

SIX SIGMA-IN INDIAN AGRIBUSINESS

Abstract

In today's competitive world, customer wants perfection and there is no room for error. Delighting the customer and new ways to exceed their expectations is requirement of today's business world. Quality management helps to achieve this goal. Quality management involves continuously monitoring, analyzing, and improving of systems and procedures throughout the process. Six sigma is a improvement over the indigenous quality management systems. Six Sigma (6σ) is a set of techniques and tools for process improvement. It was introduced by American engineer Bill Smith while working at Motorola in 1980. It is a new way of thinking about work and customer value.

Six Sigma is one of the most popular and reliable methodologies that are presently applied to the agricultural industry. It is useful because its main focus is on reaching top most quality. The ability of Six Sigma to focus more on quality and eliminate defects in production and processes make sure that the agricultural industry continues to have millions of satisfied consumers. With the continued emphasis of Six Sigma, making excellent improvements in the processes used in creating agricultural products and acquiring more satisfied consumers are greatly possible.

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I. INTRODUCTION

In today's aggressive world, patron wishes perfection and there may be no room for error. Delighting the patron and new approaches to exceed their expectancies is requirement of today's enterprise world. Quality control allows to acquire this goal. Quality control includes constantly monitoring, analysing, and enhancing of structures and tactics all through the technique. Six sigma is an development over the indigenous excellent control structures. Six Sigma (6σ) is a fixed of strategies and gear for technique development. Six Sigma is one of the maximum famous and dependable methodologies which might be currently implemented to the rural enterprise. It is beneficial due to the fact its primary recognition is on accomplishing pinnacle maximum excellent. The cap potential of Six Sigma to recognition greater on excellent and get rid of defects in manufacturing and approaches make certain that the rural enterprise maintains to have hundreds of thousands of happy customers. With the continuing emphasis of Six Sigma, making extraordinary enhancements withinside the approaches utilized in growing agricultural merchandise and obtaining greater happy customers are substantially possible.

A company is left with the following options for fixing the price of a product.

1. The price per unit is the sum of the actual expenses incurred per unit plus desired Profit.
2. Fix a competitive price and then deduct the desired profit from it to derive the total cost of the product per unit. Then focus on the processes and systems to reduce the expenses such that the total cost of the product per unit is well within the derived total cost per unit.

II. EVOLUTION OF SIX SIGMA

The evolution started withinside the past due 1970s, Japanese company took over a Motorola manufacturing unit that synthetic tv units withinside the United States and the Japanese. In 1984, Harry joined Motorola wherein he labored with Bill Smith, an engineer who become in Mikel Harry's words, "the daddy of Six Sigma". Smith determined the correlation among how properly a product did in its discipline existence and what kind of remodel have been required at some point of the producing process. On January 15, 1987, Galvin released a long time great program, called "The Six Sigma Quality Program".

III. DEFINITION OF SIX SIGMA

Six Sigma is a way aimed to get rid of defects for reaching six preferred deviations. that is the distinction among the suggest and the closest specification restriction withinside the technique of a product service.

IV. OBJECTIVES OF SIX SIGMA

The essential goal of Six Sigma is the system development and discount of version via its application. Six Sigma emphasises the subsequent key concepts:

Critical to quality: The critical to quality means the attributes which are most important to the customer.

1. **Defect:** The defect is defined as the failure to deliver a product/service as required by the customer.
2. **Process capability:** The process capability means whether the process can deliver the quality
3. **Variation:** The variation is the perception of the customer. How he/she sees and feels about the quality of the product.
4. **Stable operations:** The stable operations will guarantee a process which is consistent and predictable with reduced venation.
5. **Design for six sigma:**

V. THE BENEFITS OF SIX SIGMA

1. It sets a performance goal for everyone in the organisation.
2. It generates sustained success.
3. It accelerates the rate of improvement.
4. It enhances value to customers.
5. It executes strategic change.

VI. ELEMENTS OF SIX SIGMA

1. **Customers:** The customers of the products/services define quality. The expectations of the customers are performance, reliability, on-time delivery, competitive price, clear and correct transaction processing, service, and beyond. Their voice is to be taken as the basic input while designing use products/services subject to practical constraints of providing them. In the competitive market. Customer delight plays a vital role in retaining customers as well as expanding the customer base. If it is not done by a company, some other company will do it.
2. **Processes:** At the first instance the process is to be defined clearly. For the defined process, its metrics must be identified. Later, measures of the processes must be listed. Companies must view the quality from customers' perspective, which will lead to greater acceptability of the product at a later stage. The company should understand the transaction lifecycle from customer's needs and process. This will help to discover what the customers see and feel. In turn, the weak areas within the process can be identified for improvement.
3. **Employees:** The driving force in either manufacturing or services is the employees.

VII. ORGANISATION OF SIX SIGMA

The successful implementation of the Six Sigma project throughout the organisation requires a highly structured organisation. The members of the organisation should be assigned with specific roles to play each with a title.

1. **Leadership council:** A leadership council sets the goals and objectives for the Six Sigma programmes. The council sets out the goals, which are to be met by the team.
2. **Sponsor**

3. Implementation leader

- **Coach:** A control of six sigma is an expert whose responsibilities are schedule preparation, defining the outcome of the project and mediating conflict during implementation stage if there is any resistance.

4. Team leader

- **Team members:** A team member is an individual performing specific duties Assigned to him from the Six Sigma project with due date to meet the goal of the project. He must work in synchronisation with other members of the team for the success of the project.

VIII. SIX SIGMA METHODOLOGIES

The methodologies of Six Sigma are DMAIC, DMADV and DMAIC stands for Define, Measure, Analyse, Improve and Control. DMADV stands Define, Measure, Analyse, Design and Verify. DFSS is another name for DMADV, and it stands for Design for Six Sigma.

IX. DMAIC METHODOLOGY

1. **Define phase:** This step defines the problem of the project and its goals, which is to be addressed. The tasks that are undertaken during this define phase are the formation of project team, documenting customers core business processes, developing a project charter and developing the SIPOC (Suppliers, Input, Process, Output and Customers) process map. The formation of project team contains two tasks. Viz. determination of team members and their roles. Identifying the right team members will be a difficult task, if the project is large with several departments and complex in nature. So, the project may be divided into smaller ones and they may be executed in a serial phase to overcome this difficulty.
2. **Measure phase:** The critical components of this section are plan of information series and execution of information series, information evaluation/evaluation and failure mode and consequences evaluation (FMEA). The number one supply of information consists of enter to the system, system specification and the output of the system. The enter is the start factor of the system at which positive inputs are added into the system. The information for system for distinct assessments of efficiency, that are time of the process: fee worried for the system, illness charge of the system and guy hours spent in the process. The output of the system represents the size of efficiency. At the degree of information evaluation, the information is evaluated and the cost of sigma is calculated. which in flip is used to compute approximate variety of defects. As said earlier, the deviation from consumer specification of a product/carrier is known as as Six Sigma Defect. A Six Sigma possibility is the whole variety of occurrences for such defects. A score scale can be used for every of the above. The scale can be from 1 to 10: wherein 1 is the bottom FMEA degree and 10 is the best FEMA degree. If the extent is high, the score is greater severe. On such cases, similarly time want now no longer be spent at the project. Analyse

Phase Analyse Phase the sooner steps are aimed to outline and degree the defects. The step "Analyse" targets to have a look at the defects so that you can lessen them. There are 5 kinds of evaluation as indexed below:

- 3. Source analysis:** Source evaluation does root-purpose-evaluation to discover defects. that are Obtained from the reassets of facts of the process. After the identity of the foundation reasons one has to examine the trouble earlier than making an try and keep away from illness from the product. The root purpose evaluation has 3 steps. Viz the open step, the slender step and the near step. The open step goals to discover all viable causes for the present day sigma overall performance via brainstorming workout completed via way of means of undertaking crew. The slender step narrows the listing of viable causes of the present day stage of sigma overall performance the decreased listing of causes is confirmed via way of means of the undertaking crew withinside the near step². Process analysis:

The process analysis creates and analyses detailed process map to identify the places where maximum Improvements are possible process consists Sequence of process and movement of materials from place to place in the production process

- 4. Data Analysis:** Data analysis uses measures and to analyse patterns and identify factors which influence the cause of the problem Resource analysis: Resource analysis is to analyse the lack of functioning means.
- 5. Resource analysis:** Resource analysis aims to analyse the level of functioning/Fitness of the resources, viz. men, machine and materials that are used in the value chain of the employees are not well equipped/trained, it will be reflected in terms of more rejections in the production process or other function like accounting human resource. If the invoicing process is not integrated with the delivery of the goods to customers, confusion at customer end for settling the bill for the product which has not been delivered to that customer Similarly, if the selection of the personnel is not properly done it will be reflected in terms of worst of of the employees for the positions/jobs in the organisation.
- 6. Communication analysis:** The communication analysis aims to avoid the gap between the two parties in the communication process. The communications from in organisation to either external customers or internal customers, should be clear and well sequenced otherwise, it will lead to inefficiencies and ineffectiveness in the processes of the organisation.

X. IMPROVE PHASE

The objectives of the improvement step of DMAIC are identification of improvement breakthroughs, identification of high yielding alternatives, selection of desired method, designing the future state of the system, determining the improved level of now sigma. performing cost/benefit analysis, designing dash boards scoreboards and creating preliminary Implementation plan. The identification of improvement breakthroughs stage aims to identify potential solutions that eliminate root causes by using idea generation tools and techniques.

Identification/selection of high yielding alternatives include the following

1. Development of criteria for the evaluation of candidate solution alternative
2. Systematic and holistic thinking for improvement.
3. Prioritisation and valuation of the candidate solution alternative against the evaluation
4. Criteria of the solution alternative.
5. Performing a feasibility assessment for the highest value of solution alternative.

1. DMADV Methodology

The DMADV methodology has five steps, which are define, measure, analyse, design and verify. The first three steps of DMAIC and DMADV are the same. The DMADV methodology is a Six Sigma approach for new products or services.

- 1. Define:**
- 2. Measure:**
- 3. Analyse:**
- 4. 4 Design:**
- 5. Verify:**

2. DFSS Methodology

The DFSS methodology is known as Design for Six Sigma, which has five steps. viz. Define, identify, design, optimise and verify.

- 1. Define:** The customer and related project for attention are identified in this step.
- 2. Identity:** This step defines desirable needs and undesirable needs of the customers.
- 3. Design:** This step designs a process which meets customer needs.
- 4. Optimise:** This step determines the process capability and optimises the design.
- 5. 5 Verify:** This step tests, verifies and validates the design.

XI. SIX SIGMA TECHNICAL TOOLS

1. Process map
2. Critical to quality tree (CTQ Tree)
3. Histogram
4. Process summary worksheet
5. Pareto chart
6. Cause and effect diagram
7. Affinity diagram
8. Scatter diagram
9. Control chart
10. Run chart

XII. SIX SIGMA BELT RANKINGS

The belt degrees in Six Sigma are just like the belt scores presented within side the martial arts. Belts are titles presented to practitioners primarily based totally on their stage of skill, experience, know-how and education in Six Sigma principles. To recognize how employees' strengths and competencies may be carried out in a Six Sigma project, it's miles useful to recognize what every belt signifies.

- 1. White Belt:** This is the beginner's belt of Six Sigma. The White Belt certification is right for specialists who need to start their Six Sigma adventure via way of means of mastering extra approximately the method and the way it may affect their organization. White Belts can variety from front-line employees to company executives. This certification offers specialists with a primary running expertise of the Six Sigma method. The White Belt function usually calls for numerous hours of Six Sigma schooling earlier than certification. Once certified, White Belts normally help problem-fixing groups inside their organization, even as additionally supporting instill Six Sigma subculture into the administrative center and inspiring different personnel to exercise it. For example, a Six Sigma White Belt might also additionally lend a further pair of palms and eyes to assist acquire records and provide perception into how sure methods are running.
- 2. Yellow Belt:** Unlike White Belt professionals, Yellow Belts have already got a simple information of Six Sigma principles. They aren't professionals in Six Sigma, however they were added to the jargon and gear often used withinside the approach. Yellow Belts acquire among 10 and 15 hours of Six Sigma education, and frequently paintings below a challenge chief who's at the least Green or Black Belt certified. At the begin of a challenge, Yellow Belts are usually tasked with growing technique maps and contributing to records gathering. Yellow Belts exercise Six Sigma on a part-time basis, however what they'll lack in expertise, they usually make up for in neighborhood technique knowledge. Organizations can assist make sure that Six Sigma is known and carried out in any respect degrees of a organisation via way of means of imparting White or Yellow Belt education to employees. Professionals interested by greater in-intensity education and gear have to don't forget better degree Six Sigma certifications
- 3. Green Belt:** Green Belts are on the coronary heart of the action. Most of the paintings finished via way of means of Six Sigma task groups is carried out via way of means of Green Belts. Professionals with this certification commonly devote among 25% and 50% in their running time to Six Sigma projects. At this stage, Green Belts are taken into consideration professionals in Six Sigma philosophies and principles, however possibly maximum importantly, they're appeared as professionals within side the technique that they're improving. Certification necessities can range relying on enterprise or certifying body. Typically, Green Belts are required to finish a set variety of hours of study room training and by skip a written exam. In addition, Green Belts should take part in an real Six Sigma task earlier than turning into certified. Once certified, Green Belts play an crucial function figuring out and enforcing enhancements for the duration of the organisation via way of means of supporting their task groups acquire and examine data. This allows decrease version to be able to produce better high-satisfactory items and services. Successful Green Belts commonly own sturdy analytical abilities and are capable of speak in any respect ranges of an organisation. This stage of education is

frequently relevant for personnel running in a high-satisfactory warranty function or a mid-to-top stage control function.

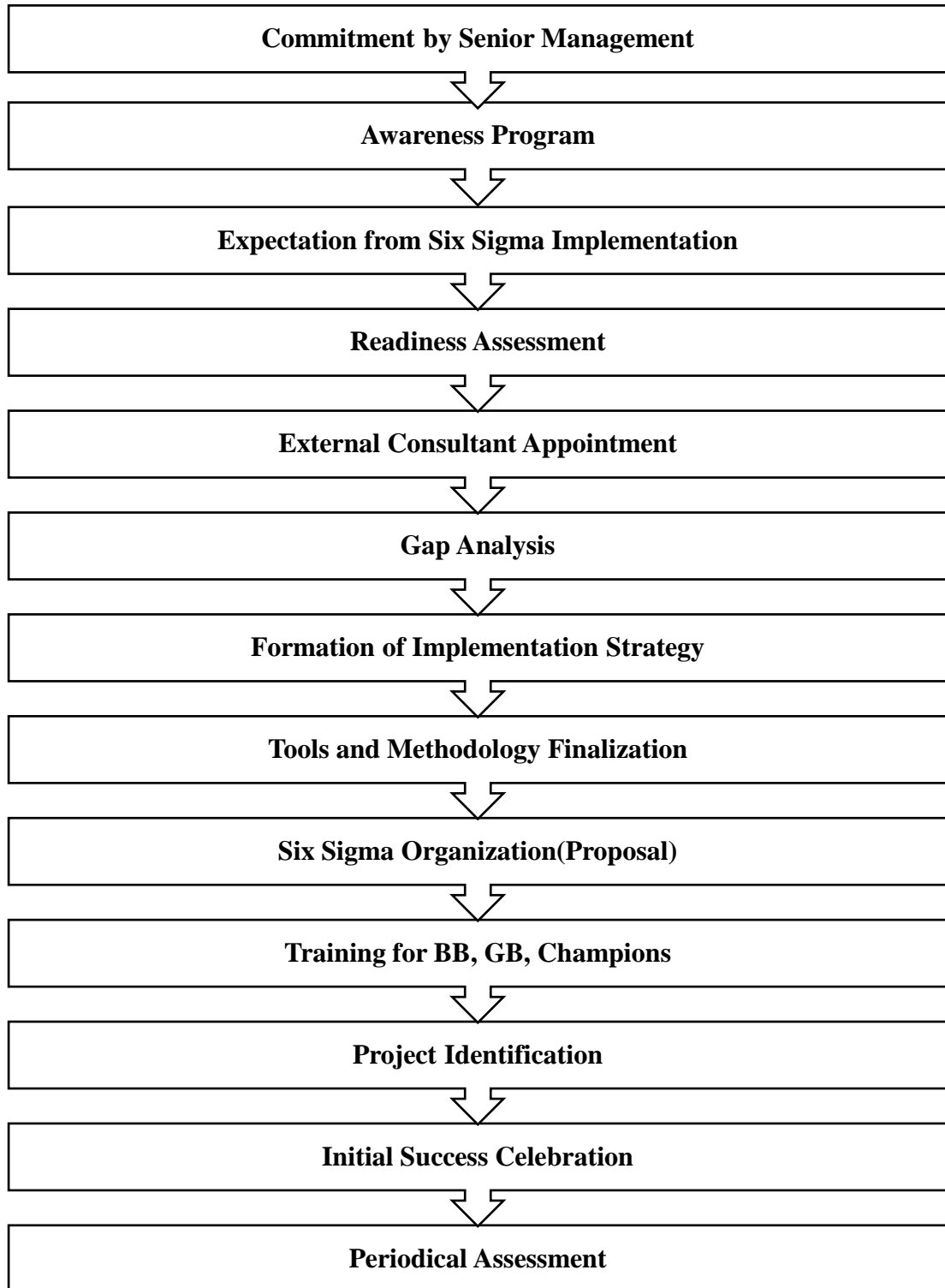
4. **Black Belt:** Black Belts function leaders and are accountable for dealing with more than one groups made of Green, Yellow and White Belts. Black Belts exercise Six Sigma on a full-time basis. Because of the know-how required, applicants must gain a Six Sigma Green Belt certification earlier than pursuing their Black Belt. Candidates have to additionally byskip a written examination and feature finished genuine Six Sigma projects. Black Belts must own a mastery of system development and statistical evaluation techniques. They must have sturdy human beings competencies and act as powerful leaders and mentors for venture group members. Black Belts also are capable of educate Six Sigma concepts to venture groups and management while needed. Consistency is prime on the subject of the Black Belt position as holders have to use their time wisely, and be excellent choice makers to make sure their venture groups live on challenge and meet deadlines. While necessities may be greater rigorous for a Black Belt, the certification prepares specialists to be professionals in Six Sigma and leaves them simply one step farfar from reaching the very best of all Six Sigma belts, the Master Black Belt.
5. **Master Black Belt:** Master Black Belts normally do now no longer characteristic as a full-time member on someone precise crew, however rather, function an inner representative for a couple of groups and assist them conquer technical limitations and solution procedural questions. This lets in them to peer the massive image of the organization's high-satisfactory development efforts and allows them to recognize and assist affect the company's Six Sigma efforts. The electricity of a high-satisfactory development crew lies now no longer simplest in its information of the standards of Six Sigma, however additionally withinside the talents and self assurance of its crew members. Therefore, Master Black Belts need to have the interpersonal talents Six Sigma regularly makes use of gear and data-pushed selections to clear up problems, however venture fulfillment is decided through the folks who manipulate and perform the projects. Understanding the obligations and certification necessities of every Six Sigma belt stage can make clear the jobs of every belt degree and assist decide which certification is proper for you.

The detailed methodology for implementation of Six sigma infarming sector

- **Existing farming process mapping:** In this step the existing scenario in the farming can be capture with of help of industrial engineering tools and techniques. Process flow chart, Spaghetti diagram and value stream mapping can be implemented in order to obtain actual farming process.
- **Identification of non-value adding activities:** The current value stream map will indicate the non-value adding activities that are wastages. The wastages can be classified in the ten forms viz. Transportation, Inventory, Motion, Waiting, Overproduction, Over processing, Defects, Unused skills, Excessive load and physical strain.

- **Data collection:** The primary data can be collected using time study, various templates, interviews and questionnaire. The template includes Process sheet, SIPOC chart, RACI matrix, etc. Also, secondary data can be collected through the research papers, magazine and government reports.

XIII. SIX SIGMA IMPLEMENTATION MODEL FOR INDIAN INDUSTRIES



Pilot study–In this study Lean six sigma methodology can be implemented in the specific farm and results after implementation are measured. If the results come positive then the detail framework will be prepared. If the result of pilot study comes negative then again improvements are made in the framework of implementation and again implemented to evaluate the results Development of six sigma implementation framework – After the pilot study the detail framework will be developed and this framework can be universally implemented in the Indian farming conditions to reduce the cost of production Six sigma Awareness & training to farmers–The successful development of LSS implementation framework is not the solution, there is requirement of awareness and training to the farmers about Lean six sigma and their advantages. Application of LSS tools and techniques– Thereafter, lean six sigma tools and techniques implementation will be carried out in the sample farms. Mostly the implementation of 5-S, Kaizen, SMED, VSM, Kanban, levelling, Poka-yoke, layout planning etc. carried out.

Performance measurement and cost benefit analysis –Performance measurements will be done in order to compare performance with the base value. The performance measurement can be carried out with the help of questionnaires analysis, audits and interviews. The performance improvement can be reflected in the monetary value. The reduction in the cost of production is then calculated through Cost-Benefit analysis.

XIV. APPLICATION OF SIX SIGMA IN AGRICULTURE

Six Sigma in particular specializes in exceptional to assure client satisfaction. This prevents faulty agricultural merchandise that frequently cause remembers and complaints. • The exceptional technique targets to apply the maximum effective analytical equipment in making sure that the inspection of all substances utilized in agricultural merchandise are excessive in exceptional. This guarantees defect-unfastened merchandise. • This targets to create agricultural merchandise withinside the maximum systematic way possible. This effects to tactics and manufacturing which places a number of emphasis on exceptional maximization. • Six Sigma promotes expanded exceptional product with the least quantity of cost. It additionally targets to preserve substances and electricity in the course of the manufacturing of agricultural merchandise. The end result could be low fees for all agricultural services and products and proper cost-competitiveness.

Measuring process performance

1. Farmer wants a seed, which gives good yield, there are two seed companies, x and y
2. Average yield of x company’s seed for 5 years = 12.20 q/ha
3. Average yield of y company’s seed for 5 years= 12 q/ha

Year	X seed(yield)	Y seed(yield)
2013	4	13
2014	17	11
2015	5	12
2016	27	11
2017	8	13
Average	12.20	12

By looking into average yield every farmer will choose X company seed, but after seeing the variations in the yield of the X company seeds the farmer will definitely go for the Y company seed which is relatively consistent yield in sequence of years.

What is DPO?

The ratio of the wide variety of defects in a pattern to the full wide variety of illness possibilities. As a result, the ratio right here allows you matter the common wide variety of defects which arise withinside the overall wide variety of possibilities in a pattern organization.

Step 1: is to decide the full wide variety of devices to be sampled.

Step 2: is to decide the wide variety of illness possibilities according to unit. Creating a listing of capacity defects or mistakes according to unit of procedure or products or services clients will care about → Focusing on routine, in place of uncommon defects or mistakes → Grouping or merging associated or comparable defects into one category

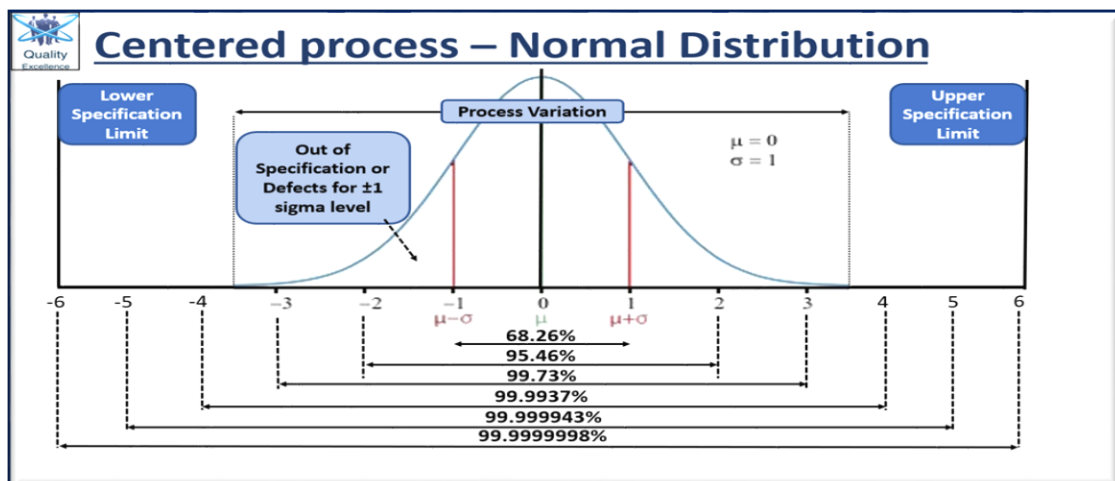
Step 3: is to decide the full wide variety of illness possibilities ONLY for the pattern length below consideration.

Step 4: is to matter the faulty possibilities within side the pattern organization. You will absolutely need to calculate what number of possibilities within side the pattern organization sincerely incorporate defects or mistakes.

Step 5: divide the full wide variety of defects via way of means of the full possibilities handiest for the pattern length below consideration. This step offers you the DPO as a decimal wide variety, which may be transformed to a percentage

XV. ETYMOLOGY OF SIX SIGMA PROCESS.

The term "six sigma method" comes from the belief that if one has six popular deviations among the method imply and the closest specification limit, as proven withinside the graph, almost no items will fail to fulfill specifications.



This is primarily based totally at the calculation approach hired in method functionality studies. Graph of the everyday distribution, which underlies the statistical assumptions of the Six Sigma model. In the centre at zero, the Greek letter μ (mu) marks the imply, with the horizontal axis displaying distance from the imply, marked in popular deviations and given the letter σ (sigma).

The more the usual deviation, the more is the unfold of values encountered. For the inexperienced curve proven above, $\mu = \text{zero}$ and $\sigma = 1$. The top and decrease specification limits (marked USL and LSL) are at a distance of 6σ from the imply. Because of the residences of the everyday distribution, values mendacity that a ways farfar from the imply are extraordinarily unlikely: about 1 in 1000000000 too low, and the identical too high. Even if the imply have been to transport proper or left via way of means of 1.5σ in some unspecified time in the future withinside the future (1.5 sigma shift, colored purple and blue), there may be nonetheless a terrific protection cushion. This is why Six Sigma goals to have strategies in which the imply is as a minimum 6σ farfar from the closest specification limit. The position of the sigma shift is specially academic. The motive of six sigma is to generate organizational overall performance improvement. It is as much as the business enterprise to decide, primarily based totally on purchaser expectations, what the ideal sigma stage of a method is. The motive of the sigma price is as a comparative parent to decide whether or not a method is improving, deteriorating, stagnant or non-aggressive with others withinside the identical business. Six sigma (3.4 DPMO) isn't always the intention of all strategies

XVI. REVIEW OF RELATED CASE STUDIES

Six-Sigma: A case study on Mumbai DabbawalaShubham Vashisht (2018): The Dabbawallas affiliation is an terrific instance of talented Logistics and Supply Chain Management. Corporate and pupils have to make observe in their running with the aid of using retaining in thoughts the quit purpose to realise their certainly considered one among a maximum specific shape and process. Today the Dabbawallas have reputable the usage of net innovation simply to boom their patron base and not anything extra. Numerous rapid meals chains and accommodations withinside the town will dependably be rivaling the Dabbawallas but their believe of unhappiness of Dabbawallas framework might also additionally by no means emerge. The dabbawallas are an wonderful affiliation of extra than 5,000 people in Mumbai. People in Mumbai who works in banks, colleges, hospitals, authorities offices, factories and ports are all unfold throughout distinctive elements of the town. The dabbawallas supply lunch packing containers for approximately 2 lakh human beings at their paintings locations on time. They additionally convey the empty lunch packing containers from the customers; they made handiest one mistake in six million transactions and were continuously appropriate at it for all of the time in their operations. Forbes international mag performed a pleasant warranty observe on dabbawalla operation and gave six sigma rankings of ninety nine.ninety nine on account that they made 1 blunders in six million transactions and that they stood excessive at the side of MNCs like Motorola, GE etc

XVII. CONCLUSION

By making use of Six Sigma, the challenge control organisation makes use of a disciplined, data-pushed technique to decrease or dispose of defects in any system. This

system may be utilized in manufacturing, engineering, leadership, and any position wherein there may be a selected system. DMAIC is the precise technique of Six Sigma that walks challenge managers thru a hard and fast step-with the aid of using-step gadget to systematically pick out defects, measure, analyze, improve, and manipulate the system. Many corporations stay and breathe with the aid of using the methodologies of Six Sigma. These corporations have pronounced better income, quicker techniques, and multiplied worker morale. Similarly, in Farming quarter farmers are overloaded with the weight of the economic problems. Farmers are going through the hassle of better price of production. It may be minimizing with the aid of using supplying appropriate high-satisfactory of seeds, fertilizers and insecticides at low-priced price. Through software of Six sigma that consists of standardizing techniques and making use of sources optimally can lessen the price of production.

XVIII. DISCUSSION

1. Can six sigma apply to Agriculture.

Yes, six Sigma can apply to agriculture it tells about variations occur in the agriculture and it predicts upcoming problems so by adopting Six sigma in agriculture farmers can utilize the resources very effectively.

2. Six sigma and Total quality management are same?

No, TQM focus only on the quality but six sigma defines quality as well as variations in the process. So, six Sigma is the improvement over the TQM.

3. Can six sigma apply to our department?

Yes, absolutely we can apply six sigma to our department, first we have to collect decide the topic on which we are applying the six sigma then the collection of data regarding that topic after that we can access the sigma level thereby we can find out the solutions to the problems.

4. What is the procedure to get the six sigma belts?

There are training programmes for different belts based on the hierarchy of the belt the duration of the training programme will be decided. For instance, for green belt 3 to 4 weeks training programme.

5. Agriculture is gambling with monsoon can you tell how six sigma can apply in this situation.

Agriculture is depending upon the monsoon if enough showers will not receive farmers will face the problem, six sigma report this variation in one year, then it will suggest the alternative solutions for upcoming years for example subsidiary occupations like dairy, poultry, fishery etc.

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