Straipsnis žurnale ***CURRENT ISSUES OF BISINESS AND LAW : RESEARCH PAPERS***
VERSLO IR TEISĖS AKTUALIJOS: MOKSLO DARBAI
ISSN 1822-9530
2010, Vol. 6

Paradigm shifts in modern approach to quality excellence

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Abstract
Quality improvement in products and services is an imperative especially in this age of globalization. However, many organizations still hold on to the traditional concepts of thought inspiration, will buildup, behavioral modification, etc. in their efforts to achieve better performance. As a rule, there is nothing fundamentally wrong with the motive behind, but very often these approaches are either overly idealistic or not sustainable. In this paper, some of such statements are examined, and the Six Sigma framework is used to illustrate how paradigm shifts must be effected to achieve real gains in quality. The explanations are non-analytical so that arguments in the paper can be appreciated or deliberated upon by managers and professionals alike.

Key words: quality management; Six Sigma; design for Six Sigma; lean Six Sigma; statistical thinking.

Introduction

Quality improvement in products and services is important for many organizations today, especially in view of globalization. Any organization that fails to excel in quality would soon find itself uncompetitive or, worse, facing extinction. Even those that are aware of the need to improve quality may not be certain of the paths to take. In this paper, some traditional concepts of quality improvement and a modern quality improvement framework, namely Six Sigma, are discussed together to highlight the paradigm shift that is taking place in the twenty-first century. It is pointed out that in order to attain effectiveness, it is not sufficient just to depend on determination and willpower; these are useful only if one has a realistic appreciation of what is attainable and has the necessary tools to achieve it. The explanations are in non-mathematical language so that anyone

who has an interest in this subject would be able to appreciate the arguments.

1. Six Sigma: extensions and derivatives

In discussions in this paper, the term "Six Sigma" covers the "classic" Six Sigma methodologies and all its variations, such as Design for Six Sigma (Tennant, 2002; Gremyr, 2005) and Lean Six Sigma (George, 2002). Nowadays, there is an abundance of literature explaining the details of Six Sigma and its general success factors (Goh, 2002; Hahn, 2005; Brady and Allan, 2006, Pyzdek and Keller, 2009), so they will not be elaborated here. It should be emphasized, however, that regardless of the specific methodology or the format used, all Six Sigma-related approaches are generic in nature, i.e. they are equally applicable to such industries as, say, petrochemical, semiconductor, machinery, food processing, and so on.

2. Traditional *vs* Six Sigma concepts

Traditionally, it has been perceived that poor quality is the result of lack of resolve, inattention, ignorance, or passiveness. Therefore, a number of slogans have been brandished at staff gatherings, in speeches, public relations literature, marketing materials etc., all expressing the resolve of an organization to come up with a better quality. It would be interesting to examine some of these.

2.1. Zero Defects

If there is any process that is said to have zero defect, then the data supporting such a statement must be either limited in applicability, i.e. the results is from a very specific physical environment, or short-term in nature. In statistical terms, it is theoretically not possible to establish, by means of any sample, that the mean number of defects of the population is zero. The issue is particularly obvious when the population (e.g. production run) involved is indefinite in a mathematical sense.

In fact, even if Zero Defect is merely held up as a vision or just as a guiding principle, once it is perceived as such, the motivation for achieving it could be totally lost. Indeed, before the motivation is lost, there is no commonly accepted metric for showing the progress toward that impossible target. It may be said that in the real world, all efforts in performance improvement, when honestly stated, must have targets inferior to Zero Defect, and any proclaimed plans to achieve a performance of non-zero defect would be viewed with suspicion, if not ridicule.

All these issues are sidestepped with Six Sigma, which is the very framework that states from the outset that there is no such thing as a Zero Defect. All Six Sigma practitioners know the 3.4 *dpmo* or "defects per million opportunities" benchmark, as well as the procedures for judging the "sigma levels" of imperfect processes. Most Six Sigma projects are about improving the sigma level of a process, i.e. from one non-Zero Defect performance to another, yet could claim success and recognition in the end by virtue of an improved sigma level. Thus, the spirit of Six Sigma is an unrelenting effort to

eliminate defects, with the knowledge that there is no outcome that can be called Zero Defect.

2.2. Continuous Improvements

The spirit of continuous improvement is truly put into action *w*hen a succession of Six Sigma projects is used to improve the sigma level. "Continuous Improvement" in practice could mean that it has no beginning, no end, and possibly no identifiable owners. Continuous improvement can be said to be there all the time, but if nothing particular is implemented, one might simply argue that only the spirit is present: it is unlikely anything long-term and self-sustaining will result, not to mention any possibility of significant change in the organizational culture. The suspicion of lip-service naturally would come about in the eyes of onlookers.

This scenario would not be the case with Six Sigma. A "Six Sigma organization" – more and more companies are calling themselves Six Sigma companies in their communication with stakeholders and customers – actually ceases to be one, once it stops launching Six Sigma projects. Six Sigma advocates a 'project by project' improvement, which by necessity requires specification of objectives (e.g. the type of improvements at sigma levels), starting and finishing dates, resources required, progress reviews, and assessment of actual achievements at the end of each project, such as financial impacts.

It may be said that Six Sigma project implementation is in fact even more pro-active than certification to such standards as ISO 9000, as the certification basically is an indication that certain *prescribed* requirements have been found as satisfied by the auditors in question, and that the state of the organization can be expected to last for the period of validity of certification, nothing more is implied. As it has been put very aptly, "I have never seen any solid evidence that ISO/QS certification alone has resulted in reduced variability, higher yields, safer and more reliable products, or better 'quality'' (Montgomery, 2001).

2.3. Do Things Right the First Time

As for the popular slogan "Do things right the first time", this is a concept which, if not supported by appropriate techniques and tools, smacks of blind belief in willpower and brute-force efforts, such as multiple inspection. No account is taken of the impact of ensuring, at all costs, of the principle of "Right the first time" on system productivity. In fact, after being right the first time, one would like to know if there is anything to sustain the performance, otherwise the follow-up statement could well be "Wrong the second time".

"Do things right the first time" is never the prime objective of Six Sigma; rather, demonstrable and sustainable improvements of the process at the sigma level are the key requirement. Process owners will be encouraged and recognized when there is a hard-won improvement, rather than being obsessed with being "right" in every step of the way. More importantly, Six Sigma entails the roadmap *DMAIC*, or Define-Measure-Analyze-Improve-Control, for process improvement, equipping anyone to do things "right more and more often" with the analytical techniques that are usually acquired through specialized training, say Black Belt courses.

2.4. Customers Are Our Greatest Assets

In the application of Six Sigma, attention to customer needs starts from the word "go" – as it is a requirement that in any project, the sigma level must be expressed in terms of some performance index that is "critical to quality", or CTQ. Thus the attention paid to the selection and definition of CTQ would be more than what a slogan, correct as it is, might achieve where customers are concerned (For an elaboration of CTQ determination, see Goh, 2009).

2.5. Quality is Everybody's Business

"Quality is everybody's business" is yet another attention-catching slogan that often appears in pep talks. While the idea is intrinsically correct, in practice there would invariably be people within an organization who have been trained more intensively, are more perceptive in problem formulation, are better communicators with people of different job background, and so on. In other words, not everyone has the same capability in using hard techniques for quality improvement.

The Quality Control Circle (QCC) movement, which was popular some twenty years ago, is based on the assumption that people, such as operators on the production floor, will know problems best. Such a bottom-up approach does have its role to play, but it is hardly the case that production floor people are aware of technology changes, market requirements (e.g. those related to legal matters, environmental concerns), and business directions. The likely result is that some local optimization (or sub-optimization) gets over-rated as valuable achievements and contributions to "company-wide improvements".

It is explicitly required in Six Sigma that professional, intensive training be given to outstanding employees of an organization so that upon successful completion of the training, they could lead improvement teams to address concerns in various parts of the organization. Depending on the positions, responsibilities and contents of training, trained personnel are given designations in a hierarchy, such as *Champions – Master Black Belts – Black Belts – Green Belts – Yellow Belts,* and so on. This is not unlike an army where there are generals, colonels, lieutenants, sergeants, and foot soldiers and so forth, though the chain of command and control would not be as rigorous. With such a structure, there can be a better match of problems and projects with the capabilities of persons assigned to them; for example, it would not be sensible to have a senior, highly trained Master Black Belt to handle a QCC-type project, or a rank-and-file QCC facilitator to lead a team for complex process modeling and optimization.

2.6. Company-Wide Quality Improvement

As for the notion of company-wide improvement, this is feasible only if there is a critical mass of personnel and a reasonably complete set of understood methodologies. For example, an isolated workshop of Quality Function Deployment (QFD) here, an occasional course on Statistical Quality Control (SQC) there, with employees "selected" to attend is unlikely to lead to company-wide appreciation or application of QFD and SQC. To implement Six Sigma, there are recommended numbers of each category of

specially trained personnel with respect to the size of an organization (Harry and Schroeder, 1999); again this is akin to firepower in an army: below a certain threshold, there is no point initiating a war because the chances of winning it are extremely low.

2.7. Quality is Free

To achieve quality, it is essential to train personnel, invest in machinery, engage specialists in particularly challenging issues regardless of whether the system in question is physical or service-oriented. It would be foolhardy to believe in the literal meaning of this phrase. It should also be recognized that training a critical mass has its costs to the organization as well; in fact other than quick "demonstration" projects, "to achieve Six Sigma, an organization must endure extensive psychological changes… it takes between three and five years for Six Sigma to become entrenched in even the most progressive organizations" (Harry and Schroeder, 1999). The needed investment in money, time and personnel would be a major reason why the publicized Six Sigma success has come mostly from large organizations, but then there can be no "free" quality without such initial investments.

2.8. In God We Trust – Others Bring Data

It is not uncommon to hear such statements as "Facts based on data", or "No data, no talk". While on surface such statements do render an awareness of the importance of data, they do not get to the heart of the matter where quality is concerned. Data refer to the numbers that carry information. Data could vary in reliability (e.g. as affected by sampling techniques and methods of measurement and collection), hence it is not always true that "some data are better than no data". Over-emphasis on data themselves tends to draw attention away from what really is needed for quality improvement, or what is generally referred to as *statistical thinking*.

According to the American Society for Quality, statistical thinking is a philosophy of learning and action based on the following fundamental principles: all work occurs in a system of interconnected *processes*; *variation* exists in all processes; and understanding and *reducing variation* are keys to success. Thus, Six Sigma addresses quality problems by way of statistical thinking, with its ensuing statistical analysis, using data as the major, common medium of information. The conscious use of statistical thinking and integration of statistical tools are important features of Six Sigma that would correct the common idea that data (or statistical tools) are emphasized and used for their own sake.

Conclusions

Six Sigma aligns and integrates statistical tools for quality excellence in a manner that is at odds with a number of long-held quality improvement concepts. Six Sigma also emerged at the right time, when data processing hardware and software became prevalent at the personal level. Such theoretical and practical advantages have rendered Six Sigma a popular framework for quality improvement for more than a quarter of a century. Quality practitioners and managers may well ponder upon the implications of the paradigm shift brought about by Six Sigma; they need not necessarily follow the DMAIC roadmap in their endeavors, but certainly those traditional slogans should now be viewed

as what they really are – statements which are politically correct, but on scrutiny are devoid of operational power.

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