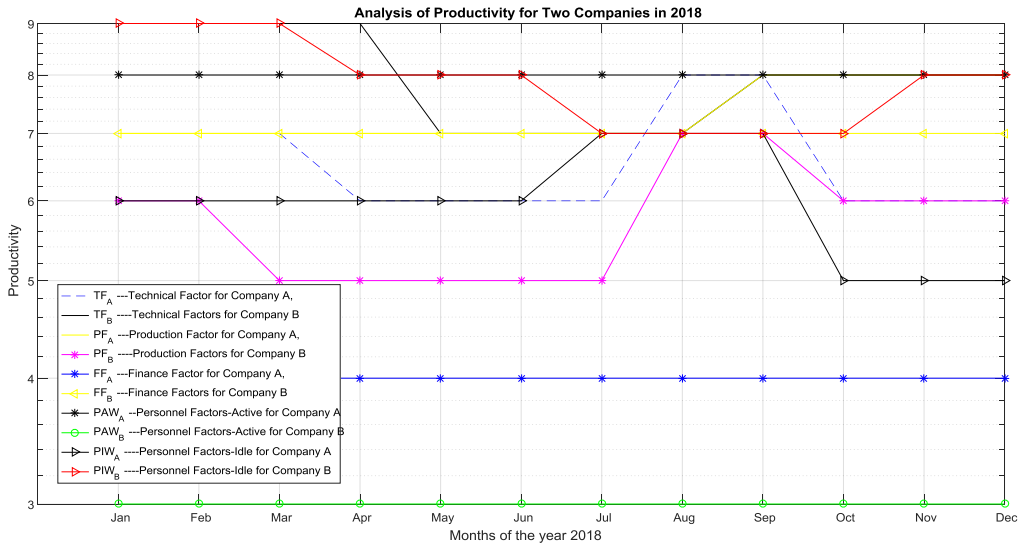

Figure 5: Analysis of Productivity for the Two Companies in 2018

Figure 5 indicates continues drop in productivity in CA due to reduction in active staff, while CB shows increase in productivity due to automation and increase in active staff.

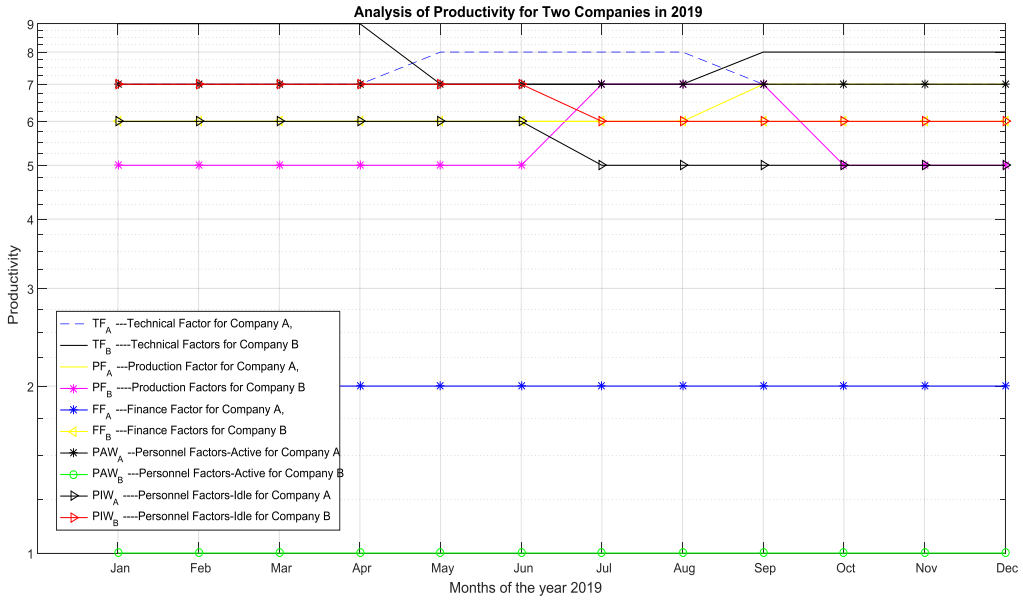

Figure 6: Analysis of Productivity for the Two Companies in 2019

In Figure 6, as technical factors increased, productivity in CB also increased due to active staff, while CA experienced continuous decline in productivity.

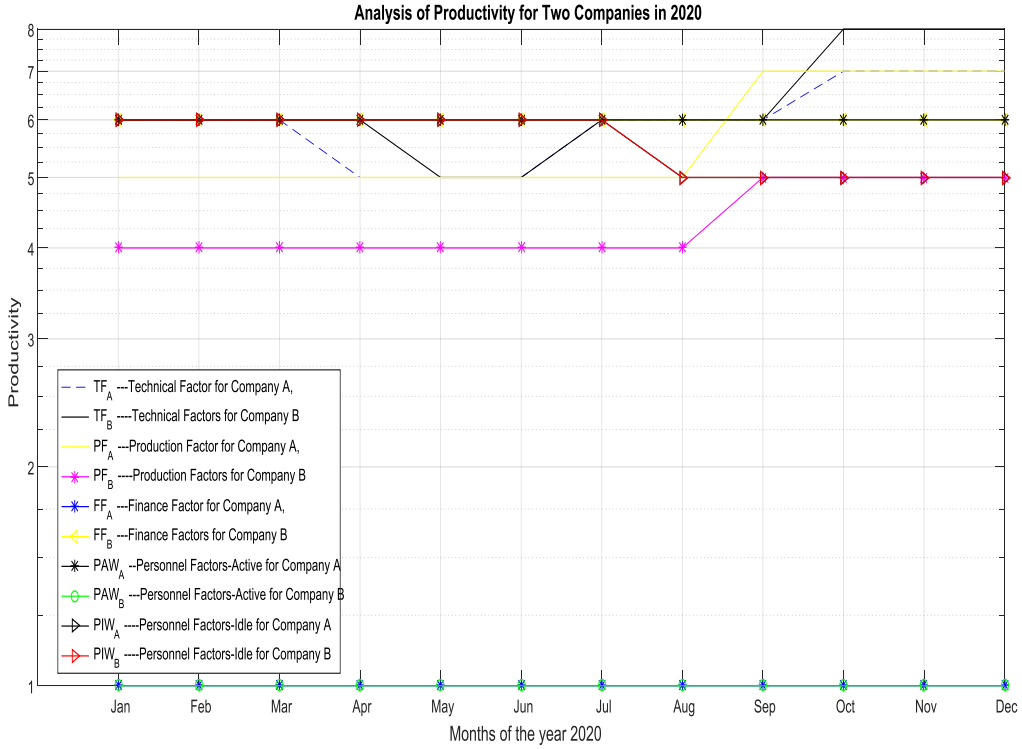

Figure 7: Analysis of the Two Companies in 2020

Figure 7 reveals the impact of factors of production in productivity in the two soft drinks bottling companies in 2020 during COVID-19 lockdown. It could be observed that CA experienced more reduction in productivity during this period due to restrictions in movement, idle staff and lack of automation. However, CB had increased productivity due to active workers and automation.

Conclusion

The need for improved productivity in manufacturing companies cannot be over-emphasized, as it a crucial factor in a firm's production performance, and any organization that wish to survive the stiff global competition must take it seriously. Also, its need and importance becomes more evident and appreciated when applied in a manufacturing company, this is because a company's advancement in productivity enhances its output and profitability.

The analysis of five years productivity factors in the soft drinks bottling companies revealed the following:

Technical Factor and Active workers in the firms have increasing impact on productivity, while idle workers leads to reduced productivity. Also, increase in Idle staff leads to reduction in productivity of CA, while productivity in CB increased. The application of Automation in the manufacturing process also shows productivity from the graph in CB.The results also indicated continues drop in productivity in CA due to reduction in active staff, while CB shows increase in productivity due to automation and increase in active staff.

Manufacturing companies should therefore carefully analyse and prioritize the different strategies of productivity improvement with regards to a company's conditions and peculiarities before selectionand implementation of the productivity factors.

References

[1]. Sreekumar, M., Chhabra, M. and Yadav, R. (2018), "Productivity in Manufacturing Industries" International Journal of Innovative Science and Research Technology, vol. 3, iss. 10.

[2]. Afsharian, M., Mirghasemi, S., Ebadzadeh, K. and KhodaBakhshi, N. (2013), "A Study of the Factors Affecting Productivity" Advances in Environmental Biology Journal, vol. 7, iss. 11

[3]. Okpala, C. (2013), "The World's Best Practice in Manufacturing" International Journal of Engineering Research and Technology, vol. 2, Iss. 10
[4]. Okpala, C., Anozie, S., and Mgbemena, C. (2020), "The Optimization of Overall Equipment Effectiveness Factors in a Pharmaceutical Company" Elsevier-Heliyon Journal of Production Engineering, vol. 6, is. 2020 https://doi.org/10.1016/j.heliyon.2020.e03796
[5]. Okpala, C., Ogbodo, I., Okpala, S., and Ogbodo, E. (2021), "Strategies for Improving Productivity in Manufacturing Companies" International Journal of Engineering and Science Computing, vol. 11, iss. 9, https://ijesc.org/articles-in-press.php?msg=1&page=article
[6]. Cresnar, R., and Nedelko, Z. (2017), "The Role and Importance of Employee's Productivity in Industry 4.0." ISMA University Press, Riga, Latvia
[7]. Akrani, G. (2013), "Nine Main Benefits of Higher Productivity" [Online]. Accessed on August 15, 2021, from https://kalyan-city.blogspot.com/2013/03/benefits-of-higher-productivity.html
[8]. Martin, L. (2019), "The 3 Most Important Factors of Productivity and How to Improve Them" Online]. Accessed on 17 January 2021, from https://biz30.timedoctor.com/factors-of-productivity/
[9]. Ngige, C. (2014), "Management as a Factor of Production and as an Economic Resource" International Journal of Humanities and Social Sciences, vol. 4, no. 6