Conformance to Specifications, Zero Defects, and Six Sigma Quality – *A Closer Look*

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Abstract*:* The aim of this article is to present "a closer look" at the management theory of "Six Sigma Quality" and to contrast it with the management theory of Dr. W. Edwards Deming. This paper will offer a perspective that the critical differences between "Six Sigma Quality" and the teachings of Dr. Deming are not technical, but rather philosophical in nature. This explanation briefly compares the technical aspects of Six Sigma Quality and Deming's theory and devotes a greater emphasis on the paradigms, vocabularies and subsequent intent imbedded in these approaches. Given the significant gains attributed to Six Sigma Quality as a quality improvement philosophy, consider the greater gains that could be achieved if improvements could be applied to the very philosophy of Six Sigma Quality itself. Such gains would be realized by challenging the assumptions imbedded in "zero defects" as a quality goal and replacing it with the philosophy of "minimizing loss to society".

Keywords: Six Sigma Quality, Deming, Taguchi, Continuous Improvement, Quality Loss Function, System of Profound Knowledge, Thinking Together.

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1 Introduction

Automobile consumers have long been accustomed to annual product launches, with year-to-year external changes such as color options and body styling, or internal changes, such as the introduction of a 6-cylinder engine to replace a previously under-powered 4-cylinder model. Other technology advances in automobiles include improved fuel-air mixing systems or new braking systems. The same conditions are found in annual or semi-annual software system upgrades that bring us more and more features and functionality. To anyone employed in industry over the past 20 years, the emergence of new management theories is as predictable as the introduction of the next version of Microsoft's Windows software. For over ten years, book shelves have been filled with releases on new approaches to quality (from Total Quality Management to Six Sigma Quality), cost accounting (from Activity-Based Cost accounting to Balanced Scorecards), and process improvement (from Business Process Re-Engineering to Lean Manufacturing). Whether or not the new theories create and embrace new thinking is the subject of this paper. On the surface, each new model is billed as different from the others. The launch of any new product, from an automobile to a software system to a management theory, would require this form of marketing, if only for differentiation from the existing products. Upon purchase, the consumer learns if the upgrades are surface-level or much deeper.

Countless workplaces have witnessed executive interest in the "quality movement", often accompanied by quality improvement goals, quality improvement teams, and quality improvement training. The quality movement of the 1980's and 1990's ushered in the concepts of Total Quality Management and Six Sigma Quality, alongside of programs in Company-Wide Quality Control and Continuous Process (or Quality) Improvement. Explicit or implied, each approach was an attempt at gaining company wide involvement for pervasive quality improvements. Each approach announces a list of well-known companies that adopted the needed changes that produced notable results, often documented in terms of financial savings. Multi-national corporations including General Electric, AlliedSignal, and Motorola have confirmed significant quality improvements and cost savings over the past few years that have been specifically attributed to the application of Six Sigma Quality. A variety of observers offer praise for improvements to the bottom line [1,2].

In the late 1980's, Motorola introduced The Six Sigma Quality management theory. The popularity of this theory spread world wide through the active pursuit of Six Sigma (and often higher) Quality levels. Consider the following statement from then Chief Executive Officer Jack Welch included in a 1997 letter to GE shareholders as evidence of this pursuit [3],

"We didn't invent Six Sigma — we learned it. Motorola pioneered it and AlliedSignal successfully embraced it. The experiences of these two companies,

which they shared with us, made the launch of our initiative much simpler and faster."

Extending beyond this initiative within GE, the following information was gathered from the websites of Motorola and AlliedSignal to provide additional background on Six Sigma Quality:

From Motorola [4]:
On the definition of Six Sigma - *"A defect rate of no more than 3.4 per million; statistically, allowing for some variation in mean, this approaches zero defects.....At Motorola, we actually have a measure for quality which we call "Six Sigma" , and this literally affects everybody and everything we do, every minute, of everyday. Six Sigma is basically a target based on zero defects per million manufactured parts. At present we are hitting 99.9996%, which is so close to perfection that we are now using a parts-per-billion measure for defects."*

From AlliedSignal [5]
On the implementation of Six Sigma Quality: *"Six Sigma is a breakthrough change strategy for accelerating improvements in processes, products and services. It is a statistical term, first used in the electronics and computer industries, to describe an almost-perfect process. A company reaches the Six Sigma level of perfection when its processes are 99.99966 percent error-free, and defects measure a mere 3.4 per million."*

More will be offered about Six Sigma Quality in section 3. These definitions are presented here to create a framework for *a closer look* at Six Sigma, a look that is as timely now as has ever been. It is perhaps appropriate to mention at this time that over the years, Six Sigma Quality has been transformed by practitioners into many unique formats that barely bear resemblance to the standard designed by Motorola. Consequently, Six Sigma Quality as a practice exhibits variation and the practices of Six Sigma Quality often vary from company to company; depending on the local practices and interpretations of those leading its implementation. Given the lack of uniqueness of Six Sigma Quality, the aforementioned definitions of Six Sigma Quality, from Motorola and AlliedSignal, are presented as very complementary foundational interpretations.

The title of this paper follows directly from the closing sentence in Deming's last book, The New Economics [6]. Deming ended this book with a quotation from Donald Wheeler;

"Conformance to specifications, zero defects, Six Sigma Quality, and all other (specification-based) nostrums all miss the point."

This quote by Wheeler, and its subsequent use by Deming, place the 1980's concept of Six Sigma Quality alongside a remarkable quality philosophy from the early 1960's, *Zero Defects*. What made "zero defects" a "delightful" level of quality was a "satisfaction" standard in the 1960's which accepted the delivery of known defective parts and products, often with the customer's consent. Holding to the preceding definitions of Six Sigma Quality, the concept of Zero Defects would represent attaining an error-free result, indistinguishable from perfection. That is to say, where perfection is defined as meeting requirements. Whereas the aim of Zero Defects is no defects, the quality goal of Six Sigma allows defects at the minuscule rate of 3.4 per million. Nearly thirty years later, proponents of Zero Defects might well consider this quality goal to be a philosophical step backwards. The common denominator of these quality approaches is the pursuit of *conformance to specifications*, also referenced in Wheeler's quotation. Taken together, Deming's admonition exposes the limited focus of these efforts to improve quality, for all of them *miss the point*. As to what is *the point*, is it possible that the quality, and value, of the products and processes we utilize as consumers suffers from *specification-based* thinking and we haven't yet noticed the impact of this mental model?

Deming's management theory offers a departure from this fragmented "part" thinking towards holistic "part of" thinking. In simple terms, a focus on "parts" and the delivery of "perfect parts" is not in keeping with a focus on the interactions or connections between the parts. A more holistic perspective is to appreciate that each "part" is actually "part of" something bigger and that no part of any given product provides value to a customer alone. While the release of a "perfect part" might well satisfy a contractual obligation, it also serves to imply the end of a relationship (and responsibility) between the individual (or organization) releasing this part and the individual (or organization) receiving the part. As widely practiced, the implication to those releasing and receiving parts is that all parts "conforming to specifications" are good parts, also known as "acceptable parts". Consistent with this unspoken "part" logic, it follows that an acceptable part cannot be associated with problems and/or losses after their receipt, for the provider has fully lived up to their expectations and responsibilities. If there are problems and/or losses, each part provider has only to demonstrate the delivery of a "good" part" to be released from suspicion as a cause of the issue at hand. The concept of the "Taguchi Quality Loss Function" [7] will be presented in section 4 to offer an explanation for potential problems and/or losses with acceptable parts, thereby demonstrating the benefits that "part of" logic would create.

The "part" logic carries broad implications, among them the belief that the connection between the "part" provider and what it is "part of" can be terminated, or disconnected. Going further, "parts" suppliers would be operating with a belief system that they function independently; each determined to deliver a "good part", each trusting that their connection to the larger task stops abruptly with the delivery of a *perfect* part. Contrast this environment of "working independently" (as well as *learning* and *thinking* independently), with an environment of “working together” (as well as *learning* and *thinking* together), which naturally includes the belief that all parts are “part of” something bigger, all activities are “part of” something larger and all employees are “part of” something worthwhile. Maintaining this set of beliefs might well create a more open roadmap toward operating as “one company” and reaping the benefits of the resulting unification. Such a transformation of thinking could well represent a breakthrough for Six Sigma Quality implementation, leading to results in excess of those already established. Deming’s concept of a “system of profound knowledge” uniquely offers a theory by which to manage an organization as one company. An introduction to this system and the potential it offers Six Sigma Quality follows in section 5.

2 The Value Proposition and Zero Defects

The contrast between Six Sigma Quality and Deming’s management theory can also be revealed through a closer look at the everyday fundamentals of quality and the development of a non-technical framework. Consider as a starting point, the perspective of a consumer – also known as the external customer. With this in mind, one might ask this question;

“What causes a consumer to be dissatisfied with a product or a service?”

The experience of a quality management professional is not required to suspect that dissatisfaction arises when the customer’s expectations are not met. What is not readily appreciated is how, implicitly or explicitly, providers of products and services create the consumer’s expectations. Traditionally, marketing and advertising inform consumers about what is available, at what price, and create a perception of the level of quality and performance. As shown in Figure 1, receiving this level of quality represents neither disappointment nor delight. Instead, it might be said to deliver *satisfaction*, which is nothing to complain about and nothing to boast about. Given this scenario of establishing expectations, the term “satisfaction” corresponds to the ability of a product or service to meet expectations, or requirements. As an example, if one was to visit a hardware store with the intent of buying four specific items, customer satisfaction might be defined as the ability to find and purchase these items at a reasonable cost. Disappointment would result from receiving anything less, such as not being able to find all of the items or from paying a price considered above reasonable (i.e., above expectations). To go beyond satisfaction and provide *more* value than what was expected is the basis for customer delight. A focus on these activities is certainly among the fundamental strategies for a company to retain customers from year to year. The extras provided by a hardware store might include lower prices than expected (i.e., found elsewhere), friendlier service than expected, or faster checkout lines than expected. In time, the customer’s awareness of the existence of the “delight” level of value would transform this performance level to “expected”. From this perspective, anything less than this value proposition is now disappointing and only higher levels of value will be delightful.

The interplay described here between delight, satisfaction, and disappointment is a naturally occurring marketplace dynamic, demonstrated everyday in industry-after-industry throughout the world. This dynamic can also be interpreted as the interplay between “acceptability” and “desirability”, concepts defined by the work of Professor Kosaku Yoshida [8]. Professor Yoshida describes the concept of focusing on “conformance to specifications” as the philosophy of “acceptability”. He defined the willingness to go further, to do more than “meeting requirements”, as the philosophy of “desirability”. Borrowing from the terminology of Joel Barker [9], “acceptability” and “desirability” represent paradigms. They represent unmistakably diverging mental models, each with its own “rules and regulations”. When considering the paradigm of acceptability, one would strive to meet requirements and in so doing provide a customer with what is requested. From the paradigm of desirability, one strives to offer more than what is requested and seeks out a better understanding of what is needed. Accordingly, conscious and continuous actions delivered through the paradigm of desirability will eventually “raise the bar” of acceptability. One unfortunate consequence for companies focusing on acceptability is lacking the awareness that what may be satisfactory today will likely be become disappointing when the bar is raised by a competitor. This display of action serves as a friendly reminder that every company’s system includes it competitors.

A brief assessment of recent quality management history offers additional insights into the paradigm of acceptability. The ultimate goal in quality for such a paradigm would be the elimination of defects, leading to the epitome of acceptability – “zero defects”. In this case, each and every product characteristic (or service characteristic) meets its requirements. Also note that the achievement of zero defects assures customer satisfaction, for a time if it is expected, but falls well short of customer delight.

Philip Crosby, former vice president of Quality for International Telephone and Telegraph (ITT) developed and to a great extent popularized “Zero Defects” as the level for quality achievement. Earlier in his career, in the early 1960’s, Crosby worked as a quality professional in the defense industry. There, he witnessed the known shipment of defective hardware to the customer (the U.S. government), notwithstanding at an “acceptable” level. By promoting the delivery of zero defects, Crosby set a higher goal for himself and raised the bar. In doing so, he initiated what was to become known as the “Zero Defects” philosophy. Years later, upon retirement from ITT in 1979, Crosby released his seminal work on quality management, a book entitled “Quality is Free” [10]. In it, Crosby theorized that there are but four “Absolutes of Quality Management”:

1. Quality is defined as conformance to requirements, not as 'goodness' nor 'elegance'.

2. The system for causing quality is prevention, not appraisal.

3. The performance standard must be Zero Defects, not 'that's close enough'.

4. The measurement of quality is the Price of Non-conformance, not indices.

Upon closer review of these four *absolutes*, one finds references to the paradigm of acceptability in phrases such as “conformance to requirements”, “the performance standard must be zero defects”, and “the price of non-conformance”.

At this point, take a closer examination at two additional insightful aspects of the paradigm of acceptability. The first is a focus on the vocabulary of acceptability. In addition to *meeting* or *conforming* to requirements and being *satisfactory*, the delivery of acceptability implies that the product or service delivered to a consumer is “good” (as opposed to “bad”). Consider “defects”, an “acceptable” product would be one free of “defects” (as in containing “zero defects”). A closer observation of the vocabulary of acceptability reveals a diametrically opposed contrast between “good” and “bad”, revealing an absolute behavior required by this paradigm as in comparing the colors “black” and “white”, with no options in between. An alternative perspective is to portray colors on a continuum of shades of gray. Some examples of the natural extensions of a contrast of absolutes follow below:

pass vs. fail
in vs. out
fast vs. slow
cheap vs. expensive
safe vs. unsafe

Each pairing above denotes a contrast between two apparent extremes, each an absolute state as well. In each case one might ask to know the point of delineation between the two extremes. For example, at what point does “good” become “bad”, or at what point does “safe” become “unsafe”? The implicit assumption behind such contrasts is that such a point, or line, exists. Quality professionals would likely recognize this distinction as the difference between parts built to specification limits and those that are not. Parts that fall between these lines are “good” and those that fall ever so slightly outside are “bad”, regardless of how close they may be to the line. Each specification limit then represents the point at which “good” becomes “bad”. Further clarification of this “part”-based assumption will be offered in figures that follow.

Another often implied assumption behind the contrasts of the end points mentioned above is that these conditions only the two extreme perspectives exist, ignoring naturally present variation. An example here is that “good” represents the maximum condition or that “cheap” represents the minimum condition. Returning to the concept of zero defects, one might ask what could possibly be better than the extreme of zero defects. Continuing beyond this end point would be to deliver less than zero defects, a challenging and unreasonable feat when operating within the paradigm of acceptability. The implication is that a continuation in improvement in the number of defects is not possible; in which case, a state of perfection has been reached. Such a situation represents the limited and only outcome when one lives within the paradigm of acceptability.

Given this brief exposure to the vocabulary of acceptability, consider next the technical nature of this paradigm. Figures 2-4 provide simple graphical representations of acceptability, given a set of specification limits located on the horizontal scale. Data points on these scales (labeled 1, 2, 3) represent parts produced with the demonstrated level of performance. Given the three data points in Figure 2, two of these parts (1 and 2) would be considered to be “good” (IN), the other (3) a defect (OUT). By comparison, Figures 3 and 4 represent “zero defect” solutions, wherein all parts are “good”.

For added technical detail, two-dimensional extensions of the paradigm of acceptability are presented in Figures 5-7. These three figures correspond to Figures 2-4, with a vertical axis included to represent the distinction between “IN” (GOOD) and “OUT” (BAD).

Each of these figures reveals the appearance of lines of distinction between “good” and “bad” parts. Using the (American) football analogy of field goal kicking, the parts within the specification limits are between the “uprights”, and equally good anywhere within this range. In passing across either specification limit, each the width of a point, the quality level of the part instantly changes from “good” to “bad”.

As an extension to the “digital” (GOOD-BAD) interpretation of the data displayed in Figures 5-7, Figure 8 offers the “digital” perspective for data that spans the range of the specification limits. The resulting mathematical “step-function” is a logical technical interpretation of the paradigm of acceptability. The demonstrated attributes of this model are parts of *equal* goodness everywhere between the specification limits and the step-like transition to *bad* parts outside of the specification limits.

As demonstrated with the vocabulary and technical interpretations of "Zero Defects", this quality philosophy follows the "rules and regulations" of the paradigm of acceptability. In consideration of external customers, a focus on acceptability will only lead to meeting requirements and, in turn, an expectation of mere customer satisfaction. Customer disappointment begins when producers fall short of meeting requirements and delivering defects instead, or when knowledge exists that competitors already receive more than the requirements. The alternative strategy of exceeding customer requirements, and delighting customers, is represented by the paradigm of desirability. Underlying the paradigm of desirability is the operating value and intent of the competitive importance of providing a customer with better value at lower prices. Taken together, the potential for "better-than good", "faster-than fast" and "cheaper-than-cheap" products and services is both reasonable and achievable. In consideration of the dynamics of the marketplace, a corporate strategy of widespread acceptability is no match for a strategy based on desirability.

A fundamental nature of the paradigm of desirability is the concept of continuity, which inherently admits the potential for improvements. By comparison to the digital features of acceptability, the paradigm of desirability is based on a continuous (analog) viewpoint. Within this paradigm, the color spectrum is naturally represented by a continuum of shades of gray, without end points or points of delineation between black and white. Moving beyond the color spectrum, the distinction between "good" and "bad" is replaced by the concept of "better". Instead of "safe" and "unsafe", there is acknowledgment of the potential for "safer". An added consequence of this analog perspective is the expectation and likelihood of efforts that will result in continuous development and improvement. Another is awareness that an alternative concept of perfection, defined by *the* point of *ultimate* achievement, is not possible if improvement is indeed continuous.

3 More on Six Sigma Quality

With the support of senior executives at General Electric, AlliedSignal, and Motorola; these companies and many more have demonstrated significant quality improvements and cost savings that have been attributed to the application of Six Sigma Quality. Additional explanations from Motorola [4] about Six Sigma Quality from follow here:

On Goals:
"We are continuing to set reach-out goals. Our metrics have changed from parts per million to parts per billion and we are going forward with a goal of 10 times reduction in defects every 2 years."

On the definition of Six Sigma:

“Six Sigma is a change strategy for accelerating improvements in our processes, products, and services. Six Sigma is a way to define our progress towards becoming premier.”

On the history of Six Sigma? Who created it?:
” The concept of zero defects, identified mainly with Quality expert Philip Crosby, is an approach that stresses that all errors are preventable. The concept is more than 30 years old. Many Japanese companies effectively implemented the concept during that period, but it didn't really catch on in the United States until the mid-1980s when Motorola Inc. adopted, popularized and led its use in the U.S. It measures quality by the number of defects per million opportunities and then creates 6 levels of achievement, with Six Sigma being the top level.”

In consideration of these statements, one notes again the underlying focus of this philosophy on minimizing errors and defect rates and the linkage of Six Sigma Quality to the concept of Zero Defects and perfection. Such statements also serve to link Six Sigma Quality with the paradigm of acceptability. Another point of consideration is that the achievement of Six Sigma Quality is considered to correspond to the delivery of 3.4 defects per million parts, or per million opportunities. As stated earlier, Philip Crosby’s goal of “Zero Defects” would represent a more formidable quality challenge than Six Sigma Quality.

Joseph Juran, the legendary quality thinker of the 20th century, was interviewed in 2000 by Quality Digest Magazine [11]. He offered his thoughts on Six Sigma Quality in his reply to the question “What do you think of Six Sigma?”;
“From what I've seen of it, it's a basic version of quality improvement. There is nothing new there. It includes what we used to call facilitators. They've adopted more flamboyant terms, like belts with different colors. I think that concept has merit to set apart, to create specialists who can be very helpful. Again, that's not a new idea. The American Society for Quality long ago established certificates, such as for reliability engineers. Right now there are more than 100,000 certificates issued by ASQ.
Most people don't even understand what Six Sigma means. It is a goal. A goal of very few defects, down to defects per million. We used to think in terms of percent defective. For example, 1 percent defective is 10,000 defects per million units, a far cry from three or four. Basically, the concept is perfectly good, but there is nothing new.
It originally started with Bob Galvin, the former CEO of Motorola and a very ardent pursuer of excellence in quality. Some years ago, he gave his organization the job of improving quality and reducing the defect level by an order of magnitude. Now, to reduce it from a few percent defective to three per million, that's four orders of magnitude.”

Juran’s explanation reinforces the similarities between Six Sigma Quality and Zero Defects, and also reveals his use of the paradigm of acceptability to define high quality as the absence of defects. The distinction between acceptability and desirability will be further clarified in section 4.

When asked to comment on the marketing and hype associated with Six Sigma Quality, Juran replied;
"I am in favor of improving quality by whatever means. Right now, I think that what has really caused the spread of Six Sigma is GE. They went into quality improvement, urged, I think, by what Bob Galvin had done at Motorola. Jack Welch personally went into this. Then he went public with the results to huge acclaim and huge savings running into the billions of dollars. That got a lot of press and was pretty hard to ignore."

Juran's reply to this question gives due credit for the advances in Six Sigma Quality through the deeply personal efforts of senior executives at both GE and Motorola, with billions of dollars in associated savings. Section 5 will offer an introduction to Deming's "system of profound knowledge" and an explanation of the advantages that could be gained by the attentive use of holistic thinking in Six Sigma Quality efforts.

4 Taguchi's Quality Loss Function

The author was first introduced to the ideas of Genichi Taguchi in 1987. Among the initial big impressions that remain to this day is Taguchi's novel concept of quality, which he defines [7] as "the minimum of loss a product causes to society after being shipped". The focus on "loss" "after being shipped" acknowledges the existence of a never-ending connection (and impact) between the provider of the part and what it is "part of". The technical aspects of this model are shown in Figure 9, along with the step-function model of part quality. As presented, Taguchi's parabolic model is consistent with the paradigm of desirability in that part quality is modeled as being continuous, rather than discrete, and there is a preferred value (target) that provides for minimal loss. Instead of the "step-function" model for part quality, Taguchi proposes a vertical axis that reflects a continuum in the magnitude of loss "imparted downstream" by the part *after its shipment to the customer*. So impressed was Deming after learning of this holistic model that he described it [12] as *"a better view of the world"*. That is, a world of connections that is not well modeled by "part" thinking.

To add further clarification to this model comparison, consider in Figure 9 the choice between the supplier producing parts with histogram 1 and a supplier producing parts with histogram 2. In accordance with the paradigm of acceptability, there is no perceived difference between the quality of the parts produced by these two suppliers since both suppliers produce zero defects. The perception of a difference in suppliers could only be explained by the paradigm of desirability, where there is an expectation of difference impacts (quality losses) downstream. To prefer supplier 1 over supplier 2 (all things being equal) is to acknowledge the technical advantage of the paradigm of desirability over the paradigm of acceptability, in this situation.

5 System of Profound Knowledge

In the final years of his life, W. Edwards Deming succeeded in his attempt to define a theory of management that captured the basis for the actions detailed in his 14 points [12], but went further to encapsulate a guiding set of operating principles. He termed his resulting management theory a "system of profound knowledge". The guiding principals of this system form the basis of his last book, The New Economics. Quoting from Chapter 4 [6], Deming states;

"The aim of this chapter is to provide an outside view - a lens - that I call a system of profound knowledge. The system of profound knowledge provides a lens. It provides a map of theory by which to understand the organizations that we work in."

The elements of Deming's system of profound knowledge consist of the four parts below, and their interrelationships.

1. Appreciation for a system – awareness of the interconnections between all parts in a system and the knowledge that none is most important
2. Knowledge about variation – awareness that variation is all around us, in the performance of all products and processes
3. Theory of knowledge – awareness that all actions are based on a theory for prediction and that management is prediction
4. Psychology – awareness of people as part of a system, with their needs to be valued and listened to, as well as to feel connected, and the impact of their fears on their actions in a system

About these parts, Deming advised [6],
"One need not be eminent in any part nor in all four parts in order to understand it and apply it. The 14 points for management in industry, education, and government follow naturally as application of this outside knowledge, for transformation from the present style of Western management to one of optimization."

The "system of profound knowledge" blends both technical and non-technical skills that one need be aware of, but not expert in. As an example of a technical skill, Deming advocated the use of statistical methods for improving and maintaining quality. The same can be said for Six Sigma Quality. Control charts, simple data collection tools and techniques, and the use of statistically-designed experiments are as much a part of Deming's management theory as they are of Six Sigma Quality. Another technical skill involves the systemic thinking imbedded in “profound knowledge”. Deming’s systemic thinking admits the “part of” thinking associated with the paradigm of desirability, as needed for a substitute for the paradigm of acceptability when loss function considerations are paramount. *A closer look* at the distinction between “part” and “part of” thinking has been a steady theme in this paper. *A closer look* at other non-technical aspects of Six Sigma Quality and comparisons to Deming’s system of profound knowledge are not covered in this paper.

6 Conclusions

The aim of this paper was to present *a closer look* at the management theory of Six Sigma Quality and to contrast it with the management theory of W. Edwards Deming. Through a close examination of the vocabulary of Six Sigma Quality, insights were offered on the philosophical underpinnings of this quality philosophy. While both Six Sigma Quality and Deming’s “system of profound knowledge” have a significant reliance in the application of statistical methods to improve quality, Deming’s management philosophy is unique in its advocacy of Taguchi’s concept of quality loss. In recognition of Taguchi’s model of continuous quality loss, Deming’s system presents a vital holistic framework that is missing in the acceptability-based framework of Six Sigma Quality. Absent the notion of “part of” thinking, organizations that implement Six Sigma Quality will be likely to focus their quality improvement efforts on problem solving, rework and scrap reductions, and the achievement of defect-free parts. By comparison, Deming-based efforts will be likely to prioritize their efforts on where and how to invest resources to minimize losses, both in-house and downstream, where parts are delivered to customers to become “part of” something bigger. Such efforts to minimize losses will be based on the fundamental belief that such losses do exist, even for parts made to specification limits. Significant gains from Six Sigma Quality efforts could also be achieved by the wider adoption of this holistic, “part of” philosophy, thereby improving on Six Sigma Quality.

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Figures

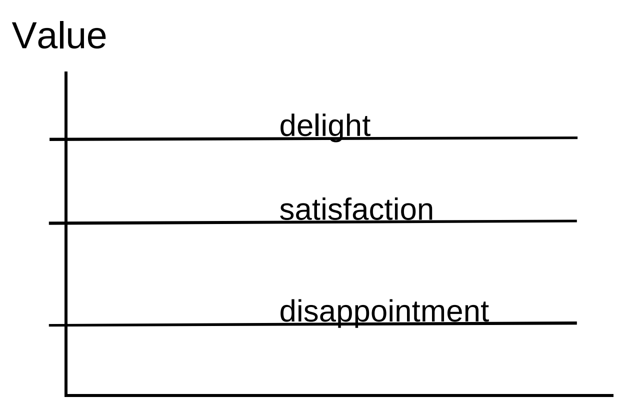

Figure 1 – The value proposition – delivering disappointment, satisfaction, or delight

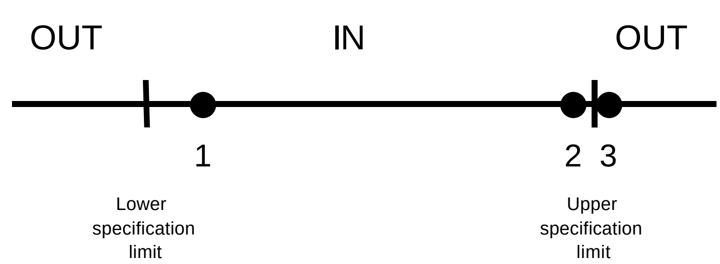

Figure 2 – A one-dimensional view of acceptability - 1 defect.

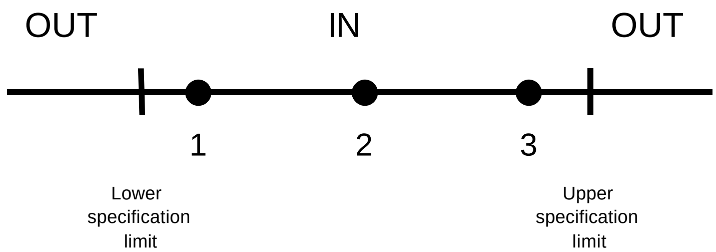

Figure 3 – A one-dimensional view of acceptability - zero defects.

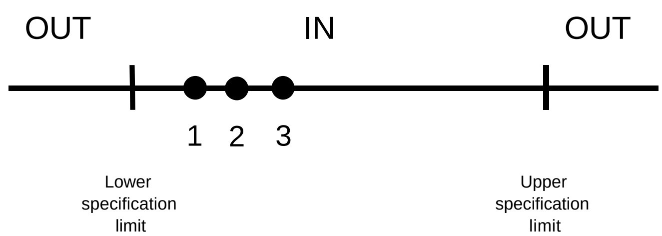

Figure 4 – A one-dimensional view of acceptability - zero defects.

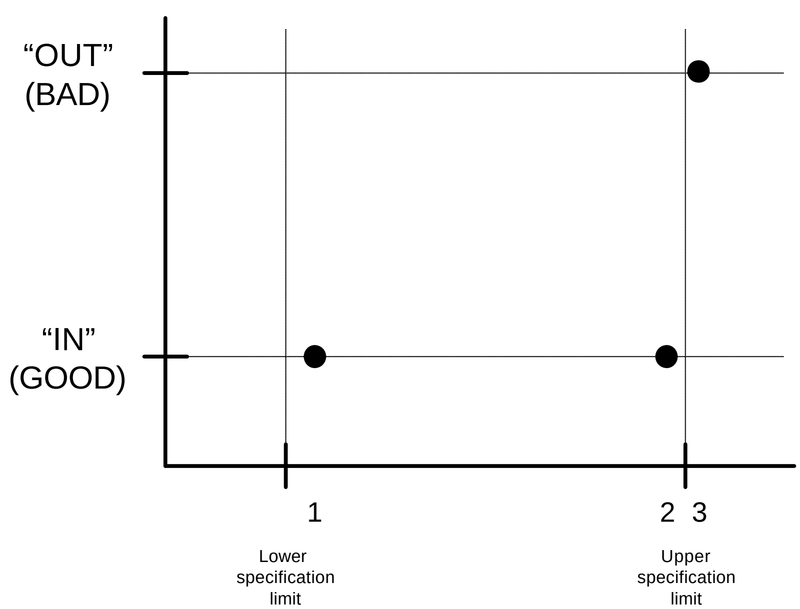

Figure 5 – A two dimensional view of acceptability - 1 defect.

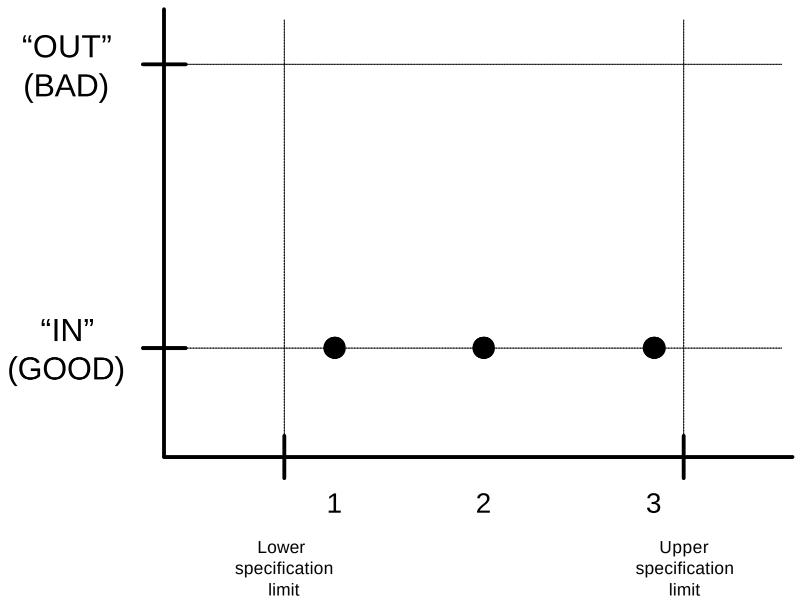

Figure 6 – A two dimensional view of acceptability - zero defects.

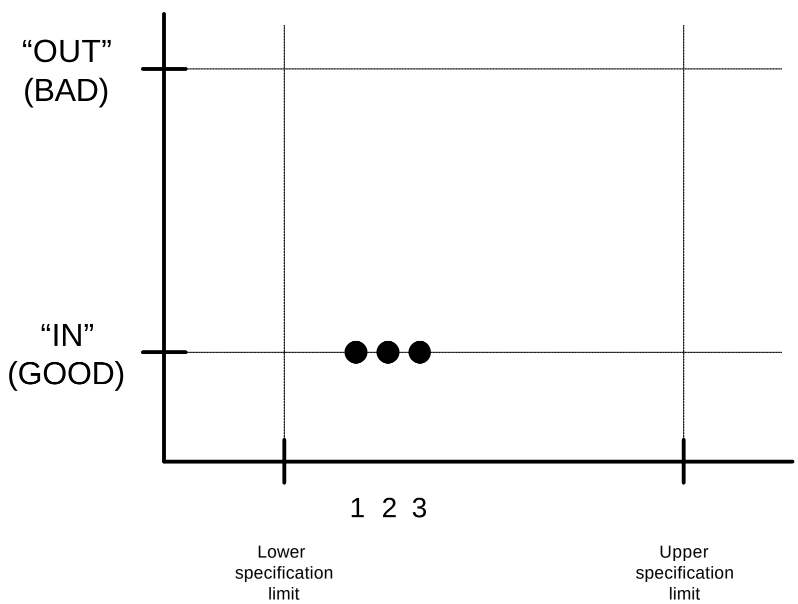

Figure 7 – A two dimensional view of acceptability - zero defects.

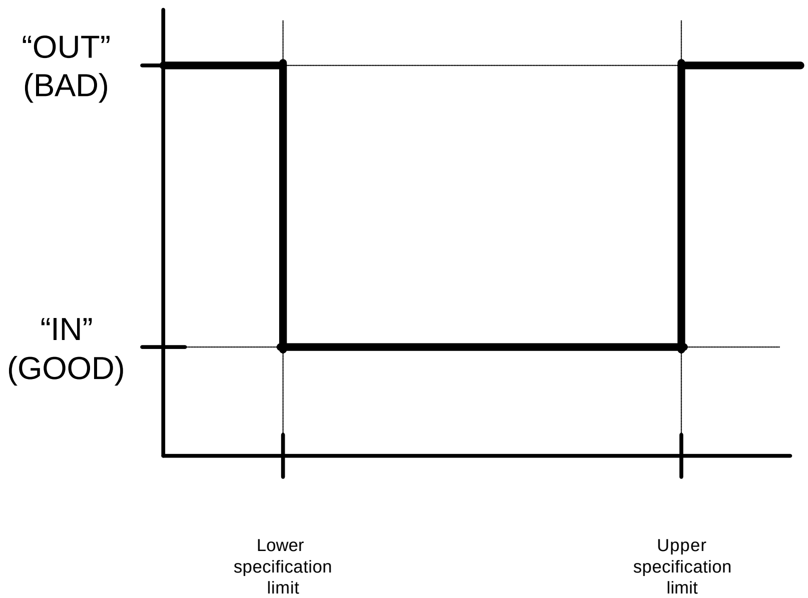

Figure 8 – A two dimensional view of acceptability – viewing quality as a step-function.

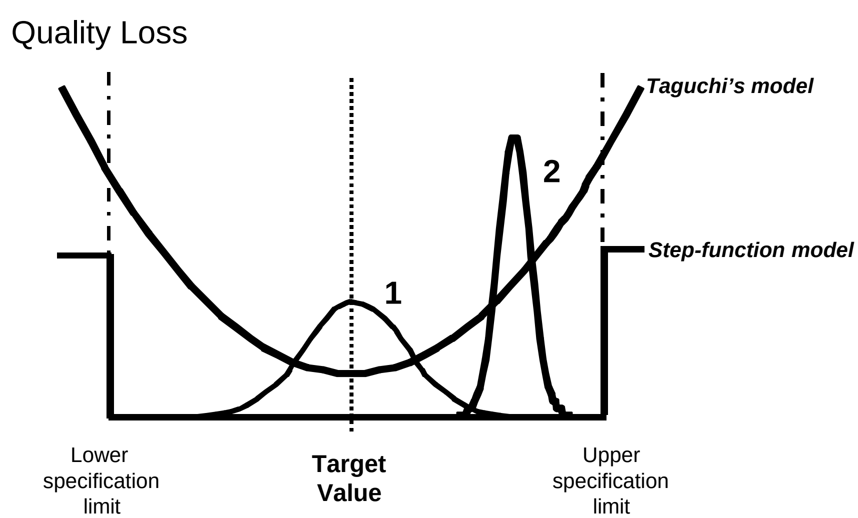

Figure 9 – Taguchi's Quality Loss Function reflects a continuous model of part quality. Histograms 1 and 2 are examples of possible results for 2 suppliers of parts.