Reduction of Training Preparation time for Employees using Lean Six Sigma Methodology

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Lean Six Sigma is one of the widely used methodologies for process improvement. Various industries have utilized it to improve the processes and reduce costs. The current paper focuses on using the Lean Six Sigma DMAIC approach to reduce the training preparation time for the employees. The paper aimed to achieve a minimum 70% reduction in training time preparation. The study examines the impact of Six Sigma on resource allocation for training, top management commitment to training, employee involvement at all organizational levels, and continuous learning and identification of training gaps. The data collection included 300 employees from HR, Finance, and Customer services departments of different organizations. A stratified sampling technique was utilized, which subdivided the respondents into top management, middle level, and operational level staff. The data were analysed using descriptive statistics and a regression model used to estimate the relationship. The study results indicate that employee training success outcomes are increased by 72% with the implementation of Lean Six Sigma.

Keywords: Training, Development, Lean Six Sigma, Process Improvement

1. Introduction

Intense competition in the manufacturing industry has necessitated employee training to enhance safety and customer satisfaction. Training is an empowerment program to impart specific knowledge and skills to improve how employees accomplish their tasks (Sunder, 2016). Through training, companies can retain highly competent staff and enhance productivity. For effective training, organizations should set specific goals and deliverables. First, there is a need to evaluate the organization to determine how training will impact organizational goals (Antony et al. 2019). It is followed up by evaluating employees and processes to identify skill gaps that should be filled through training. Analyzing the skills gap is essential to determine the level of employee motivation, mastery of skills, and critical thinking required to meet organizational goals (Honda et al. 2018). Several methods are used to implement training schedules for employees (Ha et al. 2016). However, a layered training approach is ideal since it ensures that the training targets specific needs, groups, and the right people at the right time. Finally, a system should be in place to evaluate its effectiveness and sustainable gains (Antony et al. 2019). It is essential for continuous support, sustaining performance, and evaluating objectives achievement (O'Really et al. 2019).

Training is critical in driving quality customer service to enhance passenger safety, thrilling service experience, and productivity. However, practical training requires adequate planning to identify training needs, skill gaps, and the type of training required to ensure an effective program that solves the problem. This paper aimed to reduce the training preparation time by 72% for using Lean Six Sigma.

2. Literature Review

For over a long period, organizations have an industrial age where work takes require practical approach to a knowledge era where there is a continuous need to improve knowledge to meet or exceed customer expectations (Amaratunga and Dobranowski, 2016). Companies today are striving to delight their customers, and in so doing, continuously source for measures to meet customer needs and retain their performance (Montella et al. 2017). It requires a continuous evaluation of internal skills and implementing tools and strategies to identify problems and provide solutions (Inal et al. 2018). Training is a requirement for achieving these goals since it imparts the core knowledge and skills required to solve problems. An organization's ability to conduct practical training relies on measuring skills, analyzing gaps, and improving productivity (Guerrero et al. 2017). Also, there is a high need to evaluate internal processes to gain insights into their impacts on performance and identify potential variations that should be improved. Continuous improvement processes in an organization help performance and sustainability, requiring Lean Six Sigma Methodology methodology for evaluating performance (Thapa et al. 2018).

In today's business world's dynamic state, organizations strive to maintain a competent workforce through quality training. Every organization, irrespective of the industry, is actively engaged in the continuous development of the staff knowledge and skills to keep up with the rapidly changing environment and meet consumer expectations for good performance (Adikorley et al. 2017). The maximization of the employee job training helps organizations achieve greater reruns on the limited time and valuable resources that are a constraining factor. Many organizations are constantly evaluating the efficacy of training efforts, demonstrating value for the resource investments made, and determining future training (Sony and Mekoth, 2019)

The training impact focuses on optimizing resources and promoting efficiency (Swarnakar and Vinodh, 2016). It should be adopted to improve the organization's training impact and take positions in the design and shape of high-quality training to enhance its potential impact (Ruben et al. 2018). Additionally, training resources are usually limited, which drives organizations to evaluate their training efforts to improve future improvements (Adhyapak et al. 2019). For more significant impacts, there must be a practical framework for effective training and evaluation from the very beginning of the training process, and efforts to put in place for monitoring through the development and execution of the actual training process (Antony et al. 2018; Albufalah and Tarq, 2020).

The groundwork for practical training and evaluation must be in place from the start of the training process and monitoring efforts to develop and deliver training progress (Alhammad and Tariq, 2020). Organizations have to establish a guide for training institutions and programs that offers assistance in training and evaluating the training process (Almentheri and Tariq, 2020). Training should focus on continuous improvement techniques and processes and determine the training's efficacy in improving training (Rava et al. 2019). Organizations need to have several guidelines and requirements for practical training (Cherrafi et al. 2017). First, training should integrate different parties and stakeholders for the training process, such as learners, organizations, and trainers (Gijo and Antony, 2019). It should also define the critical resource requirements at every stage, developing, executing, and measuring effectiveness (Ben Ruben et al. 2017). Finally, it is critical to evaluate the training's efficacy in addressing the organization's needs (Erdil et al. 2018).

2.1 The Lean Six Sigma Approach to Staff Training

Lean Six Sigma is defined as a structural model used by companies to improve business processes, products, and services (Almorsy and Khalifa, 2016). It is a parallel structure that provides a customer-centric metric of performance to achieve specific objectives. Six Sigma offers a flexible methodology for the achievement of sustainable business performance (Kowalik, 2018). It majored

around uncovering customer preferences, factual information, and statistical approaches to achieve business reengineering and improving performance (Yazdi and Esfeden, 2017).

Lean Six Sigma is one perfect tool that companies utilize across the globe to improve operational efficiency, rationalize costs, and improve productivity (Improta et al. 2018). Lean Six Sigma is a technique that applies data, measurement, and statistical capabilities to identify inefficiency within processes and utilize strategic tools to help eliminate defects and reduce variations (Lee and Lee, 2017). Firms that have invested in the Lean Six Sigma training for their employees at all levels within the organization have improved productivity and profits (Douglas et al. 2017). Lean Sigma training and implementation empowers employees to be problem solvers (Pugna et al. 2016). Continuous evaluation and training of employees using the Lean Six Sigma can help organizations alleviate challenges and develop a pool of problem solvers in providing solutions to organizational problems (Shamsi and Alam, 2018; Gaikwad et al. 2020).

Lean Six Sigma is executed through the DMAIC method, a technique used in solving problems with unknown causes. This denotes five Sigma; Defining, Measuring, Analyzing, Improving, and Controlling (Ahmed et al. 2018). This is illustrated in Fig. 1 below.
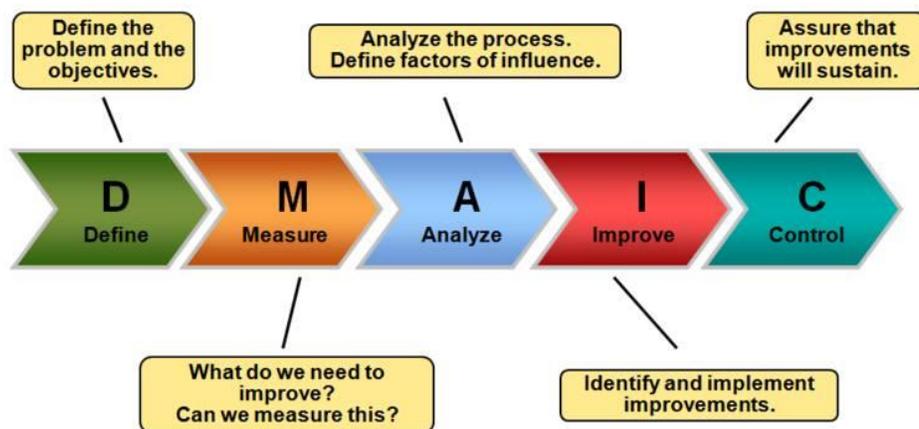

Figure 1. DMAIC Roadmap

According to Laureani and Antony (2018), the application of Six Sigma is an inspiring drive for employees in an organization. Once it is deployed, employee engagement becomes a critical factor within the organization, further boosting satisfaction levels. The study also revealed that the

application of Lean Six Sigma creates a significant impact on culture and human resource practices, such as training (Ahmed et al. 2019). According to the study findings, all stages of Six Sigma deployment exhibited a strong impact on all factors evaluated under the research. Six Sigma deployment encourages employees to showcase their skills during the early defining and ideation stages and provide work support (Singh and Rathi, 2019). Based on these findings, employee training organizations could also explore the Six Sigma capabilities to enhance their performance (Agbaeze et al. 2019). Thus, the study seeks to examine how Six Sigma's implementation of training outcomes improved by at least 72%.

2.2 Effectiveness of the Six Sigma in Training

As indicated in an earlier discussion, Six Sigma offers a lateral approach to improving quality and is widely accepted in various industries (Chaurasia et al. 2019). Six Sigma's primary objective is to implement strategies based on measuring performance in the process of improving processes in projects (Thomas et al. 2017). In the business setting, Six Sigma is applied as a technique for identifying and eliminating the causes of process variations and focusing on process outcomes critical for meeting customer requirements. The Six Sigma projects focus on productivity improvement, focusing on process outcomes, and minimizing downtimes within processes (Antony et al. 2019). In so doing, it utilizes professionals and specialists to achieve these goals, such as the Lean Six Sigma Master Black Belts, Lean Six Sigma Black Belt and Lean Six Sigma Green Belt specialists (Madhavan and Gurumurthy, 2019). A major difference exists between the Six Sigma methodology and other quality improvement processes in that it provides the context of the organization in facilitating problem-solving and cross-organizational exploration (Huq et al. 2019). Huq et al. (2019) also argued that with the Six Sigma, organizations become ambitious to switch the structure and act organically to face new ideas and act mechanically to improve operational efficiency. With this, some organizational units can pursue efficiency while others center on innovation and adapting to change. The dual organizational structure allows the organizations to explore new ways, produce and focus on innovation and productivity.

Training presents a great opportunity for an organization to expand its knowledge base. However, many companies find training expensive and unsustainable. Also, employees engaged in training sessions lose out on handling other conventional tasks assigned to them in responsibility. Organizations should thus establish an effective training program that offsets these challenges in creating a skilled and trained workforce to meet customer expectations and improve performance. Scientific tools and methodologies significantly contribute to the success of Six Sigma in process improvement. However, not exclusively responsible for the effectiveness of Six Sigma since they support and complement the inherent logic. The DMAIC approach is the most defining factor for the effectiveness of Six Sigma in improving processes. It offers a systematic approach to defining

and understanding existing business processes, assessing the impact of the problems in existing business processes, analyzing the problem, and identifying the best solutions for alleviating the problems identified (Bazrkar and Iranzadeh, 2017). It is an improvement initiative that applies the best solution identified to solve the problems to yield a greater positive outcome. Finally, the control spectrum of the DMAIC seeks to assess and evaluate the effectiveness of the adopted intervention in the improvement and to pursue remedial measures to resolve existing mismatch (Al Kuwaiti and Subbarayalu, 2017).

2.3   Define the Process

Organizations implement the Lean Six Sigma approach for the improvement of their products, services, and processes. Training is essential for the performance of firms because it inculcates competent skills and knowledge in employees (Muraliraj et al. 2018). However, when wrongly executed, it results in total waste of time if the training objectives are not met. Organizations need to maintain the competitive advantage. Competitive advantage is attained based on excellent quality service, efficiency, and passenger's safety. Inefficiencies may therefore lead to loss of passengers to competitors, reduction in revenues, and declined performance. The first process to sigma process improvement involves the identification of elements required for process improvement. These are done using customers' feedback, employees' feedback, inefficient processes, or business voice.

2.4   Measuring the Process

Training time is defined as the period between training needs assessment to eventual evaluation of the effectiveness of such training on meeting the set objectives. Training needs entail the knowledge and skills gap requiring new training to equip employees in executing their duties. The cause mapping and the Failure Mode Effect Analysis (FMEA) were used as the tools for measurement and quantify various training elements. The cause map breaks down value-adding and non-value-adding processes to streamline and eliminate restraints to training success. However, the FMEA systematically analyses failures to determine the root cause of the issues.

2.5   Analyse the Process

According to the respondents, the research critically examined the training process to identify any potential challenges that led to poor training results. The training processes were studies from identifying the needs, determining training objectives, planning, implementation, and evaluation.

2.6   Elements of Training Process Improvement

Table 1. Elements of Training Process Improvement

Stakeholder	Expectations	Their Key Issues	Critical Requirement
Employees	-To be able to access learning materials when they need them. -To achieve goals that relate to their job	-Learning resources are not readily available -Training offered is not related to their job	-Increase access to learning resources by 72%. -By increasing resources access by 72%, employees will train based on their needs.
HR Department	-To increases staff training success by 72% for better performance	Provide relevant training based on training needs and objectives.	To increase staff training by success by 72%.

2.7   SIPOC Diagram

The table 2 enlists the various elements of the staff training improvement process.

Table 2. SIPOC Diagram

Supplier	Input	Process	Output	Client
-Suppliers of Training materials -External trainers	-Training materials -Employees time -Training personnel	- Needs Assessment -Setting training objectives -Design& Planning -Implementation of training -Evaluation of training results.	-Improved sales -Enhanced customer services -Customer retention -Employee satisfaction and growth	-Employees - Passengers

2.8   Staff Training Improvement Process

To improve training success, the researcher brainstormed likely causes of poor training and likely solutions to streamline the process.
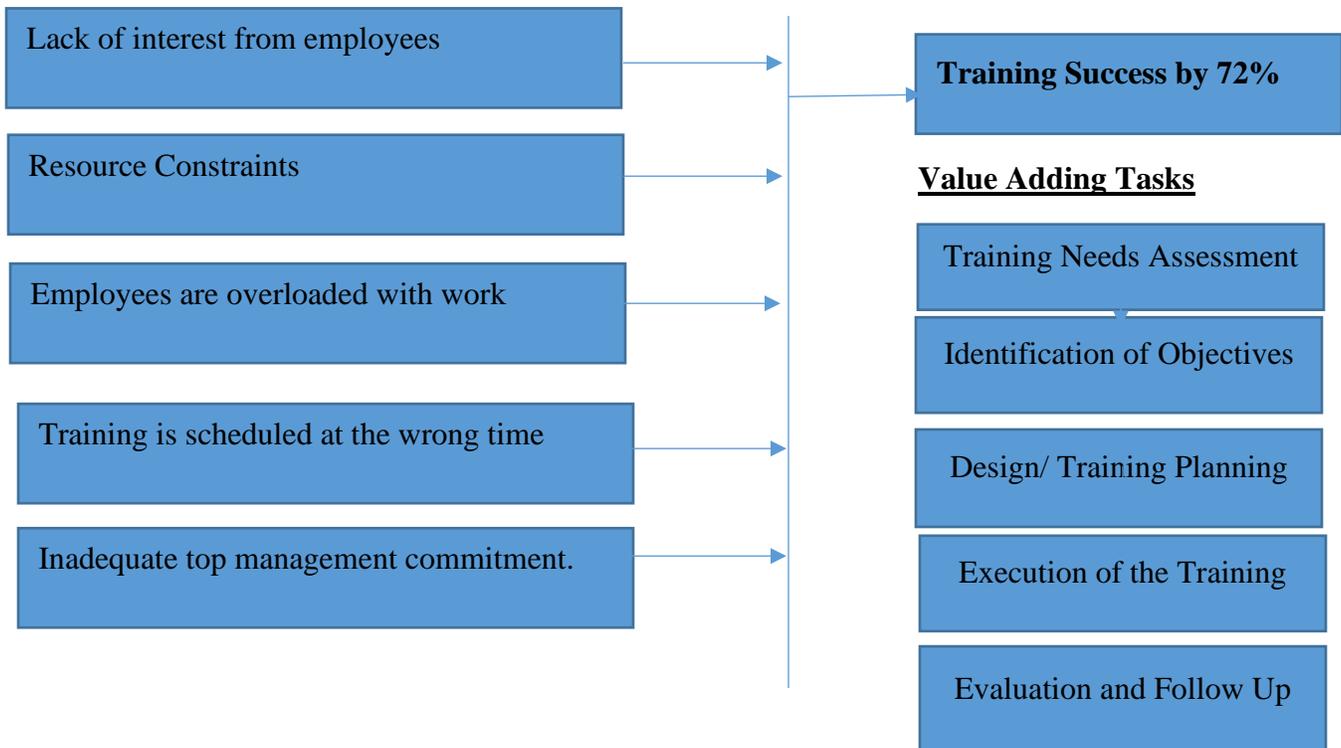

Figure 2. Cause Mapping with Value Added Tasks

2.9   Control Process

Based on the respondent's study findings, a training process checklist was created to simplify and streamline the training process for optimum staff training success by at least 72%. The recommendations on the process scheduling will be communicated to the management of and other interested companies in their future training processes to achieve at least 72% success after training.

3. Research Methodology
3.1 Research Design

The study adopted a descriptive research design to describe the Six sigma approach and its implementation in staff training. This approach relied on findings from respondents and comparison with existing literature to draw the inference. It was approached since it allowed the drawing of insights into how and why the Six Sigma implementation was vital in improving staff training by at least 72%.

3.2 Sampling and Sample Design

The study used a stratified sampling designed, which involved dividing the target population into strata. Employees of formed the target population. The population was further sub-divided into individual departments, which included Customer Service, Human Resource, and Finance. A random sample of 300 employees was then selected from each department to participate in the survey. The findings of the research, therefore, represented the characteristics of different groups within the population.

3.3 Data and Data Collection Methods

The research relied on both primary and secondary sources to draw its findings. Secondary data encompassed literature from different scholars, theoretical frameworks, scholarly journals, and books related to implementing the Lean Six Sigma model. However, primary data were collected with use of questionnaires sent to the department heads through email. Questionnaires were deemed appropriate since they are comparatively quick and reliable in collecting information from many respondents within a short time. The questionnaires were semi-structured and used a Likert scale for ease of quantifying and analysis.

3.4 Data Analysis and Presentation of Findings

Collected data were analysed using quantitative tools. The use of the Likert scale enabled data collection in numbers, which could be statistically analysed for ease of inference. Descriptive statistics were performed to generate measures of central tendencies, such as means and standard deviations. A linear regression model was then performed using SPSS 25 to estimate the extent of Six Sigma implementation's impact on performance. The findings of the study will be presented using tables, histograms, and pie charts.

4. Data Findings and Discussions

4.1 Response Rate

Out of the target sampling frame of 300 employees, only 250 participated in the surveys with total of 83%. The 17% were away from duty on the official ground (Fig. 3).
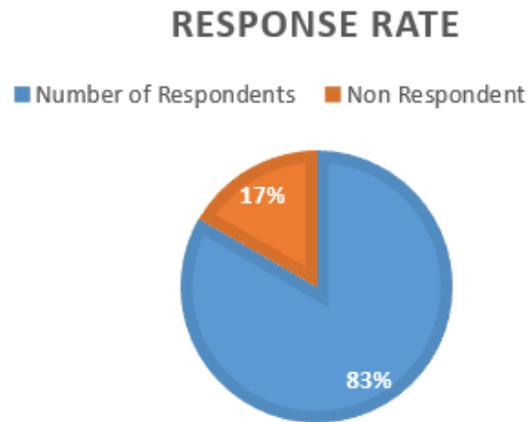
RESPONSE RATE

■ Number of Respondents ■ Non Respondent

Figure 3. Response Rate

4.2 Study Findings

The research interventions were examined and adjusted regarding the respondents' feedback, which included creating regular training programs, regular appraisal of employee skills, knowledge, and abilities, resourcing with highly trained employees in project teams, and all employees' involvement at all organizational levels and top management commitment.

4.2.1   Level of Sigma Training

Table 3. Level of Sigma Training

Level of Six Sigma Training	Frequency	Percent (%)
Master Black Belt	60	24
Black Belts	160	64
Green Belts	20	8
Yellow Belt	10	4
Totals	**250**	**100**

Respondents were asked to indicate the level of six sigma training they possessed at the research time. The findings in Table 3 above indicate that most of the employees attained the level six sigma training (black belt) and had been involved in several sigma projects in the organization. 24% exhibited high-level sigma training as master black belts.

4.2.2   Departments

Table 4. Departments

Departments	Frequency	Percent (%)
Human Resources	90	36
Finance	80	32
Customer Service	80	32
Totals	**250**	**100**

Table 4 above indicates that 36% of respondents from the HR department participated in the surveys. Finance and customer services are tied with a response rate of 32% each. The findings, therefore, represent departments role in implementation of Lean Six Sigma.

4.2.3   Employment Status

All respondents indicated were employed full-time. They were, therefore, directly involved in the Six Sigma implementation. 88% of the respondents indicated that training was regularly executed in the organization, while 12% disagreed. 56% of the respondents indicated that the training received related to Sigma, while 44% were in total disagreement, as shown in the table below.

Table 5. Employment Status & Training

Regular Training Offered	Frequency	Percentage	Training offered is related to Six Sigma
Yes	220	88%	56%
No	30	12%	44%

4.2.4 Failure Mode Failure Analysis

Table 6. Failure Mode Effect Analysis

Mode of Severity (Scale of 1-5)	Severity (Mean)	Probability of Occurring	Probability of detecting	Risk Priority
Resource Constraints	4.64	5	5	116
Inadequate top management commitment.	4.68	5	4	93.6
Employees are overloaded with work	4.48	4	5	89.6
Lack of Interest from employees	3.96	3	4	47.52
Training is scheduled at the wrong time	3.32	2	3	19.92

Table 6 above presents the Mode Failure analysis findings based on the study feedback from respondents. Resource constraints and top management commitment were identified as the main factors that influenced staff training success, as depicted by a high mean of 4.64 and 4.68, respectively. Employee workload (4.48), Lack of Interest from employees (3.96), and wrong training schedules (3.32) are the mean acquired from the FMEA analysis ass shown in Table 6.

4.3 The Linear Six Sigma and Improvement of Staff Training by 72%

The study sought to examine how the implementation of the Six Sigma would improve staff training outcomes by 72%. The respondents provided their feedback on a scale of 1-5, where 5 is the greatest impact.

Table 7. Six Sigma Implementation and Staff Training

Parameter	Mean	Rank
Regular appraisal of employee skills, knowledge and abilities to identify training gaps.	4.48	3
Improved resourcing with highly trained managers to lead project teams.	4.28	5
Motivating the top management commitment and leadership towards staff training.	4.6	2
Involvement of all employees in skills training programs.	4.68	1
Creating a culture of learning and continuous improvement among staffs.	4.48	3
Grand Mean	**4.504**	

Table 7 above shows that the Linear Six Sigma principles were used to examine and understand how the implementation of Six Sigma would impact staff training at 72%. The findings reveal that the Six Sigma principles may be used for the improvement of the training process through; involvement of staffs at all organizational levels (4.68), the achievement of top management support (4.6), creating a culture of continuous learning (4.48), and regular evaluation of employee skills to identify gaps (4.48) and improvement of resourcing capabilities.

4.4   Regression Analysis

Table 8. Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.8660[a]	.751	.674	.05675

Predictors: (Constant), Where X1= Resourcing, X2= Management Commitment, X3= Employee Involvement, Identification of Skill gaps, and X4= Continuous learning culture.

The findings in table 8 indicate that the implementation of Six Sigma can influence training outcomes by 75.1% (R Squared= 0.751). 24.9% accounts for other variables not considered in the study.   Therefore, the study retained the hypothesis that implementation of the Six Sigma approach can influence staff training of at least 72%.

4.5   Coefficients[a]

Table 9. Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	27.224	10.862		1.586	.128
	X1	.341	.380	.312	.860	.400
	X2	.251	.567	.254	.251	.804
	X3	.233	.386	.139	.176	.862
	X4	.188	.490	.113	.465	.647

Table 9 above indicates that Sigma Six would influence resourcing by (34.1%- R Sq.= 0.341), Management Commitment (25.1%), Employee Involvement (23.3%), and Continuous learning culture (18.8%).

The linear regression model explained 72% of staff training outcomes.

$Y= 27.224+0.341X1+0.251X2+0.233X3+0.188X4 +u$ where u is the disturbance error term.

5. Recommendation

The study concluded that the implementation of Six Sigma is critical to achieving at least a 72% training outcome. The findings correlate with Minas et al., 2017, who established that Lean Six Sigma could create process improvement by properly streamlining and scheduling processes. The study, therefore, recommends airline companies to apply the Six Sigma approach to eliminate non-value-adding activities, streamline business processes, and improve performance. Companies should also involve all employees in sigma training programs for better performance. The study established that few employees have attained the Master black belt sigma level.

5.1 Limitations and Suggestions for Further Studies

Even though this paper drew vital study findings and recommendations; First, the study was a case study of a small sample size. Future studies should explore the application of Six Sigma in different industries aside from aviation. Secondly, the study concentrated on the application of six Sigma in staff training. Future studies should cover other business processes not covered herein.

6. Conclusions

An organization with highly competent and skilled employees is better placed to achieve high performance. Staff training is essential for the survival of any firm irrespective of the industry it operates. It ensures that employees are adaptive to a dynamic work environment and inculcates core skills for high performance. The effective training process requires proper aligning of processes and people to ensure training goals are achieved. The study concluded that the implementation of the Six Sigma impacts training success by at least 72%. The study also established that Six Sigma creates a successful employee training process through proper resource mobilization, obtaining top management commitment, the involvement of all employees at all levels, and creating a continuous learning culture.

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Appendix

Appendix A- Research Onion

The research onion is illustrated to be the detailed and systematic presentation of the study process. The onion is analysed from the out layer to the innermost. The layers are related to each other hence follow a similar sequence to ascertain the required output in training preparation time for the employees with consideration of lean six Sigma. The research onion is comprised of six layers.
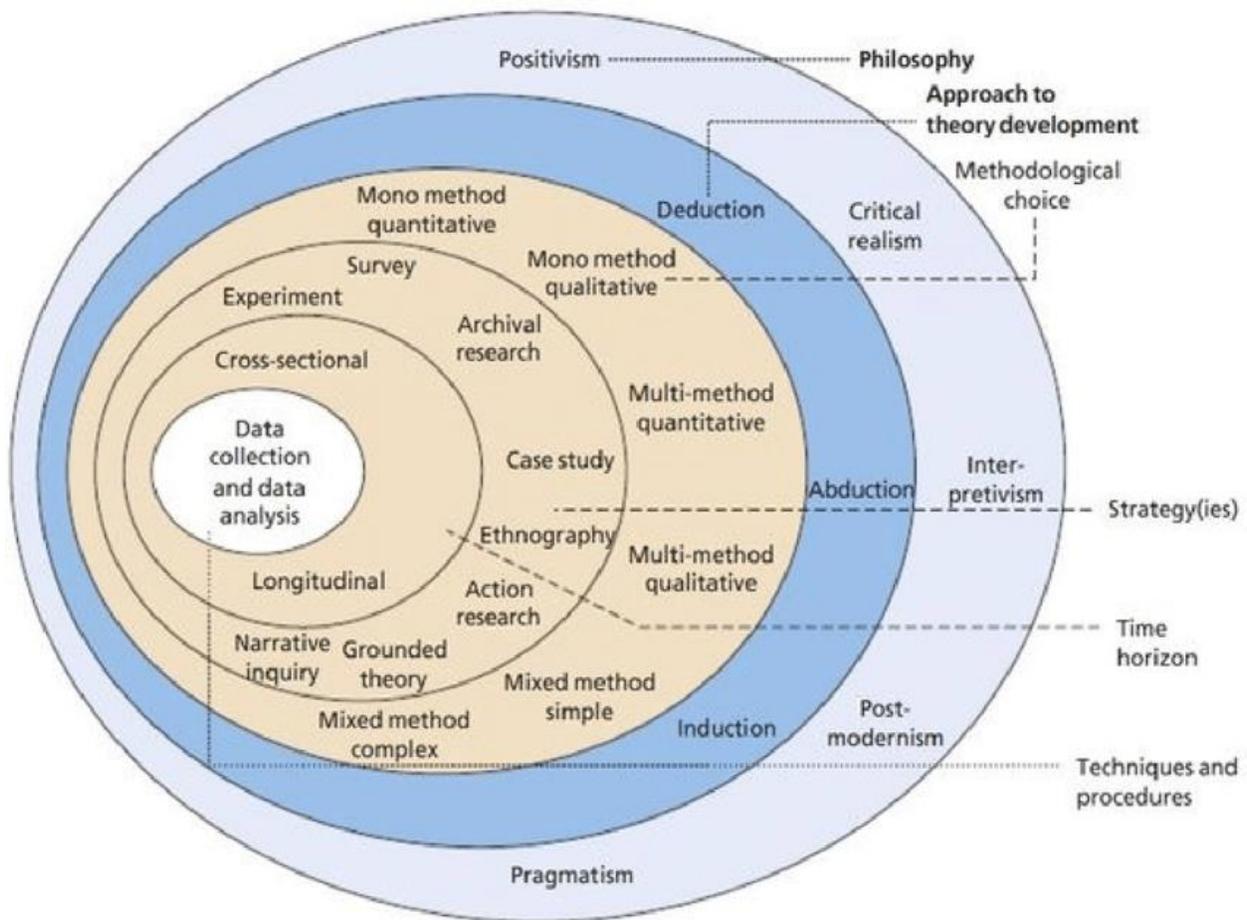

Figure 4 Research Onion

Appendix B- Research Process

Considering the mantra of success for any organization, ensures higher engagement, involvement, and dedication to its employees towards training preparation time and consistent performance to gain more. Employee engagement should not be done once to bring positive results and therefore, it should be an ending procedure that will be executed until the actuality of an organization. It is established that there is a clear link between employee engagement and organizational performance.
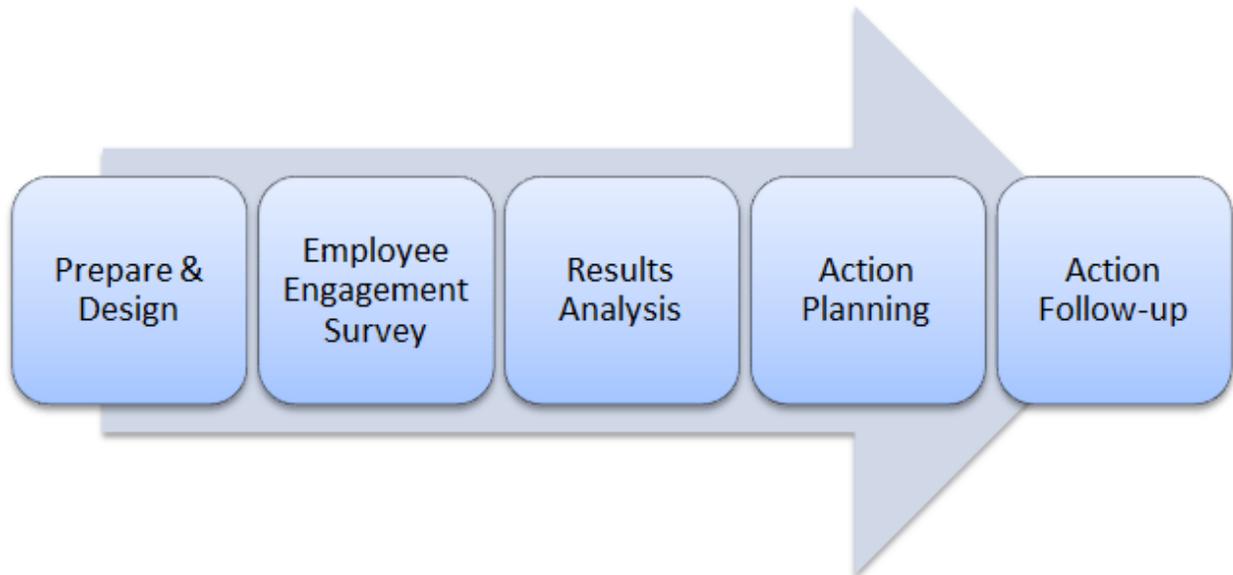

Figure 5 Research Process

Appendix C- Gantt chart

Task	Mar 29-Apr 1	Apr 2-3	Apr 4-7	Apr 8-27	Apr 9-Apr 3	Apr 4-10	April 11-17	April 18-24	Apr 25-May 25
Selecting a research topic	■								
Writing the introduction	■	■							
Writing study literature		■	■						
Writing research proposal			■	■	■				
Presenting study proposal			■	■	■	■			
Research data collection				■	■	■	■		
Data analysis					■	■	■	■	
Presenting final research paper						■	■	■	■

Figure 6 Gantt chart