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REDS—Conceptual Approach to a Single Comparative Quality Standard Measurement Using Accepted Universal Attributes

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Abstract

Quality can be a difficult commodity to quantify in measurable terms. Often exclusive singular aspects are taken as a defining attribute which focuses upon the author's view pertinent to their discipline. However, from the end users perspective a more holistic and meaningful collective measurement may invoke a differing perspective that defines quality which differs from the originators view. This monograph seeks to homogenise the originator and end user perspective of defining quality through measurement by combining several attributes that go to make up quality. Further by rationalising and combining and so measuring these attributes both the originator and end user see the result through the same perspective. Further the originator has a comparable measurement to improve or refine quality that the end user can easily see and verify.

Key words: Quality; Universal attributes; Measurement; Comparative

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INTRODUCTION

REDS is an acronym for Reliable, Efficient, Durable and Safe. This unique monograph is the original thought of the author derived from over 35 years as a medical doctor (to Consultant Otolaryngologist status) including the past 17 years as a Consultant in Clinical Risk Management through contemplation, observation and experience of using healthcare systems and observing industry risk management processes. The creation of the concept of REDS began with 'walking-the-dog'times *(a recognised time to have "downtime" thought)* and thereafter concentrating upon how systems fail from this medical and risk management background. It became apparent that there are common aspects that underpinned what end users desired and wanted of a process. Rather than trawling written articles and lectures the author has thoroughly examined and re-examined his thoughts on the subject many times with testing and re-testing the application of the concept. In such a manner, without bibliography or reference, the thoughts underpinning the concept are unique, untainted nor biased - consequently this approach is not influenced by referencing[1]; in essence it is a "free-fall thinking" form of expression. The author though is well familiar with referencing from writing and publishing a MD thesis of more than 300 references to authoring a book on consent and has over 45 clinical and risk management publications. Referencing is used in research to balance supporting and contrary opinion to the placed hypothesis under scrutiny and so draws in supportive texts and unsupportive texts as part of the discussion of testing the hypothesis results creating a "setting" to compare the main body of the text to. This constructs a positive bias for the main text as supportive referencing is sought. However *de* novo thought may not require such testing of other reference if what is proffered is a new line of original thought.

If a person believes that their work has been incorporated into this monograph then this is serendipity

[1] Where a name is used in the text the reference to that name is within the public domain / internet and so is easily followed up for further detail if desired. The purpose is to make the note but not to dissect the event as an academic analysis.

and so regrettably they are mistaken. The author has not read or listened to any texts pertaining to quality in management nor management *per se*. Any comparison is therefore the purest of coincidence which should be taken as ratification of comparable thought.

There are many texts on quality matters yet there remains no exclusive universal tool that can be set as a standard reference. The author, therefore, suggests a system and concept that does not originate from building upon previous or many textbooks or journals but has been inspired by more inspired logical free thought. Hence this is a genesis form of monograph –original untainted thoughts and should be read as such.

It is likely those steeped in traditional thought of established pathways will eschew this work as either irrelevant, "unfinished", "light" etc. due to the lack of referencing analysis. However, the monograph is not a hypothesis of academic research that necessitates empirical scrutiny but rather a work about establishing a thought process that seeks to illuminate through thought and cogitation. The intention of this monograph is to allowing the concept to penetrate and then illuminate as to its relevance or pertinence for a circumstance; not instruction. Whilst it seem primarily applicable to constructive manufacture, it is equally, and maybe more so, applicable to systems such as in healthcare. It is the universality of the attributes that constitute REDS that matter rather than specific worked detail. The latter is for those who want to take REDS to the next stage of assessment and development as to its use. Hence this monograph is offered as Open Source to permit anyone to take the concept and development it as they see fit and assess it.

Quality as a descriptive word for benefit is a term that everyone feels they know yet evades universal definition as the context of application can vary with the ethereal values that can be attributed to it. The perception of quality can defy comparison between two observers. Often it is the case that quality indicators are special items proportionate to a single aspect of a 'thing'. The ability to see wider and ascribe values that indicate quality is fraught with determining which individual factors can be validated or ranked for comparative use. The REDS approach seeks to apply a more summative approach of recognised and accepted attributes and parameters that pertain to quality. Often Reliability, Efficiency, Durability and Safety are individually used as quality indicators they are not frequently not summated together to form a quality standard composite.

1. CONTEXT

The author has reflected upon many years of active life in a medical profession exploring the existence of error analysis and investigation and so finds it clearly apparent that there are certain prime components to define "quality" that are expected both by the manufacturer of a product or system and by the end user. These attributes are seemingly universally accepted in usual parlance as common respected desires or necessities such that a "thing" is expected to be reliable, efficient, durable and safe. It is common though that standard approaches to quality seek to use just one of the ascribed attributes rather than a summative whole.

"Reliability" is taken to be a product or system that satisfies the meaning of the word reliable as in dependable and in which one can place confident trust.

"Efficiency" is taken to encompass various sub-attributes which may include financial, legal, manufacture and maintenance aspects of the system or product.

"Durability" is taken to embrace the trust that comes with a system or product that is useful, functional and maintainable in the long term.

"Safety" can embrace use or manufacture and will invoke many definitive accepted sub-headings from overall safety to individual safety aspects. It can embrace financial, welfare and many other aspects, rather a single focused outcome.

Whilst some may view E as standing for effectiveness, REDS is a composite that reflects effectiveness in total. Efficiency is part of effectiveness but the contrary is not necessarily the case as something that is effective may not be efficient.

It is a universal acceptance in engineering that structural testing is integral to the value of the final product. The principle of testing an individual component, then the sub-assembly of those various components that constitute it through to the final assembly of the sub-assembly parts - to a level of destruction, is taken as part of quality testing. Each tested component then becomes part of a whole which itself can be tested. The three aspects covered by this process are reliability, durability and hopefully safety. The testing however is absolute in that all components must pass the point of limitation assessed by both the design of purpose and the design of use; or fail. Some of these aspects may be set down in legislation as to tolerance limits and some by design limitations. However each is seen to serve as individual aspects and there is no evaluation of the whole as it presumed that the individual sums add up to a complete whole and that there is no unforeseen interaction between components.Unforeseen design faults even after destructive testing may occur – for example - the Trent 900 engines on the Airbus A380 of flight Quantas 32 failed in 2010 despite mandatory industry standards of testing under severe stress to a point of destruction. On a parallel perspective of post-production failures in aviation, in 2013 on a Boeing 787 there were Lithium battery fires on board the aircraft. The automotive industry also utilises engineering assessment tools as above, yet the view of reliability often pertains to a customer's perception. Overall quality manufacture may

be highlighted in considering the automotive industry as Communist era East European automobile is viewed to be of a lesser quality and less reliable than the Western European German equivalent, but how does one know in terms of measurement?Terms like "build quality" are ephemeral expressions. However, even rigid and formal structural testing to determine tolerance and so quality levels are not complete as human error may yet play a hand in construction, the elemental solid components may be wrongly assembled or maintained.More significant and globally has been the performance of global financial institutions – Lehman Brothers, Northern Rock Iceland Banks and one wonders how they would pass a REDS test in hindsight.

2. APPLICATION

It is apparent if one dissects systems or processes that the four words that make up the acronym REDS are what are taken to be commonly acceptable attributes.

The new car owner expects and hopes that their new automobile is reliable in that it will start every time and perform its purpose every time and that "things" do not break down requiring frequent repairs or replacement. They want to trust the automobile to perform its function every time without failure. Similarly this new owner expects that the automobile is efficient both in running costs and maintenance costs as well as purchase and expects the automobile to last and be scrapyard resistant, otherwise efficiency is thwarted. And finally,- safety. The automobile must be safe to protect the occupants in an emergency or accident.

The automotive industry rightly responds to safety as a primary fundamental objective as does the aviation industry and other risk averse industries such as the nuclear power, rail, healthcare and petrochemical industries. The safety record of risk averse industries develops from the investigation of accidents or events with the establishment of Accident Investigation Boards at a national level. In the case of healthcare events an investigation may be local or national proportionate to the perceived effect or consequences. Whilst safety is important it may come at a price of efficiency. In managing risk the final analysis of a risk assessment is control – the remedies after the investigation and assessment of the risk. There are however only 3 possible risk control outcomes namely – elimination, toleration or amelioration of the risk identified. Of which the latter is the usual outcome as elimination may not be possible or affordable.

The development of a new product often has a primary dependency on quality testing of structures inherent to it, yet, aside from constructional errors the design may be flawed through a lack of integration testing or placing a parameter higher up a scale of acceptance. A designer may be influenced by the design impact without paying proper heed to functional aspects. It is pointless having a beautiful object if it fails in any test of functional form.

3. THE VALUE OF A REDS ATTRIBUTE SCORE

As a comparative tool it is logical to score as a percentage given to each attribute 'R', 'E', 'D', and 'S'. However, within each of those attributes that constitute REDS the construction of a value will differ according to what measures are used in forming the attribute. For reliability [R] there may be 10 different components, in which case a score of 0 to 10 for each component will achieve a composite score e.g. 85 out of a possible 100 (10 x 10). This then is converted to a percentage viz. 85% in this description. This can be repeated for each other attribute 'E', 'D', and 'S'. This then may give a final tabulation for example of R85% E65% D50% and S95% which gives a composite REDS score of 73.75%. However whilst this is a score at a point in time it may change as reliability and durability values change through time. The other 'E' and 'S' attributes may also change. In this circumstance the initial REDS score can be used as a benchmark from inception to set a target to maintain and improve upon.

The attributes of the rationale are personal or professional set variables that can evaluate a REDS score in simply "light" through to "heavy" mode. "Light" mode is less intense and may reflect a singular personal view or a subjective survey with a subjective tendency. Whereas a "heavy" mode would be an accumulation of much deeper and richer data which can be laboratory / test bench evaluated and so have a richer and deeper provenance to its validity. The attribution values therefore set the validity and so provenance and so reputation of the final REDS score. Consequently the meaning and certification of the attribute rationale sets the determination of the quality value both in comparative and singular function. It is apparent that moving from a shallow to a deeper attribute score may amend an established value. In essence REDS can be as intense or as light as one desires although it is apparent that whilst more work is applicable to an intense scoring the final scores are more meaningful. Whilst the rationale basis may be variable in intensity the core attributes of REDS remains constant.

A REDS score can compare two things as well as functioning as a monitor of an individual article or component. So two different automobiles may have a composite REDS score of 85% for the first and 75% for the second at initial comparison, but in time, say 10 years the first may have fallen to 45% but the second has fallen to 70%. In which case whilst the first initially seemed to a better option from a quality value, through time the second lower scoring automobile scored better. So the scoring is comparative, dynamic and enables future assessment.

By recording the individual component tests then an

evidence trail of value in quality is maintained and can be used to look back or improve aspects if the value corrodes.

4. GENERICALLY USING REDS TO FIND INFORMATION BEYOND "LIGHT" AND "HEAVY"

It is worthwhile to remember that "things" can be divided into "hard" ware (machines & materials) and "soft" ware (systems and processes). When attempting to elucidate sub-factors to a primary attribute of quality it is important to delineate the difference. Materials will tend to fall into the recognised place of materials science and its methodology whereas systems and processes will fall into the more elusive format of analysis. In essence the two formats for systems and processes are the prospective Risk Assessment [RA] methodology and the retrospective Root Cause Analysis [RCA] system.

RA is exemplified by its three prime factors relating to a specific identified factor which may be elucidated for example by prospective thought or through retrospective learning from a RCA.

(1) Identify *(what could wrong? How could that happen? What would be the effect?).*

(2) Analyse *(how frequent will this occur? How severe will be the effect? What would be the cost financial and otherwise?)*.

(3) Control *(Does one tolerate, ameliorate or eliminate the recognised risk?)*

Drawing upon Root Cause Analysis systems one can stratify an approach into 3 levels. The 3 common RCA systems in healthcare are:

(1) The five "Why's" which is a sequential subjective approach of asking "why" and then asking a consequent "why" based upon the first "why" and so on about 5 five times. This takes the original answer further along a linked chain to a more relevant base reason as to why.

(2) The Care-Service time-line which examines a sequence of events through time divided into aspects of care and service through the time-line. It is more objective and extracts deeper issues divorced from subjective deviation as it is more factually based. It is more resource intense.

(3) The Ishikawa diagram (fishbone) which is a highly structured deep analysis of interconnecting and interdependent factors in isolation and in summary. It is highly resource intense as many parameters must be covered as primary group and sub group details.

A simple way is therefore to accrue evaluated scores from an individual observed parameter into a composite value that compares like with like is the REDS composite. It is then possible to follow this pattern of levels of RCA into a REDS analysis approach as follows:

Level 1 Like the five 'Why's' use customer / client / user feedback, or survey to look at the questions based upon the four REDS attributes, rather than one, or a sought after exclusive answer. It is more rapid than others but loses the depth of detail due to its subjective approach.

Level 2 Like the Care-Service time-line using a deeper factual analysis of the four REDS attributes utilising agreed or standard analytical methods that are verifiable, broad based yet neutral in analysis. The micro-data can be summated into a whole and then recombined to give a final REDS value. It is much more resource intense than a level 1 analysis but is truer to the reality and so remedies that may be ascertained.

Level 3 Like the Ishikawa diagram (fishbone) this builds upon a Level 2 analysis but seeks to explore the relationships between each of the four REDS attributes. So R vs E & D & S, E vs D & S, D vs S creates a rich three dimensional architecture of values and inter-relationships whereby one attribute may impact upon another and affect its attribution value. By observation this is a deeper, broader but richer and more accurate analysis. However, the downside is the amount of resource required despite the richness and size of the remedies it reveals as natural evolution of the analysis.

5. APPLICATIONS THAT CAN USE REDS

Almost anything can be assigned a REDS value from inception through comparison to termination. Whilst it is easier in principle to apply to the construction or engineering of a component through design, manufacture of component and stress testing through sub assembly to final assembly, it can also be used to stress test systems and people.

Manufacturing & Engineering. By virtue of the universality of materials testing these industries have a head start. However, the completion of the final total product tends to veer away from this. So an automobile may look good, perform well and be safe, however, if a replacement headlamp bulb requires a difficult access that means a cost of returning the vehicle to a garage for a replacement of a cheap bulb – then the design has failed in efficiency. The headlamp may look superb in the external aspect but fails if it requires replacement as the cost of replacement exceeds the cost of the specific failed item – so dragging down an 'E' score – the headlamp is not replacement efficient.

Healthcare. This is a more complex matter as it involves a combination of equipment and personnel and

may be a function of systems and processes as much as a single tool. Nevertheless the application of REDS is applicable provided the sub-attributes of each R, E, D and S is well established and verifiable through validation. Again the methods used are not necessarily directly important to the final score which it is derived from the sub-components as a percentage. So, a healthcare system or subsystem when analysed as to its construct can use various recognised system analysis tools of a variable nature as long as the composite score is a percentage of the qualifying scores that make it up. Again these primary attributes look across a system or construct in an overall manner. Healthcare however has thrown up serious anomalies of quality in the past and recently and often new things in healthcare are heralded as the absolute "must have". The drug Thalidomide is an obvious example of unintended consequences albeit within the context that teratogeneis was not so well known as it is today. One wonders what the REDS score would have been. With limb prostheses and particularly artificial hip replacements each new design from the original of metal upon metal has seemed ideal yet many have failed when complex interactions between metal and the other substances has led to failure. Again how would REDS have scored in original design? At an organisation level the failure of a private company [Circle] to make a Hitchingbrooke NHS hospital run as a private enterprise successfully begs the question of if a full REDS analysis had been performed would such a failed venture have occurred? Healthcare is very complex due to the high levels of interactions between the various components that constitute how something exists. The basic parameters of things that can go wrong or err are those that underpin the Ishikawa diagram used in Root Cause Analysis [also known as 'the fishbone'] namely – humans, systems and equipment. Whilst a manufactured product used in healthcare has a certain liability appended to the manufacturer, it is perhaps more unusual to expect a purchaser to assess a REDS score that reflects whether this is a quality product or not. Within humans and systems there are deeper interacting complexities that allege they testify to quality, but are at a superficial level of presumption as each is not objectively or even subjectively measured. A highly cynical opinion might consider healthcare as "an accident waiting to happen" if one applied a more critical analysis of quality attributes which are often not applied. Often the quality indicators are measurements of raw data that are then often contested. There is variable, if any, rigour in testing the quality of indicators as the outcomes contain so many variables at the end user point. That quality indicators are used is a positive thing but as in the Trent 900 engines scenario above or the Lithium batteries in aircraft – if the fundamental properties inherent are of poor quality then the test that relies upon those qualities is doomed to fail, in which case the matter is a fruitless exercise. By being more stringent in defining what constitutes quality at every level and further to use the same attributes measured in the same way at least gives some form of provenance to the end use.

6. A HYPOTHETICAL END USER VIEW OF COMPUTING - USING REDS

In the world of computing technology there is a forever change occurring, yet amongst other aspects of life such technology has become fundamental and essential and so one can review such an aspect of life from the end users perspective. The author has been using computers from the early days of a BBC 'B' and used and explored various computers thereafter. So how does "computing" stand up to a REDS analysis? For this hypothetical "light" analysis general computing operating systems and general delivery can be viewed in tabular form. This analysis is formed of opinion whereas in practice more detail would be applicable and so this serves purely as an illustration. Table 1 looks at an example of general computing operating systems. Table 2 looks at information / data delivery systems in computing.

Table 1
General Computer Operating Systems Irrespective of Type

	Score %	Rationale
Reliability	60%	Constant upgrades Developments required Software conflicts Do start and function most times Easily available
Efficiency	60%	Memory capacity Software junk files accumulation Constant upgrades Software design bugs and conflicts Variable range of software applications No cross platform functionality
Durability	30%	Software junk files accumulation Hard drive longevity Long term support from developers Accessibility
Safety	30%	Vulnerability to malicious attack
average	45%	

Table 2
General Information Delivery Systems e.g. Broadband

	Score %	Rationale
Reliability	70%	Capacity demand Infrastructure conflicts with other telephonic systems Multiple providers on single exchange
Efficiency	90%	Newer delivery by fibre optic systems Standard cabling layout in existence
Durability	90%	Solid state delivery systems Stable provider networks
Safety	90%	Vulnerabilities are at the end user level
Average	85%	

From the above the strengths and weaknesses of individual and composite attributes can illuminate the areas that require more attention. In the above it is apparent that the individual units [computers] are the areas of lesser quality, although within the delivery systems whilst the hardware systems are of good quality the demand and capacity issue may make end users feel that computing is not reliable, whereas the greatest risks lie within the end users machine itself and not the defamed delivery system.

Whilst the above is a light generalisation and professional technologists can add more detail and accuracy to scoring, the internal attributes of quality and their comparative components can be used to look at the "whole" or individual aspects to find areas for improvement and attention. If an end user is asked about what annoys them most, often the broadband is stated. Whereas the constant software tinkering and accumulation of junk files as well as risk of malicious attack are a constant feature of daily computing life which revolve around the end user / developer rather than the service provider. From the above one might question why operating system developers have a need for constant change which can reduce stability and trust in the product. Operating system developers may accept redundancy but it is likely that end users prefer stable, unchanging, reliable and safe computers. As an analogy it is akin to a truck carrying bricks. If properly filled and packed one truck is required to deliver the whole load of bricks safely to the end of the journey. If however, the bricks are simply tossed in for delivery then bricks will fall off and a second truck is required to pick up the fallen bricks all the way to the destination.

Once a researcher or evaluator begins to evaluate and work in REDS mode the application has a more widespread application be that a pair of shoes, a political party, a politician, a new system, a rocket, a policy, guidelines, a new pharmaceutical drug, a surgical procedure or anything one is disposed to evaluate for quality.

7. DEVELOPMENTAL FUTURE

The above is offered for those who desire to think differently and try and be more complete. By retaining and adhering to the four attributes of REDS there is an ability to look at quality in systems or things or people in a more constructive and evidential manner.

In essence REDS attributes permits a commonality of reason that fulfils three-dimensional scrutiny. On a vertical upward (y) axis development from sub-component to sub-assembly and then to final assembly accrues defining attributes. Similarly investigation when an issue occurs looking "downwards" utilises the same attributes. On a horizontal (x) axis the developer can once again use similar attributes looking at the end user and the end user using the same can feed back to the developer. Finally on a separate (z) axis a comparison is possible between new and older versions of a "thing" as well as against comparative alternatives. The remaining constant across all these six parameters (x, y and z axes) are the four attributes that constitute REDS – reliability, efficiency, durability and safety.

This can be represented as in Figure 1. The interrelationships between Reliability & Efficiency & Durability & Safety are shown in Figure 2,

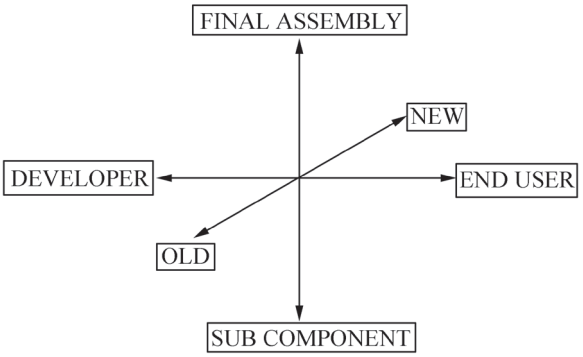

Figure 1
The Axes of Comparison

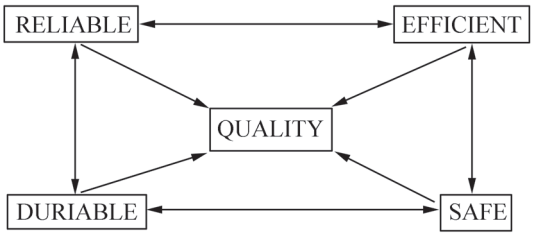

Figure 2
The Interrelationships of Quality

8. SUMMARY

By using constant set parameters that cross all fields of the production or use of a "thing" that encompasses the various ascribed features attributed to "quality" an ability to harmonise set features that are appropriate to all stages and so comparable allows a better distinction of fault and design improvement from isolated sources e.g. from developer to end user of any product and allow for enhanced territories for exploration and validation coupled with a knowledge of the commonality of quality indicators that are constant and universally applicable.This gives the topic a measurable and so comparative universal trustable value and so provenance.

In compliance with the ethos of "open source" the ability to develop such an approach to quality is offered to whomever chooses to develop it and apply and so author a view. There are no limitations to the process and hopefully many will attain satisfaction from applying a tool that exercises and develops the mind with logical application to universal cohesion.

9. ADDENDUM: ETHICAL REDS

It is possible to add a fifth attribute – viz. 'h'. As a base attribute an ethical criterion enhances the application towards the humanities and sociology. Such an acronym would become REDS(h) whereby the 'h' stands for 'humane' which embraces a wide vista such as humans, environment etc. There are many ideological concepts and principles within ethics, however, common thematic aspects include reasonableness, fairness, non-discrimination, beneficence, non-malfeasance, democracy which are taken to beneficial in a positive manner. It is reasonable to propose the addition of such an aspect if such ethical considerations generally pertain to the overall principle of quality desired that is proportionate to the application that REDS is being used for. Example having arrived at a REDS score how ethical is your product / organisation? It is applicable to those organisations or institutes that have a large human contact such as Human Resources Departments or those with charitable or ethical foundation.

CONCLUSION

For those of a healthy sceptical nature try running a quick critical REDS or REDSh assessment across your organisation, policies, departments or products and procedures or personal or professional relationships and so derive a figure and observe if it your, or your end users, expectations are met. A few questions can stimulate the mind into REDS usage viz.

Q1. Is your personal life reliable, efficient, durable and safe? *(your bank, your religion, your political party, your team, your partner, your encounters, your interactions, etc.)*
Q2. Is your professional life reliable, efficient, durable and safe?*(your work, your colleagues, your career path etc.)*
Q3. Is your service reliable, efficient, durable and safe?
Q4. Is your department / division reliable, efficient, durable and safe?
Q5. Is your organisation reliable, efficient, durable and safe?
Q6. Is your workforce reliable, efficient, durable and safe?
Q7. Is your employer reliable, efficient, durable and safe?
Q8. Are your systems and processes reliable, efficient, durable and safe?
Q9. Is your environment reliable, efficient, durable and safe?

Any or all of these questions may stimulate reflection upon what quality is and its defining attributes / parameters within a summated format that supports and enhances provenance and so enhances reputation as publishable, comparable and measurable quality value – its own REDS.