

# DOES ADOPTION OF SIX-SIGMA MODERATE EMPLOYEES INVOLVEMENT IN ORGANIZATIONAL PROCESS? EVIDENCE FROM NIGERIA

**Okafor I. Godwin, University of Nigeria**  
**Emmanuel K. Agbaeze, University of Nigeria**  
**Geoffrey O. Ekoja, University of Nigeria**  
**Joseph Obamen, University of Nigeria**  
**Benjamin I. Chukwu, University of Nigeria**

## ABSTRACT

*This study examines the effect of Six-Sigma adoption on the employee involvement in organizational process. The study specifically determines the influences of Six Sigma approach on employee's involvement in organizational process. A cross-sectional survey design was adopted and the multistage sampling technique was utilized to select sample of 528 top and middle management staff from total of twenty randomly selected medium scale manufacturing firms in the Southeastern part of Nigeria. The study recorded 100% returning rate of the administered instrument. The data collected were analyzed using mean rating, while t-test was used for testing of formulated hypothesis. The study found that the adoption of Six-Sigma influenced the employee's involvement in organizational process. Informed by this finding, the study concluded that Six-Sigma positively improved the employee's involvement in organizational process. It was recommended that there should be more involvement of employees in the organizational activities and this should be supported with effective training of staff and supervisor on the implementation of Six Sigma.*

**Keywords:** Six Sigma, Employees Involvement, Employee Development, Organizational Process.

## INTRODUCTION

One of the demanding tasks for industries at every stage of production is to effectively manage the quality of their products from the getting the needed input such as raw materials through production to the end-users. Usually, the acknowledgement and credits go to managers that retain the quality of products at every production cycle and the real appreciation and commendations are for that top management that achieves timely production with efficient resource utilization. The motivation to produce more products and sustain the industry lead in the competing market could be argued and can result into replacement of manual power with machine in early 1820s, which later led to industrial revolution. The attention of today's industries, however, has moved from the well-known machine-driven into intelligent-driven, in which both human and other resources have to be conservatively deployed. The brain behind the idea of conservative production along with the optima decision making creates rooms for several approaches among which gave nod to the adoption of various quality assurances including Six

Sigma practices. The regulatory bodies also pressurizes that that production firms must produce quality products. The increase in the level of awareness among consumers is also enforcing production firms to comply with qualitative production while taking the firm resources into consideration. Hence, the consideration for organizational resources is more consciously observed through reduction in wastes and minimal rework among employees.

Ang et al. (2010), explains that the exact role of Six Sigma in production process is to guide the process from raw to finishing product without neglecting both the firm and the consumers. Rosen (2012) argues further that it was in those days that firms felt satisfied for disposing its products through marketing, nowadays, firms are taking steps further to show concern to what happens to their products after purchases. This post-sale interest and motivation is focused on the perceptions held by the users about the products, the needs for required adjustment or the conformity of the products toward environmental protection policies after used. This results to shorter span of the production cycle and also ensures that it no longer stops at marketing, firms need to extend qualitative services to the end-users and assure the quality of waste disposal in respect to their products and room for recycling and obtaining feedback from end consumers. The introduction of Six Sigma process has been adjudged by many experts as effective in terms of general quality management, continuous improvement in production, reduction of waste of human efforts and organization resources as well as realigning the production process to customer's taste. However, little or no evidences have shown how fair are those employees that usually engaged at various capacities to instill the Six Sigma process regarding knowledge gained and production development. The research light has not been shown on whether application of Six Sigma is remolding employee's production knowledge, or more likely the employees are unconsciously carried out the production technique as instructed by supervisors or unit heads. Earlier study by Nur-Afni et al. (2013) has suggested that employees are not totally benefiting since they mostly get involved in only one stage or the other of the process, not in totality of Six Sigma production stages. Likewise, study by Okonkwo and Mbachu (2015) opined that more often, employees are only better off in particular production stage where their input is needed, thereby felt incapability in other stages of Six Sigma due to their non-involvement at those stages. Whereas, study by Durga-Prasad (2017) & Ang et al. (2010) expressed that those organizations that preferred Six Sigma as process approach spent less on staff development since every production comes with refined process. Also, Ovir & Brian (2015) expressed improved level of expertness and less supervised production. This shows that the empirical evidences on the actual effects of Six Sigma on employee is inconclusive, thereby required the more clarity through empirical study. Therefore, this study examines the effect of Six Sigma on employee development among medium scale manufacturing firms in south-eastern Nigeria. Specifically, the study evaluates the influence of Six Sigma approach on employee's involvement in organizational process.

## LITERATURE REVIEW

### Concept of Six Sigma

Six Sigma approaches could be perceived as a double-headed sword that could correct things in both directions. According to Nur-Afni et al. (2013), Six Sigma requires process management which influences innovation within the firm that may require self-discretion among workers, continual efforts to meet the demand of consumers and multiplied conscious or

unconscious innovative capacity among workers. The attempt to balance the allocation of resources to activities across the firm requires employees to be changing tactics at all process. This automatically checkmates the dormant production and insensitiveness among workers as a result of the monotonous production of a similar product that will cease to exist (Oko & Parminder, 2015). At another instance, process management through Six Sigma deals with minimizing sources of variability in internal and external activities and this simply implies self-adjustment especially for the identified unit or section where design variability was observed in the earlier production. This may result in focusing on employees to retrain them on specific types of innovations that are consistent with reducing variability in the processes (Onwughalu et al., 2017).

## Employee Development and Performance

Performance of Employee is one of the most discussed issues in the organization and by researchers holding to the important contribution employee brings to the workplace. Employee performance translates into good service delivery and interaction which affects every area of the organization. To achieve this organization need to make policies that will encourage employee performance. Performance is the record of outcomes produced on a specified job function or activity during a specified time period (Bernadrin & Russell, 2008). In-line with the above assertion, performance is a function of sets of outcomes produced during a certain time period. Therefore, employee performance is the assigned tasks targets reached by employees within particular period of time. Performance is not only related to the action but also involves judgment and evaluation process. Colantonio (2009) posits that performance is related to what the individual employee does in fulfilling his/her duties and the activities that can be examined and measurable. Organization needs high performing employees to meet its goal and be able to achieve competitive advantage. Orogbu et. al. (2015), is of the view that organization success depends on the employee performance. Therefore, it is important for a manager to create a well-grounded approach to managing and coaching its workforce. The popularity of an organization's service is based in part on the level of service received by the customer. For any industry, the business is based almost solely on their employee's performance. That is why management must look for various ways in improving employee performance

## Employee Development and Six Sigma

To understand the effect of innovation through Six Sigma on employee development, one has to be familiar with different types of innovations and the respective requirement for their attainment within the production firm. Researchers have looked at innovation from different perspectives. Innovations could affect the technological base of the firm, the subsystems may have to be adjusted, there may be a call for the adjustment of production routines and meeting innovation may require the employee to learn latest procedures to meet the customer's needs. Okoro & Washington (2012) classify technological innovation into two dimensions: (1) the degree to which they are close to the current technological path and (2) their degree of closeness to existing markets or customers. Whenever, incremental changes are being built upon the current technological capabilities of the firm, by fundamentally changing the current technological base, firms can exhibit radical change and the employees have to be rearmed in such developmental direction (Green, 2010).

Generally, technological innovations affect the systems and processes within a firm without sparing the employees. In some firms, where human resources management is poor, employees may be expected to adapt themselves to new production techniques or asked to leave the services on failing to meet the technical requirement. Whereas, some organisations with sound human resources management will training the existing staff in the line with new production technique and engaged experts to support the trained staff. Whichever way the firm chooses, employees have to be modified in tactics and production techniques to meet the desired innovation. Any innovation within the organization that affects the subsystems, routines or processes without necessarily affecting the integration and interconnectedness among processes and routines are considered modular innovation and firms may not require the engagement of new experts since existing employees can be retrained or guided to achieve the desired outcome.

On the other hand, innovations may bring architectural changes, such a change may affect the way subsystems, routines and procedures are linked and totally restructure the configuration and interconnectedness among procedures and routines of the firm. Likewise, technological innovations can affect the market and customers the firm is serving. They may address the needs of the existing customers or the emerging customers (Bottani & Vignali, 2008). While improvement in current technological base is suitable for addressing the needs of existing customers, products and/or services designed for new customers/markets need different type of technological capabilities; technologies that are fundamentally different from the current technological trajectory of the firm and the employees need to readapt to innovative design which might imply acquiring new techniques and experiences (Bottani & Vignali, 2008).

Since Six Sigma programmes translate the voice of customers into independent process improvement projects; they enhance the technological innovation of the firm and bring development to the employers. Accordingly, it is proposed that Six Sigma programmes significantly improve technological innovation of a firm as well as enhancing the coverage experience of the firm and its workers. The key decision regarding Six Sigma programmes is to determine how it is going to impact on the technological base of the firm (incremental vs. radical); the processes, procedures and routines within the firm (modular vs. architectural); new customers/markets or existing customer/markets (sustaining vs. disruptive technologies) and employees requirement (training, recruitment and reequipped). Guided by the preceding relationship between Six-Sigma and employees development, the study hypothesized that:

*H<sub>a1</sub> Six Sigma approach enables positive involvement employees in organizational process.*

## **Theoretical Framework**

This study is supported by expectancy theory propounded by Victor Vroom in 1964. The expectancy theory expressed that the behaviour results from conscious choices among alternatives whose purpose it is to maximize pleasure and minimize pain. Vroom realized that an employee's performance is based on individual's factors such as personality, skills, knowledge, experience and abilities. The expectancy theorists such as Edward (1969) & Lyman (1972), in their respective efforts to buttress the Victor Vroom expectancy theory, suggested that the relationship between people's behaviour at work and their goals was not as simple as was first imagined by other scientists. These theorists identified that the employees are of different personalities; therefore, motivating them uniformly may not necessary results in better production. The effect of motivation based on the depth of the wants of an employee for extrinsic

or intrinsic rewards which management must discover. The ability to discover the causes of defects is addressed by process measurement phase in Six Sigma approach through identification of various inputs, non-conforming production variables (labour inclusive) as well as types and probable causes (machine or labour) of production defects. Going by Vroom's suggestion, employee's beliefs about expectancy, instrumentality and valence interact psychologically to create a motivational force that will ensure that the employee acts in ways that bring production enhancement and self-development. Thus, the expectancy theory justified the need for the organisation to persistently review its process to ensure that all production variables are keyed into working efficiently as well as self-development and growth among employees. Providing modern instrument and innovative production technique might in-turn motivate some employees that attached value to their success rate and as well as engineering consistency in the production standard, which likely to results in attainment of product positioning in the competitive business environment.

## METHODS

This study adopted a cross-sectional survey research design. The choice of this method was based on the fact that the population and sample of this study are scattered in different states across the south-eastern part of Nigeria which is study area. South East state constitutes Anambra, Enugu, Imo, Abia and Ebonyi States. The data used for this research were obtained specifically from primary source which involved using questionnaire to obtain data for research variables. The population of the study consists of 528 management staff of twelve purposefully selected firms that adopts six-sigma in South-East Nigeria. The study adopts multistage sample size determination. At the first stage, the total 12 firms were sampled as a representation of 10% of total 117 Six-Sigma medium scale manufacturing firms operating in the study area. At the second stage, the study purposively sampled all 528 employees from the 12 selected firms in the South-East States, Nigeria. Thereby, the total 178 questionnaires were distributed to employees of the sampled firms in Anambra State, 116 questionnaires were distributed in Enugu state, 54 questionnaires were distributed among sampled employees in Ebonyi state, while 96 questionnaires were distributed among sampled employees in Abia state and the remaining 84 questionnaires were administered in Imo state among sampled SMEs, detailed below. The information gathered from the field was given and investigated with distinct measurements. The responses opinion and hypothesis were tried with mean and t-test analysis. The instrument was validated through content and face validity and Cronbach's method was used to determine the reliability. The justification for using this method and not any other methods like Test-retest, split-half methods is because of their inherent shortcomings which Cronbach's Alpha relieves. The results of reliability test show a coefficient of Cronbach's Alpha of 0.700, indicating high reliability of the instrument. The table below is a representation of the questionnaire administration.

## RESULTS

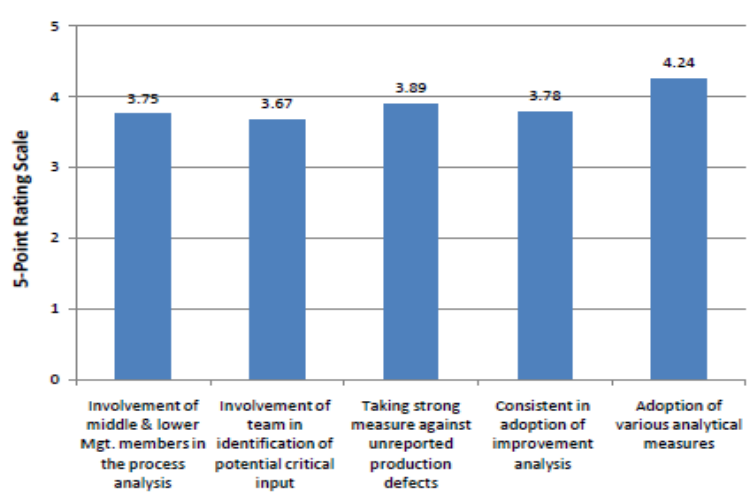
The presentation and interpretation of data were based on the data generated through the questionnaire administered to the sampled employees. A total of five hundred and twenty-eight (528) copies of the questionnaire were distributed, out of which, five hundred and twelve (512) were returned, this gave the overall response rate of 97.0%. The result from the study revealed

that in overall, 3% of all sampled employees have non-formal education, while 7% of all respondents hold primary school certificates. More so, 22% of sampled employees hold secondary school certificate, while most sampled employees (68%) from medium scale manufacturing industries hold certificates from the various tertiary institution. The distribution of sampled employees from by years spent in their respective firms shows that in overall, 24% of sampled employees were those spent less than five years in their respective firms. Likewise, most sampled employees (45%) have spent between 5-9 years in their respective firms, while 21% of the sampled employees of medium scale manufacturing industries had spent between 10-14 years; the remaining 10% of sampled employees were those spend more than 15 years.

TABLE 1 THE INFLUENCE OF SIX SIGMA APPROACH ON EMPLOYEES INVOLVEMENT AND DEVELOPMENT IN ORGANIZATIONAL PROCESS.								
S/n	Items	SA(5)Fx (%)	A(4)Fx (%)	U(3)Fx(%)	D(2)Fx(%)	SD(1)Fx(%)	AVG	RMK
1	Participating in the investigative analysis on each of production cycle in your firm your overall understanding of every process in your firm	97(19%)	231(45%)	28(5%)	105(21%)	51(10%)	3.43	Agree enhanced
2	Being among the team responsible for the Identification of potential critical input make you fully aware of the challenges involved in the production activities	102(20%)	248(48%)	21(4%)	91(18%)	50(10%)	3.51	Agree
3	Ensuring prompt report about stages of the production process is influencing your self-ability in taking discretion decision during production	298(58%)	78(15%)	16(3%)	65(13%)	55(11%)	3.97	Agree
4	Activities regarding process improvement analysis in your firm are exposing the employees to additional production knowledge	156(30%)	312(61%)	20(4%)	13(3%)	11(2%)	4.15	Agree
5	Knowledge about analytical measures among the employees in your firm could be attributed to the adoption of Six Sigma production approach	111(22%)	369(72%)	21(4%)	7(1%)	4(1%)	4.13	Agree

SA: Strongly Agree, A: Agree, U: undecided, D: Disagree, SD: Strongly Disagree, AVG: average. Rmk: Remark, Fx: Frequency, (%): percentages in parenthesis

Table 1 revealed the results on the employees responds on extent at which the process diagnostic by medium scale manufacturing firms in South-Eastern Nigeria is influencing employee development in their respective firms. The results showed that 45% of sampled employees strongly indicated that participating in the investigative analysis on each of production cycle in their respective firm enhanced their overall understanding of every process in their firm (average=3.43, remark=agree). More so, 48% of sampled employees across the selected medium scale manufacturing industries expressed that being among the team responsible for identification of potential critical input is making them fully aware of challenges involved in the production activities (average=3.51, remark=Agree). Also, 58% of sampled employees from medium scale manufacturing firms expressed that ensuring a timely report about stages of the production process is influencing their self-ability in taking discretion decision during production (average=3.97, remark=agree). This shows that involving members of staff to write a report about production stages is exposing them to more production etiquettes and improving their self-decision making during production. Likewise, 61% of sampled employees from medium scale manufacturing firm in south-eastern Nigeria expressed that the activities regarding process improvement analysis in their respective firms are exposing the employees to additional production knowledge (average=4.15, remark=agree). More so, the majority (71%) of sampled employees from medium scales manufacturing firms attributed their knowledge gained regarding analytical measures to the adoption of Six Sigma production approach in their respective firms (average=4.13, remark=agree).



**FIGURE 1**  
**LEVEL OF PROCESS ANALYTICAL MEASURE AMONG THE SAMPLED MANUFACTURING FIRMS IN SOUTH-EASTERN NIGERIA**

Results in Figure 1 revealed the 5-point rating scale by employees form sampled medium scale manufacturing firms in south-eastern Nigeria on the level of analytical process measures in their respective firm. The results showed that all analytical process measures in the sampled firms were all rated high (above average), especially, the involvement of middle and lower management members in the process analysis was rated high with a mean score of 3.75. Likewise, the involvement of the team in the identification of potential critical input was rate high, mean score of 3.65. More so, taking strong measure against unreported production defects

was rated high with means score of 3.89. The consistency in the adoption of improved analysis was rated high with a mean score of 3.78, while adoption of the various analytical measures was rated high with a mean score of 4.24. This shows that the manufacturing firm realised the importance of process analytical measure as one of the pillars of six sigma product approach.

Data collected for the study were analyzed using statistical tools such as, descriptive which are simple percentage and average. Hypothesis was tested using linear regression at 5% level significance.

$H_{o1}$  Six Sigma approach enables negative involvement employees in organizational process

$H_{a1}$  Six Sigma approach enables positive involvement employees in organizational process

The opinion of the respondents from Table 1 above was used to test the validity of the formulated hypothesis and the result is shown below:

Model	Unstandardized Coefficients		Standardised Coefficients	t	Sig.	Colinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
$\beta_1$ (Constant)	7.792	0.429		18.144	0.000		
Process diagnostic	0.783	0.026	0.796	29.695	0.000	0.732	1.17

$R^2=0.634$ ,  $F=881.810$  (1, 510),  $p<0.05$

- a. Dependent Variable: Employees Development
- b. Predictors: (Constant), Six-Sigma process diagnostic

The result of linear regression analysis in Table 2 shows that there is a significant contribution of process diagnostic on employees development among selected firms in South-Eastern Nigeria ( $B=0.783$ ,  $t=29.695$ ,  $P\text{-value}=0.000$ ). Hence, rejecting the null hypothesis stated that process diagnostic does not positively affect employee's development in medium scale manufacturing firms in South-eastern Nigeria. More so, the  $R^2=0.634$  and ANOVA  $F=881.810$  at the degree of freedoms of 1, 510, suggested that about 63% variability in the development among employees can be explained by their participation in process diagnostic among the six sigma adopted manufacturing industries

## DISCUSSION

The findings from this study shows that Six Sigma approach enabled positive involvement employees in organizational process. This may be associated with the fact that diagnostic activities expose both the human and machine errors during the productions. This further guided the operators to adjust their production techniques while requiring the firm to replace the faulty engine. this findings tally with the results of (Ibeawuchi & Okwara, 2016; Okonkwo & Mbachu, 2015) who argued that whenever employees are encouraged to participate in the diagnostic to determine the causes of production defects their roles in the defects become more evident to them. Also, the current finding concurs with the finding made by Enofe (2010)



that participating in the investigative analysis by employees enhances their understanding of every production process and helps them to abide by corrective measures. Likewise, Enoch (2013) maintained that encouraging employees to be among the team, for analysis of the critical inputs is exposing them to various other possible challenges involved in the production process. Though, it could be argued that process diagnostic is meant to guide the firm to discover the production defect regarding nature and causes, the involvement of employees showed that the participating employees would be gaining more knowledge about causes and possible correction to production defects. More so, the findings of this study showed that involving employees in reporting occurrences at every stage of production is influencing employee's ability to take self-discretion decision during production. This agrees with the submission made by Dileep & Rau (2010) that training employees to detect and write a report on the stages of production will further expose them to various descriptive capacities. Likewise, the findings from a study conducted by Darabi (2007) established a significant relationship between the level of employee involvement in organisational decision making and their ability to take a critical decision without monitoring. Also, Bottani & Vignali (2008) argued that engaging employees in defect detection during or at post-production period would expose them to additional production knowledge, which can further enhance their ability to master production routines.

The findings of this study showed that medium scale manufacturing firms adhere strictly to the process diagnostic, which further reaffirmed that the sampled firms understand the importance of process analytical measure as one of the pillars of six sigma product approaches. This could also explain the contribution of about 48.3% staff development by their involvement in process diagnosis. This concurred with the conclusion drawn by Alireza et al. (2011) process diagnostic focuses on employee improvements due to their involvement in analysing all steps that require bringing a product or service from a raw state to the customer, without defects. Likewise, Abidakun et al. (2014) argued that process diagnostic could be used to achieve high reductions in idle time among employees. When employees are aware and convinced of tasks ahead, the time spent for talking and other activities that usually lead to rework will automatically be checkmated. The enlightenment gained by employees during their involvement in diagnostic activities lead to improvement that offered to reduce many time wastage which will result in increased utilisation time and process cycle efficiency. The process diagnostic allows the top management in an organization along with the employees to collectively determine the specific changes needed to strengthen their firm performance. Agina-Obu (2015) argued that one among the benefits offered by Six Sigma is staff growth and development, the management in any organizations are left with no option than to expose their workers to the various design process, which directly build their experiences, developed their knowledge and widen their discretion power.

## CONCLUSION

The study demonstrated that six sigma enabled positive involvement employees in organizational process. The study reaffirmed that level of competence, self-decency and overall capability is increasing as adoption of six sigma process is increasing. This study has also refuted the initial claimed that due to the fact most attentions are always being focused on waste management and production perfection, the current study showed that employees are benefiting self-development through processes. Based on the findings and conclusion from this study, the following are the recommendations. First, the management of the medium scale manufacturing

firms should intensify the adoption of Six Sigma to ensure that their employees are becoming self-dependent during production process and minimize supervisor's roles. Further, the management in the various medium scale manufacturing industries needs to bring more of their employees on board for the adoption of Six Sigma to further enhance employee involvement in organizational activities. Lastly, the management in medium scale industries should not limit the training of their employees to their participation in Six Sigma; more resources should be invested in employee training to make them more efficient in adoption of modern production process.

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