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RESEARCH ARTICLE

SIX SIGMA IS A QUALITY DEVELOPMENT TECHNIQUE IN PRODUCTION INDUSTRIES

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ABSTRACT

Six Sigma's intend is to purge ravage and incompetence,in that way escalating customer satisfaction as a result of distributing what the customer is anticipating,in the end enhance quality. Six Sigma is a exceedingly obedienced route that aids to spotlight on expanding and distributing quality products and services. Six Sigma is a records obsessed tactic, and entails exact records assortment for the routes being evaluated. Six Sigma is as regards placing outcomes on Financial statements. Six Sigma chases a madeup tactic, and has delineated positions for the partakers. Six Sigma is a commerce obsessed, multidimensional madeup loom for perking up routing, lesser defects,tumbling route variability, plummeting costs,escalating customer satisfaction, enlarged profits. If you can evaluate how many defects are obtainable, It can methodically make out how to purge them and dig up as close to zero defects as possible or towering quality products and explicitly it ways a malfunction rate of 3. 4 components per million.

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INTRODUCTION

Six sigma is one of the nearly all vital and admired development in the quality meadow. Six Sigma has three divergent elements to its definition, First, a measure, It is a statistical definition of how far a process deviates from perfection. Second, a target, it is 3. 4 defects per million chances. Third, a philosophy, It is a long term commerce strategy alerted on the diminution of cost through the diminution of changeability in products and processes. Accordingly, it is definited in a assortment of conducts by some authors, but for the rationales of these comments the explanation from Pande et al alerted on the other inclusive philosophy of Six sigma will be used. "A inclusive and stretchy method for pulling off, underneathing and exploiting commerce accomplishment. Six Sigma is exclusively motivated by means of close up indulgent of customer necessitates, regimented make use of of particulars, facts, and arithmetical analysis, and conscientious consideration to supervision, improving, and again deviseing commerce processes. "A well-built configuration and lucid coalition to managerial aims, mostly financial, are a chief element of the Six sigma loom as definited by Eckes. Guidance is endowed with by a panel of champs as Senior champ, Deployment champ, Project champ at commercial, division and section stages correspondingly shored up by a panel of connoisseurs. The connoisseurs are submited to as Black belts who effort complete time on projects at process level to decipher decisive difficulties and accomplish outcome and Master black belts who effort mentoring, working out and authority prop up to the Black belts. Ingleand Roe note down that this noteworthy managerial arrangement can vary since four thousand Black belts in a corporate populace of three lakhs fourty thousand and one hundred twenty Black belts in a corporate populace of one lakh. Black belt training is typically sixteen or twenty weeks and a year in Motorola by Ingle and Roe, even though both are scattered with projects that fetch worth to the association. There can be only some proposals which have been boasted as stridently as Six sigma; only some where the avers have been so spendthrift; and only some which carve up the quality neighborhood as a result entirely. While this division does not, definitely cannot, put forward to probe entirely the substantiation underneathing the self asserted results of major conglomerates it endeavors to elucidate the level of anticipation placed upon Six sigma course. The clauses below tackle the impending responds to the query; 'Why Six sigma?', and depicts on the effort of Henderson and Evans who considered the experience in some detail. Perchance the nearly all evident substantial assistance of quality upgrading is the diminution of costs related with non quality. If anyone has to hurl a product away because anyone has completed an inaccuracy in its production, it is lucid that

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there is an urgent financial brunt as the entire the costs downcast into the product are vanished. Correspondingly, burdening an erroneous maneuver over yet again soak upscost operator time, power, additional materials, other cost. Even if anyone who efforts in an association will be memorable with countless illustrations of together of these subjects, commerce accounting systems are not set up to confine these costs. Conventional accounting looms are intended to follow the inflow and outflow of funds in an association. There is modest prominence on whether the funds in the division is depleted efficiently. Yet when it does emphasize a cost of poor quality, perchance in an over financial plan stipulation in material splurges, it will not bestow lucid signal of where accurately the over expend croped up.

Fiegenbaum's prevention-Appraisal-Failure model of costs of poor quality, even though there are extras. Be short of lucidity of the cost of poor quality in associations led to a be deficient in spotlight on upgrading for various years. It was just with the advent of the Cost of Quality approach by Defoe and Juran that associations had a financial tool to evaluate the costs associated with quality failures and thus spotlight on the most imperative areas for upgrading. Six sigma unswervingly evaluates costs of poor quality on a venture by project basis, on condition that lucid inspiration for upgrading and an hint of supposed gains. The crucial judgment is that a comparatively minute boost in expenditure on hindrance activities will carry a more than giving back diminution in assessment and malfunction costs. Cost of quality models are definitely obliging in engendering thrust in the quality upgrading progress, yet,at greatest, a incomplete outlook of the fiscal gains. The spotlight on malfunction disregards facets of waste which speak about tostream and effectiveness as contrasting to accurateness. The perception of ravage is moderately common in scenery and has been just about for a elongated instance. Several associations pass on non value added activities and process waste. On the other hand, these are somewhat extensive stipulations and, even as it is effortless to consent that ravage is awful and should be wiped out. It does not greatly facilitate in the process of upgrading. The Seven wastes were acknowledged by Ohno as division of the Toyota production system and have since been extensively applied to process upgrading, flattering predominantly associated with the attitudes of lean manufacturing. It can voluntarily be witnessed that a few of the costs associated with these activities would fit painstakingly into the cost of quality. This type of approach allocates for a lucid recognition of possible cost savings, even as also allocating for the upgrading and what to carry out in your own way. The remarkable financial gains associated with Six sigma definitely relation for much of its status, but on the shortcoming may also be liable for the rapid stick attitude which has distinguished at smallest amount of the submissions. To be there receptive to, and alerted on, customer's product out vs. market in. Deemed specialist in our customer's necessities.

Anyone who has been on the end of a customer service argument where it have been informed that it must have been maltreatmenting the product, or that it was not proposed for the positions expressed, will distinguished this attitude. It is identified as the Product out theory where the spotlight is on functioning to measurement or tutoring and the product is pushed from the industry to the customer. The predicament with a product out spotlight is that it is leisurely to take action to varying markets and customer requirements.

The Market in loom permits for a more receptive system and spaces a necessity on the association to depart and note the customer requisites. Customers may not be specialist in the mechanics of the product, but customers be familiar with what the necessitate the product to do for them. The Six sigma inventiveness endeavors to install the accent of the customer all the way through the processes of the association. To advance product and service performance, a decline in defects will be supportive to customers in that it will condense the chances that and defects will getaway recognition and impinge on the final customer. On the other hand, in glancing to condense disparity in product and service outcomes. Six sigma seizes approach to quality and makes out the yawning certainty of the Taguchi loss function by Taguchi. The Taguchi loss function demonstrates how escalating potential by plummeting product discrepancy concerning the tolerance band which can perk up customer satisfaction even though all products by now convene specification. The Loss function as definited by Taguchi is fundamentally a defy to the established concept on what makes up adequate quality for produced products. Six sigma is intrinsically a erudition process and, by itself, has the impending to supply to managerial erudition. Experiences necessitate to be widen all the way through the association so as to engender erudition.

Manifestation entails the amalgamation of the practice into an managerial framework. To build mutual conceptions and intellectual models combined elucidation of the circumstance practice occurs. Act is entailed to investigation and the analysis, which strengthens the explanation. It is lucid that a Six sigma upgrading project produces erudition all the way through inquiry of a process, put togethers that with managerial goals and detailed knowledge of statistics and other. It construes this to produce upgradings through action. At an managerial level giving out of good quality practice of projects picks up the erudition to a high-level. De Mast explains the aptitude to assist workforces at all levels in an association to find out how processes effort and to place this new knowledge to successful use as the core competence that Six sigma can carry to an association.

LITERATURE REVIEW

Even though several supporters of Six sigma hassle the distinctiveness of the loom, it is, indeed, aspect of a continuing encroachment of outlook in what might in general be entitled Quality. It is significant to perceive Six sigma within this extensive circumstance. Standardization was actually the first significant edifice chunk, upwarding the initiative that steadiness was imperative, in both products and processes. It extended into a broad appreciative of disparity and its shock. The cost of quality faction alerted managers to the express relation of better quality to the bottom line, while the TQM progress fetched spotlight on quality as a strategic main concern and established set working, headship and taking part of the workforce as key concerns. There are individuals who will enlighten that Six sigma is essential and new. The reality is that Six sigma is a decipherable fruition of TQM. De Mast (2006) glimpses it as an enduring segment in the fruition of methods and approaches for quality and effectiveness advance. Six Sigma can be seen as the amassing of beliefs and practices extended in management statistics and quality engineering, all of which establishedd extensively over the way of the Twentieth century. Six Sigma approach was first enlargeed in the late 1980s within a mass production environment in

Motorola (Harry, 1998) as moved violentlyd to congregate challenging quality goals on multifaceted produced products; and happen to usually celebrated when GE espoused it in the mid-90s (Folaron and Morgan, 2003; Thawani, 2004) when, questionably, it developed from individual a process upgrading methodology to a broader, industry wide philosophy. Both industries at rest mull over Six sigma as the base for their unending strategic upgrading approach. Since the 1980s Six sigma has turned into one of the mainly admired advance initiatives; usually executed just about the globe in a ample range of zones such as Boeing, DuPont, Toshiba, Seagate, Allied Signal, Kodak, Honeywell, Texas Instruments, Sony, Bombardier, Lockheed Martin that all asserted substantial financial savings as Harry, 1998; Antony and Banuelas, 2001; Kwak and Anbari, 2006. Additional gains asserted for Six sigma embrace augmented reserve price, better processes and products quality, smaller cycle times,better design and augmented customer satisfaction (Lee, 2002; McAdam et al, 2005). Six sigma has undergone a substantial fruition as the untimely demonstrations (Folaron and Morgan, 2003; Abramowich, 2005). At the outset it was a quality dimension approach rooted in arithmetical attitudes. Then it distorted to a regimented processes upgrading technique based on plummeting variation within the system with the facilitate of a number of statistical tools. For example, Snee (1999) defined Six sigma as an approach that looks for hit upon and eradicate reasons of gaffes or imperfections in commerce processes by spotlighting on outputs that are decisive consequence to customers. The clarity specified in 1999 by Harry and Schroeder (1999) also describes Six sigma as a obedienced method of using awfully meticulous data congregation and statistical analysis to pin down sources of errors and modes of eradicating them. In its existing embodiment, it is usually obtainabled as a advance tactic and yet quality philosophy (Pande, 2002; Eckes, 2001). It is nowadays usually acknowledged that Six sigma is appropriate to a variety of milieus such as service, transactions or software industry despite the extent of the commerce (Pande, 2002; Lee, 2002) and being adjusted, Six sigma may produce just about just right products and services. Furthermore, Six sigma is amplifying its vicinity of application very in haste and there are exemplars of concerning Six sigma to foretelling the probability of a industry insolvency (Neagu and Hoerl, 2005) or ruling chances for augmentation (Abramowich, 2005). In the precedent five years, hundreds of associations have signified their attention in building Six Sigma their management philosophy of preference. Whilst numerous of the commerces endeavoring to put into operation. Six sigma are fine intentioned and desire to put into practice. Six sigma suitably just as General Electric did, there are also intolerant executives who now consider Six sigma in the same way as consider economizing. This approach to Six sigma is a certain alleyway to the similar instant upshots that put off lasting effectiveness. It is value remindering that the fruition of Six sigma is enduring with, for example, the amalgamation of Lean standards, advance of a product or service deviation (Design for Six Sigma) among others (De Mast, 2006).

STANDARD NUMERICAL DISTRIBUTION CURVE

All normal distributions are symmetric and have bell-shaped density curves with a single peak. To articulate expressly of any normal distribution, two quantities have to be precised: the mean, where the peak of the density occurs, and the standard deviation, which indicates the spread or girth of the bell curve. The empirical rule shows what percentage of your data falls within a certain number of standard deviations from the mean:

- 68% of the data falls within one standard deviation of the mean.
- 95% of the data falls within two standard deviations of the mean.
- 99. 7% of the data falls within three standard deviations of the mean.

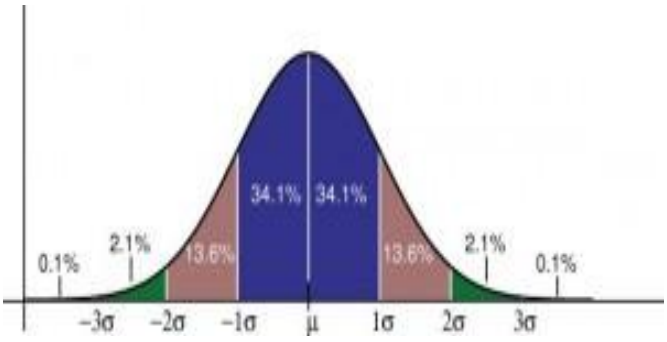

Fig 1. shows Standard numerical distribution curve

The standard deviation directs the widen of the distribution. A smaller standard deviation means that the data is tightly clustered around the mean; the normal distribution will be taller. A larger standard deviation means that the data is spread out around the mean; the normal distribution will be flatter and wider. The normal distribution is the mainly vital and mainly expansively used allotment in statistics. It is also called the "Gaussian curve" after the mathematician Karl Friedrich Gauss. As you will see in the section on the history of the normal distribution, although Gauss played an important role in its history, Abraham de Moivre first discovered the normal distribution. Strictly speaking, it is not acceptable to utter about "the normal distribution" since there are many normal distributions. Normal distributions can differ in their means and in their standard deviations. The density of the normal distribution (the height for a given value on the x axis) is shown below. The limitations μ and σ are the mean and standard deviation, respectively, and define the normal distribution. The symbol e is the base of the natural logarithm and π is the constant pi.

$$\frac{1}{\sqrt{2\pi\sigma^2}} e^{\frac{-(x-\mu)^2}{2\sigma^2}}$$

Since this is a non mathematical dealing of statistics, do not agonize if this expression bewilders you. Seven features of normal distributions are listed below. These features are illustrated in more detail in the remaining sections of this chapter.

- Normal distributions are symmetric around their mean.
- The region under the normal curve is equal to 1. 0.
- Normal distributions are denser in the center and less dense in the tails.
- Normal distributions are defined by two parameters, the mean (μ) and the standard deviation (σ).
- 68% of the region of a normal distribution is inside one standard deviation of the mean.
- Approximately 95% of the area of a normal distribution is within two standard deviations of the mean.

Properties of a normal distribution

- The mean, mode and median are all equal.
- The curve is symmetric at the center (i. e. around the mean, μ).
- Exactly half of the values are to the left of center and exactly half the values are to the right.
- The total area under the curve is 1.

Standard normal model

One way of figuring out how data are distributed is to plot them in a graph. If the data is evenly distributed, come up with a bell curve. A bell curve has a petite percentage of the points on mutually tails and the bigger percentage on the inner part of the curve. Fig. 2 shows Standard normal model.

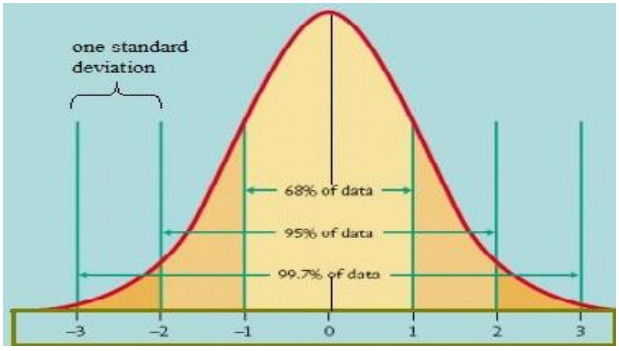

Fig. 2.

SIX SIGMA

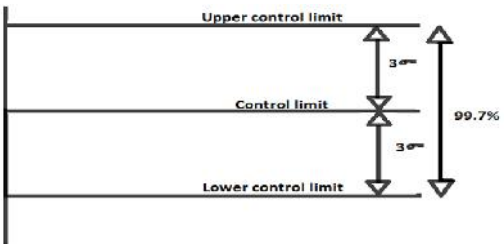

Fig. 3 Six sigma

In Six sigma, Control limit is the mean of all data. Upper control limit and Lower control limit are designed to calculate using formula of control charts. Data are accepted below the upper control limit and above the lower control limit. Fig.3 shows Six sigma. In the past, proposals centred on quality have commonly been commenced at a tactical level, paying attention on projects or cost diminution.

Eckes, amongst others builds the point that Six sigma activities must be sustained by processes and structures to ensure commerce intents ahead. Six sigma has progressed the spotlight rear to quality as a planned initiative, conceivably nearly all eminently in the individual of Jack Welch who not only asserted that Six sigma was intimate to the mode, supposed GE to do commerce and based fourty percent of senior management bonuses on attainment of Six sigma targets but also necessitated that senior management does by Henderson and Evans. For myself splurge time in each, Six sigma training gesticulate banter to candidates and answering their questions, thrust on six sigma appraisals seized weekly and monthly, build place breaks to scrutinize immediate the amalgamation of Six sigma into commerce ethnicity and operations, examine advancement through weekly outline reports and monthly reviews with the Master black belt team. By argument in the lingo of senior management and by entailing applied assurance and straight concern. Six sigma produce a much stronger cultural impact. Shiba, et al. note the difference between the conventional product out concept, where the industry efforts to a set of standards and a good product is one which kowtows to the industry standards, and the Market in concept where the spotlight is on gratifying the customer.

On condition that the standards are supported with the customer requirements, it may be disputed, there is no quarrel in these two approaches. On the other hand, the distinction deceits in the behavioural implications. A product out outlook will produce faithfulness to standard in spite of gloomy customers. It congregates our standard so it must be ok. This loom will be conciliationed with an unpredicted amend to customer leniences, and has led to the failure of several associations when a recovered option smacks the market rooting customers to abruptly anticipate more of the product. An example might be the advent of smart phones and the problems Nokia have experienced in their market share since Apple launched the iPhone, and radically changed the market. Playing catch-up when the market changes suddenly is very difficult and expensive, as Nokia has discovered. A Market in approach encourages the active engagement with customers which makes it less likely that companies will stick to outmoded specifications, or miss coming trends for too long. There is also a degree of arrogance which can set in with the Product out mentality.

An assumption often expressed by designers that the customer does not know what they want. Whether this is true or not is largely a moot point. A quote attributed to Ford is often used to illustrate this idea:If I had asked my customers what they wanted, they would have said a faster horse. Of course this merely misunderstands the idea of customer focus. What customers can be asked for is what they need, or what they would value in this case faster movement from A to B rather than how we should deliver the requirement, the horse versus internal combustion engine. This is not to say that at times an innovation cannot create a hitherto non-existent need, simply to say that this happens fewer times than is perhaps suggested. Did Apple truly create a new set of customer needs, or simply respond innovatively to emerging trends of mobile computing? Six Sigma recognises the value of customers to the organization and focuses on creating value for the customer. Six Sigma plans which spotlight on cost diminution overlook the point that what distributes lengthy term fertility are happy customers, even more so than lower costs.

A good Six Sigma project focuses on the customer rather than short term financial gain. Six Sigma recognises that variation in products generates problems not only in terms of defects (Defects Per Million Opportunities metric) but also in terms of adding cost and reducing customer satisfaction – and future revenues. The Taguchi Loss Function shows this effect elegantly, but a few examples might help to illustrate the issues. Variation in component parts can lead to issues in assembly where fits vary to a significant degree. Time can be taken up with adjustment and ‘fitting’ as opposed to simple assembly. The extreme case is ‘selective fitting’ where components have to be selected to fit together adding time to the operation.

Inconsistent performance of products which are ostensibly the same causes customer dissatisfaction leading to reduced future purchases due to the impact on reputation from the few poorly performing products. Variation reduction is the key mechanism for Six Sigma to deliver business benefit. By focusing on product, service or process variation as depending on circumstances projects create consistency of performance and improved conformance to customer requirements. Six Sigma focuses on the concept of defects per million opportunities. It uses the standard normal distribution as its measurement system. From the standard normal distribution, the mean is μ and the standard deviation is denoted by σ. From figure 1, 68. 2% of the population lies within ±1. 0σ of the mean, 95. 45% of the population lies within ±2. 0σ of the mean and 99. 73% of the population lies within ±3. 0σ of the mean. When addressing variation it is important to remember the effects of special and common cause variation. The normal distribution and defects per million opportunities cannot apply if special causes are dominant within the process.

The Four focuses of a Six sigma project are Strategic focus, Customer focus, Cost focus,Learning focus. In strategic focus,Black belts are assigned projects strategically from a central committee, rather than selecting their own which has been shown to produce poor results or opportunistically co-opted onto projects by process owners. It behoves the Black belt and project champion to be aware of the strategic context for the project in their running of it; otherwise, it is easy to be seduced into looking for short term cost reductions instead of seeking strategic benefit. In Customer focus,the voice of the customer is at the heart of the Six sigma and drives much of the decision making in the improvement projects. Although it is subordinate to the strategic focus. In practice, it sometimes gets subsumed into the concern with cost reduction often being seen as the key focus for Six sigma. In Cost focus, In theory at least, subordinate to the other two. Cost is the most common reporting element of a Six sigma project and the principal focus of most discussion and hype on the matter. This reductionist approach gives you by far the lowest long term impact.

In Learning focus, a learning orientation for Six sigma is, as indicated in fig. 3 higher order focus. There are two elements to project as based learning. In intra project learning: which requires a reflective focus as the stages of the project progress and facilitation of the team in developing learning within the project about both the Six sigma process application and the commerce process on which it is functioning. In inter project learning which necessitates an effectual after deed review as well as giving out the intra project learning on an ongoing basis.

The project based learning must be keyed in to the wider organizational learning mechanisms to deliver the full impact. As Black belts and team members develop into more adroited at reflecting, sense making and developing appropriate actions. It will be causativing to emergenting the nucleus capabilities of the association in learning. For too long organizations have been obsessed with outcomes. Outcomes are driven the effective application of appropriate processes. Emphasis needs to move from assessment of outcome performance to the development and control of processes to deliver customer value. Six Sigma emphasises process over outcome and focuses on improvement of the critical process parameters to deliver excellent performance. A key aspect of a Six Sigma project is making clear and robust links between the required process outcomes to the process variables which principally affect the. This requires a reasonable depth of process understanding and rigorous testing.

Fig. 4 Six sigma methodology

Six sigma is a methodology shown in fig 4.

Step 1: The Define phase has a number of key purposes. Links to the strategic cycle, Project definition, Team formation. Learn about the process. Firstly it links to the strategic cycle to assess the current project against the strategic objectives and ensure that it something which has the potential to contribute to strategic goals. In Project definition, once the project is cleared as aligned to the corporate strategy the project scope,objectives, sponsors, schedule, deliverables and team members should be identified. In Team formation,as with all change projects a team of knowledgeable and motivated individuals should be formed and supported in developing an agreed understanding of the project,assess the potential benefits: An initial understanding of the benefits of the project. In Learn about process,it needs to be developed and agreed with sponsors. Develop measures of success relevant to this project.

In the define phase we need to understand how the process works and who it affects and links to; in particular customers and suppliers of the process need to be considered along with what they get from, or provide to the process. In actions phase, action phase has a series of interlinked actions, the numbers imply a sensible order, but this may well be an iterative process. In Review Strategic Plan, build a clear understanding of how the project contributes to organizational goals. Is this a good use of resources when considered strategically? Identify appropriate sponsors and champions to support the project. Select appropriate measure. In review the opportunity, What do the customers want? What is the current performance of the process? Realistically, what is the opportunity for improvement? Is the effort involved in improvement likely to be repaid by the benefit?

In Canvas support,build links with the people who are going to have to live with the change early in the project. Is there an appetite for change? Can changes be made in a way which is a good cultural fit with the area and create a win/win situation? In form the Team,blend expertise in process improvement with process knowledge and ensure that aspects such as motivation and linkages to the rest of the process stakeholders are considered asleaders, whether official or de facto need to be incorporated. In agree Timing Plan and review process, the team need to agree the timescale for the project and conclude a rough project plan so that progress can be effectively monitored. Agree what feedback is required, to whom, and when it will occur. In learn about the process, gain deep knowledge of how the process works by interaction with people involved in the process and observation of the process in action. Ensure that the picture you build up is accurate by testing it with key fact holders. Clarify principal customer requirements and review the measures identified in define phase for consistency with these requirements. In streamline

and standardise the process, take advantage of any quick wins to ensure that obvious sources of variation and waste are removed.

Step 2: The Measure phase has a number of key purposes as establish metrics and measurement system: What are the Critical to quality elements? How should it be measured? Is the measurement system capable of discriminating to an appropriate level?, listen to the voice of the process,understand present levels of performance in detail. Is the process stable? If so, what is the level of capability? The measure phase has a series of interlinked actions, the numbers imply a sensible order, but this may well be an iterative process, select metric and measurement system,remember to review the question being asked and to generate the most appropriate measure. This may not always be as obvious as it first appear, run control harts. Control charts are the only effective way of establishing whether a process is stable or whether it is under the influence of special causes. In assess process capabilitity. It can establish a notional sigma level for the process. Of course, the assumption of normality means that it need to establish stability before either of these metrics can usefully be calculated.

Step 3: The Analyse Phase has a number of key purposes. In analyse the value stream, what are the necessary steps to deliver value for the customer?In analyse the sources of variation,what are the potential sources of variation in the process for both specialand common causes? How can they be verified as significant? The appropriate actions for the analyse phase will depend upon the outcomes of the measure phase and onthe issue being tackled so this is a broad guide only. In value stream analysis,establish the process steps which create value for the customer,understand which elements of the existing process add value and which do not, reduce non value add. In analysing sources of variation, initially seek to understand all potential causes of variation by use of tools such as brainstorming and cause and effect analysis. Establish those which seem to be common and those which are likely to be special. Simple analytical tools like pareto diagrams can be used to establish the most frequent causes. More sophisticated tools such as design of experiments, correlation plots and hypothesistesting can more rigorously establish the significance of effects or relationships. In establish key process drivers, The same tool is used here.

Step 4: Again, this is self explanatory; value stream mapping tools to support analysis of the value stream and basic or more rigorous analytical tools to investigate and validate key sources of variation and establish process drivers. The Improve Phase has a number of key purposes. Determine the new process operating conditions: As an outcome of the analyse phase the conditions are decided to provide improved performance. In implement and verify, ensure that the new process functions as expected and identify issues, problems and failure modes, refine the process as required. In get buy in from stakeholders, get feedback from local personnel, assess the likely benefits and agree with project sponsor. The appropriate actions for the improve phase will depend upon the outcomes of the analyse phase and on the issue being tackled so this is a broad guide only. In process map or value stream analysis, establish the process steps which create value for the customer, compare to previous process. Publish the new process and key measures.
In train and test,train all those who require it, set up the new process and allow them to try it out, run a pilot test, ensure everyone is comfortable. Assess possible failure modes and address where possible. In analyse performance, use appropriate tool to establish stability, hypothesis testing etc. To understand new levels of performance. Seek feedback from local employees on how they view the new process. In review and predict,review data and feedback,take improvement actions and return to step 3 as required,predict expected performance and get buy-off from the sponsor. In plan for control phase, create a plan for embedding the changes and creating the opportunity for continuous improvement once the project is complete.

Step 5: The Measure Phase has a number of key purposes. In standardise the new process, document the new process, test with the staff to ensure they are happy with the solution. Train everyone and investigate opportunities to standardize across products, sites etc. Create new measurement and control regime: Set up measurement regimes which are aligned with the new process and required behaviours. Put in place control mechanisms to ensure that improvements are maintained. Verify and reverify the savings and benefits of the change. In document lessons learnt, no project can be completed without the team learning about both the process. It is working on and the process they employed to do it, conduct an after-action review and document lessons learnt. The appropriate actions for the control phase are listed. In Flowchart and map process, to clarify the new process. In run workshops, to test the solutions with the wider population. In set up controls, as required to provide on-going control,In after action review, to understand key learning points.

Conclusion

Six Sigma is constantly evolving. New combinations spring up in seemingly endless numbers. Some are superficial in the extreme and appear to be more about giving consultants something new to sell than about improving the Six sigma Paradigm. Into this category I would place Lean Six Sigma; for the most part it is bolting Lean tools into the Six sigma framework in a way that savvy practitioners had already done informally. It fails to engage with the aspects of Lean which challenge Six sigma. Design for Six sigma appears to offer more hope, but closer examination shows that in a lot of applications it stifles innovation just as much as Six sigma can by focusing on strict processes for risk reduction rather than supporting innovation. It tend to revolve around combination with bigger concepts such as TQM principles, which are much more challenging and promising on issues of leadership, worforce, innovation etc. Of most interest are the attempts to combine Six sigma with organizational learning principles. There does seem to be a genuine synergy between these two approaches. And this logic, while not perhaps bringing us full circle, leads us back to the work of Jack Welch at GE. He has stated time and again that he had to turn GE into a learning organization before it was ready for Six Sigma; the GE workout process was a critical precursor to Six sigma.

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