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## QFD and the BEST Paradigm: Deploying Sustainable Solutions

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### Abstract

This paper integrates concepts from sustainable development, business excellence, and quality function deployment to develop a vehicle that deploys a unified concept of *BEST* Business Excellence. Four sustainability cornerstones comprise *BEST*: **B**iophysical/Environmental Sustainability; **E**conomic Sustainability; **S**ocial Sustainability; and **T**echnical/Technological Sustainability. The European Foundation for Quality Management Business Excellence Model provides a conceptual framework to which the construct of business excellence has been wedded. Other TQM/Excellence models provide similar frameworks but without a deployment mechanism, good policies are no more than words and diagrams, therefore this paper provides such a contribution via its *BEST* Deployment model.

### Keywords

Business Excellence, EFQM Model, Environment, QFD, Society, Sustainability.

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## INTRODUCTION

The world is an increasingly complex place – or at the least its inherent complexity is made ever more apparent by burgeoning woes that span societal, environmental, technological and economic boundaries. As daunting as the world's woes are, their solution will require human desire and effort. The imperative is for precision channelling of that desire with effort that must be intelligent and coordinated – with coordination extending beyond that of agreements and activities among and between individuals to complex relationships that blur corporate, societal and national borders.

Moreover, the relationships among these are such that advancement in one realm may come at the expense of progress in at least one other realm. Or ... is it this mode of thinking that must be expunged? Should we not be searching for synergies that simultaneously advance our concerns in each of the aforementioned realms? Shouldn't we be looking for the equivalent of  $1 + 1 > 2$ ? Or, in terms of resource consumption, perhaps  $1 - 1 < 0$ ? In mathematical terms ... a search for joint optimisation?

This requires commitment to stewardship of economic, environmental, and human resources – the conscious choice of service over self-interest with a concept of profit embracing the notion of residue – that which remains after all obligations are fulfilled. Indeed, new paradigms and ways of working must be developed if our progeny are to prosper.

Residue ... stewardship ... and ... *kyosei*, that is, “living and working for the common good” (Rosen, Digh, Singer and Phillips, 2000). Given particularly well-known needs, the

proposal here is to develop and deploy a paradigm that integrates well-known tenets of business excellence and sustainable development. The paradigm suggested herein is the *BEST Paradigm* (Edgeman, 2000) and in many ways is captured by artfully weaving a fabric with strands of profit as residue, stewardship and *kyosei*.

Provided herein then, is discourse on Total Quality Management, its evolution to the current paradigm of Business Excellence, and the progenetic paradigm shift to BEST Excellence – an integrated approach that considers **B**iophysical/Environmental Excellence; **E**conomic/Business/Financial Excellence; **S**ocietal Excellence; and **T**echnological Excellence.

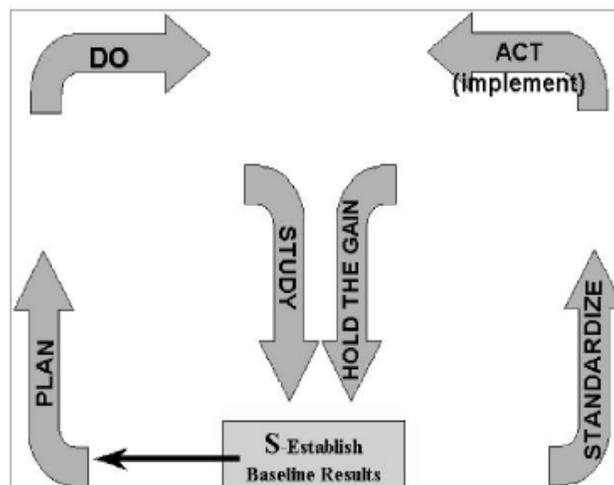
Of course, paradigm without deployment is – in the words of Solomon, the wise king of ancient Israel – “vanity of vanities”. Thus suggestions for deployment of BEST Excellence/Sustainability through what may be regarded as “Macro-QFD” are also provided.

## TOTAL QUALITY MANAGEMENT

Total Quality Management (TQM) – three words strung together. But what do they mean? One concise explanation of TQM is a progressive one that begins with “what is quality?” *Quality is satisfying customer wants and needs continuously*. “What is quality management?” *Quality Management is satisfying customer wants and needs continuously, at low cost*. “What is total quality management?” *Total Quality Management is satisfying customer wants and needs continuously, at low cost, by involving the whole of the organisation’s human resource*. (Dahlgaard, Kristensen, and Kanji, 1998).

Bedrock to TQM is the *Plan-Do-Study-Act (PDSA) Cycle* popularised by Dr. W. Edwards Deming. A modified version of the PDSA Cycle can be found in Figure 1.

**Figure 1** A modified plan-do-study-act cycle

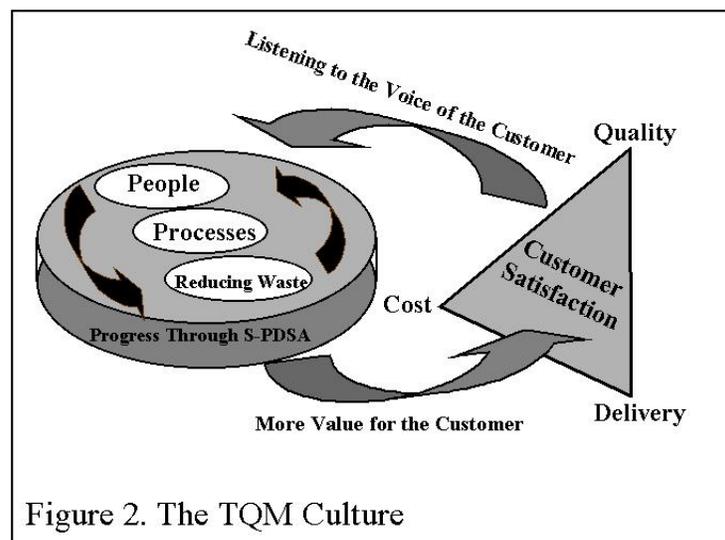


The modified version represents PDSA as it is commonly practiced. In its most simple version it can be referred to as the S-PDSA Cycle in that baseline results must first be determined before planned improvement of a process occurs. Once the planned improvement is

identified, we move to the “do” stage. This ordinarily implies implementation of the planned process improvement – often on a small scale, since – convinced as we may be that the planned improvement will be just that – beneficial – our planned improvement may fail or may not produce results that warrant full-scale implementation. Implementation of the planned improvement produces results that may then be “studied” or analysed through various lenses. Actions that will depend on the conclusions generated by our analysis are then initiated. Commonly this will call for full-scale implementation of the improvement, but could also correspond to simple maintenance of the *status quo*. As PDSA is a cycle, the next planning phase is initiated. In theory the cycle continues *ad infinitum*, though in practice, diminishing returns, scarcity of resources, or more pressing needs will eventually lead to control of the process at some steady-state performance level – this is an application of the *Pareto Principle* – one that calls for dedication of the organisation’s resources to its “vital few” issues of importance.

The modifications of the S-PDSA cycle appearing in Figure 1 are simply explained. The “standardize” phase is a practical one that allows for portability of solution, rather than deployment of multiple forms of what is presumed to be the “same” process. “Hold the gain” requires that the process improvements be permanent, even as the next planning phase is underway.

Figure 2 captures the *TQM Culture*. Therein we can see that the organisation will listen to the voice of the customer and will then implement that voice by making use of some version of the PDSA Cycle. Astute use of the human resource (the “total” in TQM), improved processes, and reduction of waste and other non- value added activities of all sorts (the lean approach) will deliver more value to the customer as reflected in the “big three” elements of “quality”, “delivery”, and “cost”, resulting in increased customer satisfaction.



## BUSINESS EXCELLENCE AND OUR GENERATION

While those of us in the profession may bristle at the suggestion, some regard *Total Quality Management* as passé. For many holding to that perspective, it is *six sigma* or *business*

*excellence* or its synonyms of *performance* or *organisational excellence* that are the more comprehensive or enticing paradigms. Discourse as to whether and how much these paradigms differ from or compete with one another is outside the scope of this paper, and it is not the aim of this work to start a “paradigm war” – but it is worth stating the obvious – that *progress* is a key aim of those of the quality profession and that progress sometimes involves change – whether evolutionary or revolutionary – from a dominant paradigm to a one that incorporates a modified view of the world – thus it is left to readers to hone their own perspectives. Business Excellence models and criteria supply the bases for the European Quality Award, America’s Malcolm Baldrige National Quality Award, and various other quality awards, as well as similar models employed by organisations employing self-assessment. Indeed such models are most commonly used for *organisational self-assessment* (SA), that is, the comprehensive and regular review of an organisation’s activities and results against a specified model. The assessment identifies the organisations’ strengths, weaknesses, opportunities for improvement, and threats to its competitive position (**swot**) with the goal of development and deployment of efficient and effective strategies leading to a sustainable competitive advantage in the marketplace. With this in mind, Edgeman, Dahlgaard, Dahlgaard and Scherer (1999), provide one widely accepted description of Business Excellence, that is:

Business Excellence is an overall way of working that balances stakeholder interests and increases the likelihood of sustainable competitive advantage and hence long-term organisational success through operational, customer-related, financial, and marketplace performance.

Figure 3 provides a Business Excellence model that is based on this description and on the principles and criteria of the European Quality Award. Figure 3 portrays leadership as responsible for development and deployment of a balanced stakeholder driven master plan.

**Figure 3** A business excellence model



The policy and strategy captures the, fulfilment of which is attained through deployment of various resources, including human capital and by formation of strategic partnerships. Organisational processes transform these, yielding informative results along dimensions that include people, societal, customer, and financial. Communication is the shadow or constant behind all of this and the overriding result that is desired is sustainable competitive advantage.

This model is cyclical nature and the key ideas are captured by the acronym ITOI – that is, “input, transform, output, inform”, where the various results are analysed and used to inform the subsequent planning phase. A more familiar acronym that is highly consistent with ITOI is SIPOC, or “suppliers → inputs → processes → outputs → customers” and its Six Sigma twin, COPIS that flows in the opposite direction.

## ELEMENTS OF THE BEST PARADIGM – A PROGENETIC SOLUTION

*BEST* is an acronym for elements that must synergistically combine to create a sustainable society in an environmentally sustainable world.

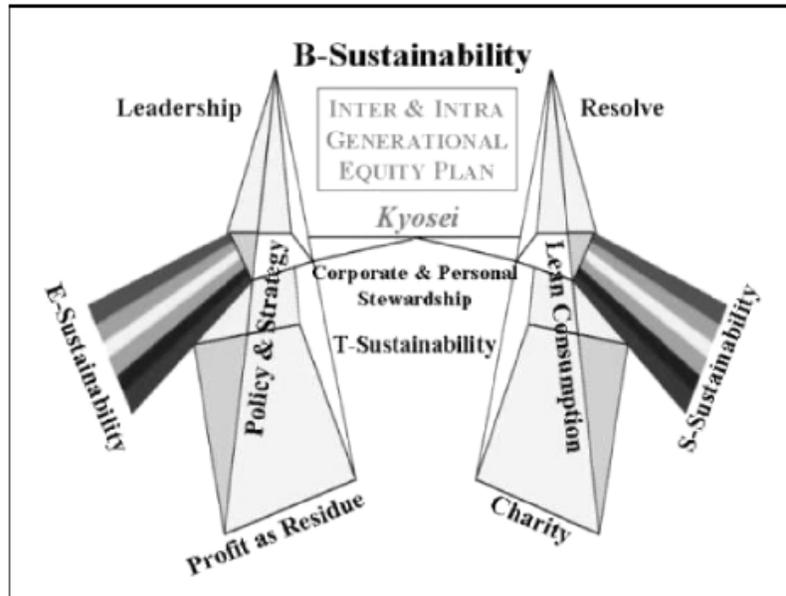
Successively, these are described as follows. *Biophysical/Environmental Sustainability* (**B**-Sustainability) is fundamentally ecosystem oriented and regards the environment as an essentially closed system where consumption of non-renewable natural resources must be at a rate at or below replenishment through renewable substitutes. *Economic/Business Sustainability* (**E**-Sustainability) concentrates on improvement of the human condition, particularly at the individual level, but is generally promoted through corporate and governmental policies and practices. Various widely-accepted constructions promoting such sustainability exist, with the most familiar being those preferred by the European Foundation for Quality Management and America’s Malcolm Baldrige National Quality Award model. *Social Sustainability* (**S**-Sustainability) points to improvement of the human condition at the societal level and as such many of the key considerations of S-sustainability are ones for government entities. *Technological Sustainability* (**T**-Sustainability) is concerned with the built and technological environment and – to a large degree – focuses on construction, maintenance and humanization of lasting facilities that strengthen urban infrastructure and do not contribute to so-called urban sprawl. Additional *BEST* considerations are provided in Rwelamila, Talukhaba and Ngowi (2000).

## A MODEL FOR BEST EXCELLENCE – EXPLORING SYNERGIES

An obvious challenge is that of combining *BEST Paradigm* elements synergistically, rather than as important – but distinct – considerations. One possible such combination appears in Figure 4. This construction can be explained as follows. The “inter- and intra-generational equity plan” incorporates society, future generations, and the environment as stakeholders into the “balanced stakeholder driven master plan” employed by Business Excellence models. An organisation’s leadership - represented on the left side of Figure 4 – is responsible for derivation and deployment of policy and strategy that will deliver E-Sustainability. While ecological and societal considerations are present in most Business Excellence constructs, these considerations receive relatively little attention. In contrast, a key posture of this contribution is that ecological and societal aspects warrant immediate and far greater attention. Thus critical in the *BEST*

*Paradigm* is the aforementioned regard for *profit as residue* with obligations that include reasonable care for the environment and society. Certain business strategies commonly employed by organisations in pursuit of excellence such as lean approaches simultaneously support all of these considerations and demonstrate wise stewardship of an organisation's resources.

**Figure 4** BEST business excellence



The right side of Figure 4 portrays personal and societal interests and obligations key to the *BEST Paradigm*. Primary considerations are a deep resolve to consume carefully and to share our excess (charity) – perhaps even share that for which we have legitimate need (sacrifice). By-products, albeit carefully crafted ones, that result from the described joint organisational, personal and societal effort include T-Sustainability and, more importantly, B-Sustainability. This is at the heart of the aforementioned concept of *kyosei* -- symbiosis or "living and working together for the common good".

## DEPLOYING THE BEST PARADIGM – SAVING THE FUTURE

Deployment of the *BEST Paradigm* is the hard part. That deployment is difficult is illustrated by the concept of *kyosei* which, though heretofore presented in the positive, can also communicate adverse meaning. In Japanese, *kyosei* is written as two characters:

### 共棲

*Kyo*, on the left, means “an action done in common, all taking part in it.” The ancient definition of this character actually means “twenty pairs of hands.” *Sei*, on the right, means to roost, settle,

or stay. The ancient definition of this character is “tree” (in which to roost) and “wife” (woman holding a broom and taking care of the household) (Weiger, 1965). The interpretation of *kyosei* is that all people roost on the various branches of the tree, some higher, some lower, some closer to the trunk and more stable, others out on a limb. This latter image is consistent with attributes of uncertainty and risk aversion, integral parts imbedded in economics, vis-à-vis, E-sustainability. Many hands are holding the broom, the instrument of caring for the household, the trunk and roots of the tree. The common mindfulness to this duty keeps the tree healthy and alive; postponing or neglecting this duty by any of the many hands leads to destruction of the tree and eventually all branches. Though infrequently applied as such and relying on characters other than those we have used, *kyosei* has other meanings, including castration, bluff, coercion, and extortion.

Taken together, the common and uncommon constructions of *kyosei* suggest that any attempt at symbiosis that is not consensual will be seen as a threat to those holding power. Unfortunately, many see the world as constrained and limited, that any shifting of wealth and power must be a zero-sum gain – “for me to win, you must lose”. The key to deploying the *BEST Paradigm* is to create a win-win scenario in which human creativity and innovation expand the resources available and motivate people to change because it is in their best interest to do so.

While a simplex of human motivation models exist, much of our understanding of such motivation emanates from a synthesis of a large body of psychological studies by Abraham Maslow. (Huitt, 2000). Maslow’s *Hierarchy of Needs* is valued as a reasonable organisation of human needs that motivate human action. Therein Maslow divided such needs into two groups, that is, *deficiency needs* and *growth needs*.

The deficiency needs – those that must first be met, are:

1. *Physiological*: hunger, thirst, physical comforts, etc.
2. *Safety/Security*: shelter from danger
3. *Belongingness and Love*: to love others and be loved and accepted by others
4. *Esteem*: to achieve, be competent, gain approval and recognition.

The growth needs are:

5. *Cognitive*: to know, to understand, and explore
6. *Aesthetic*: symmetry, order, and beauty
7. *Self-actualization*: to find self-fulfilment and realize one's potential
8. *Transcendence*: to help others find self-fulfilment and realize their potential.

As a human being begins to fulfill each level of need, higher levels take on greater importance. Including individual personalities, cultural issues, and the like, it is not difficult to see that, depending upon the individual, community, society or nation, the degree of importance and fulfilment of these levels may differ and can change over time. In addition, as Jensen and Meckling (1994) note, individuals will substitute across Maslow’s boundaries. Quality Function Deployment, or QFD (King, 1987), is able to accommodate this complex situation since this phenomenon is included in the basic QFD structure in the House of Quality’s Planning Table, where customers prioritize their needs according to importance and degree of satisfaction with current and competitive products. Similarly, the work of Kano (199) defining attractive and

must-be quality shows the latency and emergence of these needs over time and across groups. In other words, because QFD is a proven system that can take wants, importance, fulfilment and change, and translate them into actions for product developers, our position is that QFD can also help translate humanity's wants into actions that support – perhaps assure – *BEST Sustainability*.

One more issue requiring attention is that of local improvements versus system improvements. Widely understood in the quality profession is that attempts at local optimisation can cause sub-optimisation at the system level. An illustration of this issue would be a team of basketball players where each player attempts to maximise his or her scoring production, resulting in a breakdown of team play including passing, pressing, posting, etc., since these actions would allow others, rather than self, to score and would decrease the team's likelihood of success. The organisational situation is analogous and, similarly, local attempts to improve sustainability could result in decreased system sustainability attainment.

A large-scale example of this principle can be cited. In the People's Republic of China a national policy took only one generation to undermine the health of the country's children. China's policy of one child per family is resulting in a generation of overweight children. This is the societal reaction to a system change resulting in parental focus shift from the family to the individual child. Chinese parents are giving their one child everything they can offer, including food. Also, since some parents value boys above girls, an unacknowledged practice of infanticide is leading to a future gender imbalance. With these examples in mind, *the application of QFD here and other methods must encompass time, level of needs, and a systems approach if the results are to be useful.*

## THE PROPOSED QFD MODEL

Henceforth assumed is that the reader has some level of familiarity with QFD. Those in need of rudimentary QFD background are referred to [www.mazur.net](http://www.mazur.net). Still, a few general principles merit repeating. The purpose of QFD is to correctly develop something new the first time, instead of the costly design-test-redesign approach. QFD establishes a cause-and-effect analysis where the success causes are discovered at the inception of the design, and are communicated to each successive process in the language of that process. QFD works because its inputs are desired outcomes, positive expressions of want, as prioritized by the customer. In the present case, Maslow's Hierarchy of Needs provides the critical input that is prioritized by different segments of society, again with the Jensen and Meckling (1994) substitution modification.

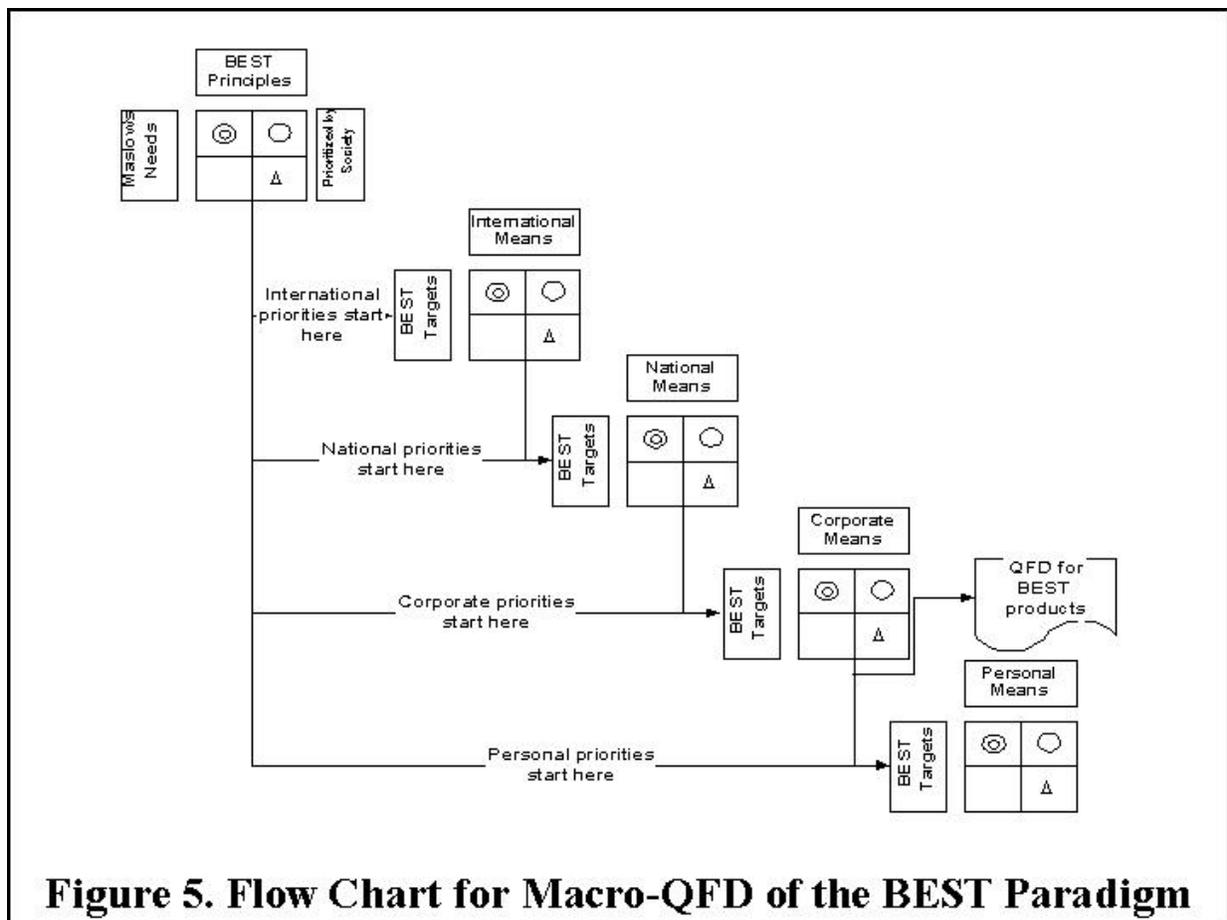
Once prioritized, these wants are correlated with the principles of the *BEST Paradigm* cited previously. The expectation is that each segment of society yields a different prioritization of these principles, but also that a significant number are common to all. These common principles may be technically difficult to enact but should be socially and politically easy to accept. Where there are differences, oversight can trace the potential impact those differences have on the wants of each segment of society. Other tools can be used to create win-win resolutions when the inevitable conflicts occur, but the QFD process provides a framework for rational discussion and compromise. Addressing this latter objective, Hensler and Edgeman (2002) present a model for joint optimization, not just compromise.

The highest prioritized *Best Principles* become targets to be achieved by different levels of society: internationally, nationally, organisationally, and individually. *Policy Deployment* (Pyzdek, 2001) provides a related method for achieving this vertical alignment of targets, as well

as the means to achieve the targets. Like QFD, this method uses cause-and-effect analysis to determine for every level of an organisation, who must do what by when. Further, policy deployment establishes a measuring system to track progress in real time so that significant deviations can be addressed as early as possible.

Finally, these actions lead to changes in products, where QFD can be used again to redesign for sustainability while still protecting consumer wants; organisational change introducing new and needed business models; and national and international policy changes developing new regulations and rules of engagement, along with ways of assuring compliance. The scope herein is to introduce key concepts with the expectation that model improvements will follow.

Figure 5 is a flow chart of the *BEST Deployment* process. The chart at the top left of Figure 5 is the system level chart. Therein Maslow’s Needs would be listed and prioritized by the use of the Analytic Hierarchy Process (AHP), a group decision-making tool that allows constituents to vote the strength of one want against another in pairs, thus eliminating the need to juggle multiple issues (Saaty, 1990). The AHP permits a lack of consensus in the voting, is robust against bias and human inconsistency and, most importantly, yields ratio scale priorities.



**Figure 5. Flow Chart for Macro-QFD of the BEST Paradigm**

The Quality Planning Table provides for entry of each societal segment's prioritized wants, along with their evaluation of how well each want is currently fulfilled and how much fulfillment they want in the future. Akin to gap analysis, the ratio of one's future fulfillment want to one's current level is called the improvement ratio. The product of this improvement ratio and the priority of the want is an absolute weight that is normalized to a Maslow Needs Weight.

The *BEST Principles* are then correlated to Maslow wants using a standard QFD correlation value set, that is, blank = no correlation, 1 = weak correlation, 3 = medium correlation, and 5 = strong correlation. The Maslow Needs Weight is then multiplied by the correlation value in each cell, and cells are summed column by column, then normalized to yield the BEST Principle Weight. Repeating the process with different societal segments, as well as intertemporally, yields evolved Maslow Needs Weights and the correlated *BEST Principle Weights*. The expectation is that many of the BEST Principles will not change in weight significantly, thus providing a set of actions upon which all societal segments agree. Where there are large differences between the weights of *BEST Principles* from societal segment to societal segment, dialog and negotiation can implement a rational review of the matrix whereby the degree of impact of any decision can be traced backward to the unfulfilled Maslovian need.

Once *BEST Principles* are prioritized, a determination can be made regarding the appropriate level of policy management at which they are addressed: the international, national, company, or individual level, as shown in Figure 5. Political, economic, and technological considerations help determine the starting point for each key principle. Once the level is determined, the implementation cascades down to each successive lower level for detailed implementation. Appropriate metrics, corrections, and feedback make this an ongoing process of improvement. When policy conflicts arise, methods such as the *Evaporating Cloud* (Goldratt, 1994) provide a method for finding a win-win solution by exposing erroneous assumptions that have led to conflict. When technological conflicts arise, methods such as the *Theory of Inventive Problem Solving* or TRIZ (King and Schlicksupp, 1998) can be used to find innovative solutions.

At the company level, policy management may dictate a design change in a product to support the *BEST Principles*. This could lead to a QFD study to protect consumer satisfaction during the design change. Case studies illustrating these points can be found in Edgeman, Hensler and Mazur (2001) and it is our hope that these case studies, in league with the ideas presented herein will stimulate further development and, ultimately, deployment of sustainable solutions.

## SUMMARY

Globally, resolution of deep and varied issues is paramount if humanity is to endure. Among these are environmental, economic, societal, and technological issues. These manifest in radically different ways so that their impact varies from society-to-society and within societies. Resolving these issues calls for deploying a paradigm. This paper suggests one such paradigm – the *BEST Paradigm*. The *BEST Paradigm* combines key concepts of sustainability and business excellence with the integrating factors being ones that speak to the human condition ... stewardship, charity, profit as residue, and *kyosei* ... living and working for the common good. Indeed, that is what is called for ... in ways that we have perhaps not yet dreamt of, with efficiencies that we have not achieved, and with a depth of deployment that transcends cultural, corporate, and national boundaries. This paper provides suggestions about deploying the *BEST*

*Paradigm*, and those suggestions essentially call for "macro-QFD" with inputs from various societal segments.

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