Journal of Investment and Management
2015; 4(6): 319-329
Published online August 27, 2015 (http://www.sciencepublishinggroup.com/j/jim)
doi: 10.11648/j.jim.20150406.15
ISSN: 2328-7713 (Print); ISSN: 2328-7721 (Online)

Management Versus Science: Peer-Reviewers do not Know the Subject They Have to Analyse

Fausto Galetto

Industrial Quality Management, Politecnico Di Torino, Turin, Italy

Email address:
fausto.galetto@gmail.com

To cite this article:
Fausto Galetto. Management Versus Science: Peer-Reviewers do not Know the Subject They Have to Analyse. *Journal of Investment and Management*. Vol. 4, No. 6, 2015, pp. 319-329. doi: 10.11648/j.jim.20150406.15

Abstract: The purpose of this paper is to show the ideas to overcome the deep ignorance on Reliability Theory of some authors and Referees (mainly professors). We analyzed some very few cases, taken from some published documents found on the web: Montgomery, Rade, M. A. El-Damcese [paper 41], M. A. El-Damcese, A. N. Salem, and N. S. Temraz [paper 42], and others (Wang, Pham, Xie, Peretto); two cases are from the Montgomery book, a very WWU (World Wide Used) Book; other cases are from books: we show that high scores on documents do not prove the Quality of those documents. This paper is especially written to settle the matter for the researchers who want to learn Reliability and Availability. Researchers must be alert in order to do a good job…. Many others cases should be shown: the paper should be 10 times longer The methods used are the Logic and the Scientific Theory (Mathematics, Probability, Statistics, Physics…). Several Professors do not practice them.

Keywords: Reliability, Availability, Integral Theory, Quality Methods, Scientific Approach, Intellectual Honesty

1. Introduction: "The Problem Outline"

The problem was originated at least 40 years ago, when the author was working in big Corporations [General Electric, Siemens] and continued in [Fiat (now FCA, Fiat Chrysler Automobiles), Philco, IVECO)] and at the Politecnico of Turin (Italy): many and many "false Scholars" were writing wrong papers that defeated the readers (managers, researchers and students) of their right of getting good ideas. UNFORTUNATELY the Peer-Reviewers were worse than the authors: very few of the readers took care of this big problem!

Fausto Galetto was ever fond of Scientific Management and tried to make the managers, professor, researchers, and students aware of their need of learning Scientific Ideas… He had little success: ignorance increased constantly.

If the reader acted sometime as a Peer-Reviewer he must admit that very few Journals asked him to evaluate the SCIENTIFIC content of the articles. The Journals prefer the "literature review of the problem" as though that is a symptom of Quality….

We do not present a literature review of the problem, because it will need at least hundreds of pages to be settled, both for Quality, Reliability, Statistics, Confidence Intervals and for Design of Experiments that are subjects very little known by managers and professors; we list here only few docs in the references [1-6,12-16,19-23,29,31-38, 44-54].

Few weeks ago I came across to some papers on reliability [41, 42]: it is a good example of Peer-Reviewers incompetence. Do not think, please, that only the "Italian" authors have problems in their papers. Other documents [44-54] show errors. At international Conferences F. Galetto met many people who did not properly know the subjects they were presenting.

The author is aware that these statements are risky (because his paper will be Peer-Reviewed)! UNFORTUNATELY the Peer-Reviewers many times, to F. Galetto experience, were worse than the authors and very few of the readers took care of this big problem!

In the paper [41] very recent, M. A. El-Damcese "Reliability Equivalence Analysis of a Parallel-Series System Subject to Degradation Facility." *Science Journal of Applied Mathematics and Statistics*. Vol. 3, No. 3, 2015, pp. 160-164. doi: 10.11648/j.sjams.20150303.19, we find (Excerpt 1)

«Following Rade (1989-1), the reliability function of each component improved by a cold via perfect switch can be given by: $R_{stb}(t)=\{1+\ln[1/R(t)]\}R(t)$…».

Excerpt 1. From the paper [41]

Citing Rade, El-Damcese improves the indexes of Rade!!! Citing Rade and El-Damcese, Fausto Galetto, WHO found them WRONG, improves the indexes of Rade and El-Damcese! WHERE is the Quality?

In the paper [42] M. A. El-Damcese, A. N. Salem, and N. S. Temraz "Semi-Markov Model of a Series-Parallel System Subject to Preventive Maintenance", J. Stat. Appl. Pro. 2, No. 3, 307-318 (2013) we find (Excerpt 2)

«Case (ii) As a special case, let us consider that the failure, repair, and maintenance times are exponentially distributed as follows [exponential distribution]…. We obtain the availability function by substituting in relation (1) and using MAPLE program. The results for the availability function versus the time and the effect of preventive maintenance are shown in [the following graph, named by F. Galetto "Figure 0", *Comparison of the availability… with and without PM …*]».---

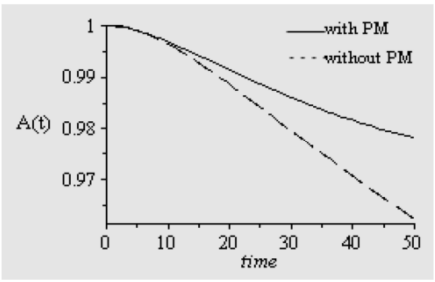


Figure 0. *Comparison of the availability function for the system with and without PM versus the time (case ii) named by F. Galetto "Figure 0"]*

Excerpt 2. From the paper [42]

Citing El-Damcese and his co-authors, Fausto Galetto, WHO found them WRONG, improves the indexes of El-Damcese! WHERE is the Quality?

AS ANY STUDENT knows the exponential distribution has the "*memoryless property*", so that the Preventive Maintenance is USELESS! HOW can the availability A(t) be better with the Preventive Maintenance?

LET'S HOPE that all those incompetent professors will consider their duty to teach scientifically, in order to satisfy the learning need of their students and of the whole society. See Deming, Gell-Mann, Galetto Fausto (figure 1)…

Actually anybody can see [44-54] that professors teach wrong ideas to the readers; we highlight some points here for the reliability field. They all say the following idea, while teaching the concept of *failure rate* or *hazard rate*. [with symbols h(t) or λ(t)]: «*the $h(t)\Delta t$ [$\lambda(t)\Delta t$]: represents the probability that a device with age t will fail in the small interval (t, $t+\Delta t$] for small $\Delta t>0$.*» All those authors do not realise that "a device with age *t* does not mean that it never failed before the age *t*" [see Figure 5 (of this paper)], for a device where various up and down times happen till the age *t*! The failure rate is a "reliability characteristic" related to a device that NEVER failed before t. Actually the quantity $h(t)\Delta t \approx \Pr\{t < T \le t+\Delta t | T > t\}$ represents the probability that a device will fail in an interval $(t,\ t+\Delta t]$, GIVEN that the "random variable Time To Failure" is bigger than t [the duration of the interval $0^{--}t$], which means that the 1st failure will happen after t (as one can see in [17])! Putting H(t), the integral form 0 to t of h(x), it is known that [17] the Reliability is R(t)=exp[-H(t)], and, obviously, R(t)≠exp[-h(t)t], (except for the case h(x)=λ=constant).

Only Deming, Gell-Mann, Einstein and F. Galetto seem to have taken care of the "Quality in the published papers"; I would like to know somebody else who did that!

It is not surprising that professors, researcher, managers and students learn wrong ideas, in the Quality field, IF we have a very widespread book with many wrong concepts [D. C. Montgomery falls in *contradiction*!] (see figure 1)

Let's see; D.C. Montgomery says:

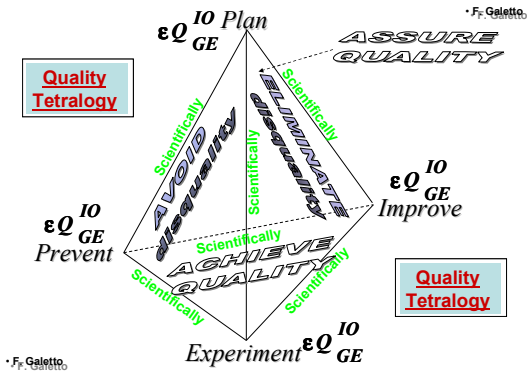
We prefer a **modern** definition of quality:

Definition

Quality is inversely proportional to variability.

Note that this definition implies that if variability[1] in the important characteristics of a product decreases, the quality of the product increases.

Excerpt 3. (Quality definition from the 6th edition of the Montgomery book, found in the Politecnico Library, and commented by F. Galetto)



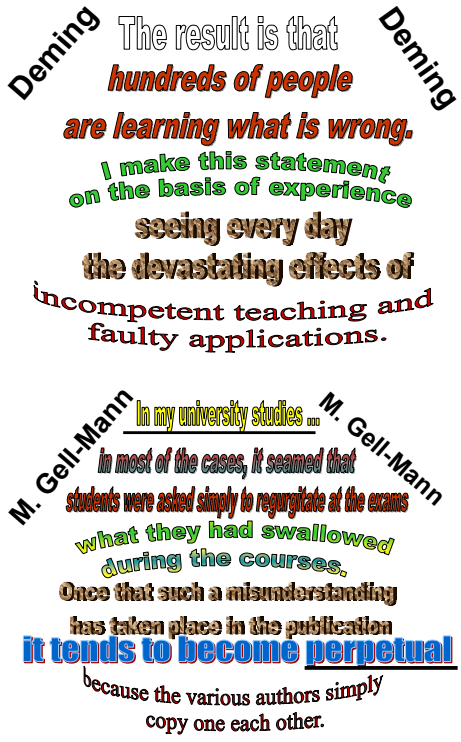


Figure 1. *Statements from Deming, Gell-Mann, Galetto ideas.*

Montgomery himself does not realize that he is in contradiction when he says:

Definition

The **Weibull distribution** is

$$f(x)=\frac{\beta}{\theta}\left(\frac{x}{\theta}\right)^{\beta-1}\exp\left[-\left(\frac{x}{\theta}\right)^{\beta}\right] \qquad x\geq 0 \qquad (3.41)$$

where $\theta>0$ is the **scale parameter,** and $\beta>0$ is the **shape parameter.** The **mean** and **variance** of the Weibull distribution are

$$\mu=\theta\Gamma\left(1+\frac{1}{\beta}\right) \qquad (3.42)$$

and

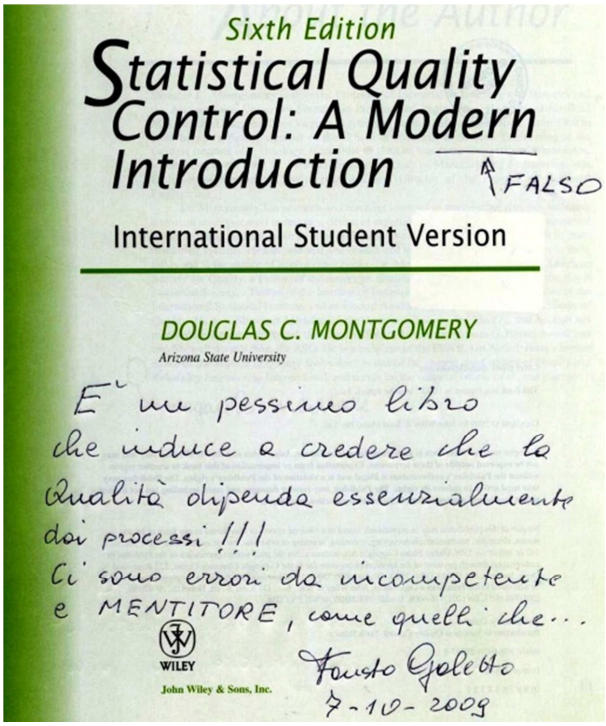
$$\sigma^2=\theta^2\left[\Gamma\left(1+\frac{2}{\beta}\right)-\left\{\Gamma\left(1+\frac{1}{\beta}\right)\right\}^2\right] \qquad (3.43)$$

respectively.

Excerpt 4. (Weibull distribution from the 6th edition of the Montgomery book, found in the Politecnico Library, and commented by F. Galetto, excerpt 5)

IF the Mean Time To Failure, MTTF (μ in the excerpt 4) increases, hence the product has both better reliability, AND higher variance; therefore a product that fails less has "Montgomery quality WORSE!!!!". *Montgomery himself does not realize that he is in contradiction!*

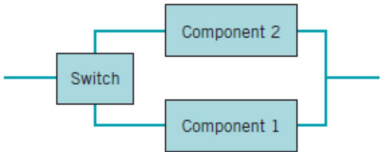
Moreover see the following stand-by system (Excerpt 6)



Excerpt 5. (front page from the 6th edition of the Montgomery book, found in the Politecnico Library, and commented by F. Galetto)

EXAMPLE 3.11 A Standby Redundant System

Consider the system shown in Fig. 3.24. This is called a **standby redundant system,** because while component 1 is on, component 2 is off, and when component 1 fails, the switch automatically turns component 2 on. If each component has a life described by an exponential distribution with $\lambda=10^{-4}$/h, say, then the system life is gamma distributed with parameters $r=2$ and $\lambda=10^{-4}$. Thus, the mean time to failure is $\mu=r/\lambda=2/10^{-4}=2\times10^4$ h.



■ FIGURE 3.24 The standby redundant system for Example 3.11.

Excerpt 6. (Stand-by redundant system from the 6th edition of the Montgomery book, found in the Politecnico Library, and commented by F. Galetto)

IF the Mean Time To Failure, MTTF (μ in the excerpt 6) increases, hence the product has both better reliability, AND higher variance; therefore a product that fails less has "Montgomery quality WORSE!!!!". *Montgomery himself does not realize that he is in contradiction!!!!*

Any Manager needs data to take decisions, suitable to the case he has to solve. But it is not enough: he needs to analyze the data and transform them into VALID information. To get this he NEEDS methods: better it is if they are SCIENTIFIC. In my working life as Lecturer, Manager, Professor, … I have been seeing a huge number of Lecturers, Managers, Professors, … taking wrong decisions BECAUSE they used wrong methods, NOT APPLICABLE to the problems they wanted to solve! This is my long experience in the Quality field, as teacher, Manager, professor, papers writer, …When arguing on Scientific matters, everybody MUST act SCIENTIFICALLY.

2. Reliability of the Stand-By System

We consider now a *cold standby system* made of two units A and B [we assume that the "switch" S that recognize the failure of the unit A is perfect, i.e. with reliability 1 (as in the Excerpt 6)]; we know that any unit can perform the intended function of the system; the unit A start at time 0 (B stay in stand-by) and if it fails before t, at time s say, then the other unit B start working from s to t; $R_{stb}=P\{T_A+T_B>t\}]$, where T_A and T_B are the random variables (RV) *"time to failure of the units A and B"*. Any student knows that the variance of two independent RVs is $Var(T_A+T_B)=Var(T_A)+Var(T_B)$: so the stand-by system which is more reliable than any of its units has "Montgomery quality WORSE!!!!". The general formula of the reliability of the stand-by system is

$$R_{Stb}(t)=R_A(t)+\int_0^t f_A(s)R_B(t-s)ds$$

If the reliability of the units is *Exponential*, then $T_A\sim Exp(\lambda_A)$

and T_B~Exp(λ_B): $R_A(t)=\exp(-\lambda_A t)$ and $R_B(t)=\exp(-\lambda_B t)$. The cold STAND-BY system reliability is, IF the units failures are INDEPENDENT, [as in the excerpt 6!] we have the formula

$$R_{Stb}(t)=e^{-\lambda_A t}+\int_0^t \lambda_A e^{-\lambda_A s}e^{-\lambda_B (t-s)}ds=$$
$$=\frac{\lambda_A}{\lambda_A-\lambda_B}e^{-\lambda_B t}+\frac{\lambda_B}{\lambda_B-\lambda_A}e^{-\lambda_A t}$$

The failure rate $h_{stb}(t)$ has to be computed by the formula $f_{stb}(t)/R_{stb}(t)$ and is NO longer CONSTANT! NOTICE that here t is the age of the stand-by system AND not the age of the units, comprising the system. The $MTTF_{stb} = 1/\lambda_A+1/\lambda_B = MTTF_A+MTTF_B$. If the two units are identical then $\lambda_A=\lambda_B$ the previous formula cannot be used and one has (*see excerpt 6!, which proves the incompetence of Montgomery!!!* about the definition of "Quality"!!!) to use

$$R_{Stb}(t)=e^{-\lambda t}+\int_0^t \lambda\, e^{-\lambda s}e^{-\lambda (t-s)}ds=$$
$$=e^{-\lambda t}[1+\lambda t]$$

This formula, valid only when $h(t)=\lambda$ for both the units, originated the big and stupid error of RADE and EL-DAMCESE in his paper «Reliability Equivalence Analysis of a Parallel-Series System Subject to Degradation Facility. *Science Journal of Applied Mathematics and Statistics*. Vol. 3, No. 3, 2015, pp. 160-164. doi: 10.11648/j.sjams.20150303.19»:

$$R_{Stb}(t)=\ 1+\ln[1/R(t)]\ R(t)$$

Citing Rade, El-Damcese improves the indexes of Rade!!! Citing Rade and El-Damcese Fausto Galetto, WHO found them WRONG, improves the indexes of Rade and El-Damcese!!!!!! WHERE is the Quality?

This formula for a Cold Standby is true ONLY IF $R(t)=\exp(-\lambda t)$ for the units!!! It is false for any other pdf!

If the RVs "time to failure" of the two units are *Weibull*, T_A~ Wei(η_A,β_A) and T_B~Wei(η_B,β_B), then

$$R_A(t,\eta_A,\beta_A)=\exp[-(t/\eta_A)^{\beta_A}], R_B(t,\eta_B,\beta_B)=\exp[-(t/\eta_B)^{\beta_B}]$$

IF the failures of the of the two units are independent then the cold STAND-BY system reliability is given by the general formula

$$R_{Stb}(t)=R_A(t)+\int_0^t f_A(s)R_B(t-s)ds$$

BE CAREFUL the reliability of the system is NO longer a Weibull function!!! The failure rate $h_{stb}(t)$ has to be computed by the formula $f_{stb}(t)/R_{stb}(t)$. The $MTTF_{stb}=MTTF_A+MTTF_B$.=area under $R_{stb}(t)$.

Let's see again a *cold stand-by System, non-repairable [two identical units with non-constant failure rate h(t) and a switch with R=1]*

We can depict the *cold stand-by* system as a 3-states one, where in the state 0 one unit works while the other is in stand-by [not working and assumed that it cannot fail], in the state 1 the stand-by unit works (the other is failed) and finally in the state 2 both units are failed.

Let be H(t)=integral of h(x) in the interval 0‾‾t, then for each unit R(t)=exp[-H(t)]. The RV "time to failure of the SYSTEM" is the sum of two identical RVs, as one see in the diagram; we get the important formula that proves Rade and El-Damcese WRONG,

$$R_{stb}(t)=\mathbf{exp}[-H(t)]+\int_0^t \mathbf{exp}[-H(s)]h(s)\,\mathbf{exp}[-H(t-s)]ds$$

If $h(t)=\lambda$ then $H(t)=\lambda t$ and $R_{stb}(t)=\exp(-\lambda t)[1+\lambda t]$, the probability of a Poisson Process (with failures=1).

One cannot derive $R_{stb}(t)=\exp[-H(t)]\ [1+H(t)]$ from

$$R_{stb}(t)=\mathbf{exp}[-H(t)]+\int_0^t \mathbf{exp}[-H(s)]h(s)\,\mathbf{exp}[-H(t-s)]ds$$

The REFEREES (Peer Reviewers) of the paper were incompetent: they did not find the ERRORS. To make things easier, we assume $\lambda_1=\lambda_2=\lambda$, so that $R(t)_{orig}=2\exp(-\lambda t)-\exp(-2\lambda t)$; the error between the Egyptian guy and Galetto is -37%! (see fig. 2)

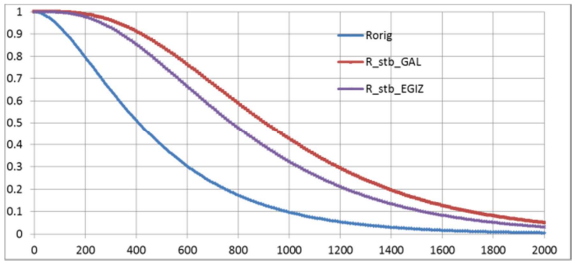


Figure 2. *Reliability of a Stand-by system with Rorig=reliability of a parallel (el-damcese vs Galetto ideas).*

So we see that using «the various indexes one cannot measure the Quality of the paper»; ONLY Logic and Probability/Reliability Theories are useful to make sound investigations. Unfortunately many "bad" managers (named by me "monagers") do not use Logic.

Let's make another example: we put in stand-by two units whose reliability is $R(t)_{orig}=\exp(-\lambda t)[1+\lambda t]$; it obvious that the reliability of the stand-by system (using the formula above) is $R_{stb}(t)=\exp(-\lambda t)[1+\lambda t+(\lambda t)^2/2+(\lambda t)^3/6]$. The error between the Egyptian guy and Galetto can be as big as -89 %! (see fig. 3)

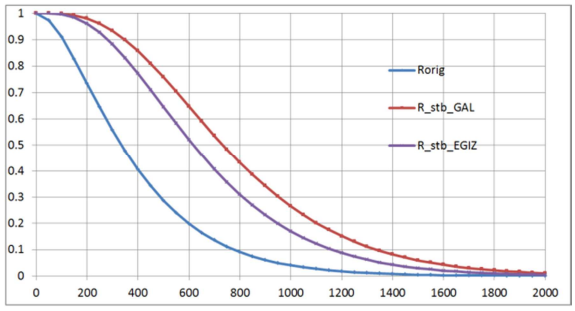


Figure 3. *Reliability of a Stand-by system with Rorig=reliability of a "stand-by" (el-damcese vs Galetto ideas).*

If the Peer-Reviewers had known the basics of probability they could have found the errors, we showed before …

Therefore we see that Managers, Researchers and Students must be alert and use the methods of Science (Logic, Mathematics, Physics, Probability, Statistics, ….) in order to avoid to be cheated by incompetents.

3. Reliability of a Parallel System with Preventive Maintenance

We consider now the paper [42] M. A. El-Damcese, A. N. Salem, and N. S. Temraz "*Semi-Markov Model of a Series-Parallel System Subject to Preventive Maintenance*", J. Stat. Appl. Pro. 2, No. 3, 307-318 (2013).

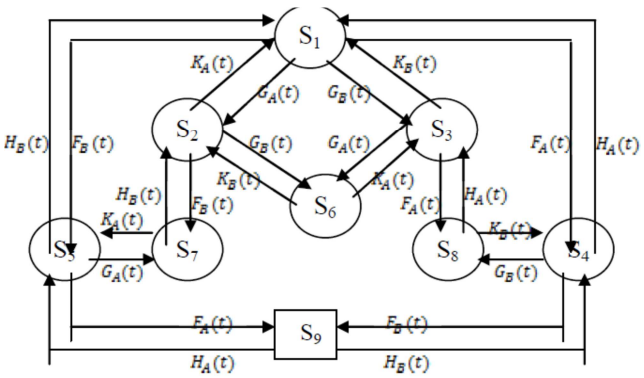
The three authors made a big mess of the reliability methods and concepts: see excerpt 2, with the figure 0. We use their own words to see how much they were in error: any logical person could find some of them. They say:

(1) The system consists of two subsystems A and B connected in parallel. Subsystem A consists of n_1 identical units connected in series and subsystem B consists of n_2 identical units connected in series.
(2) At time t = 0, the system is up and it fails when the two subsystems fail at the same time.
(3) Each subsystem fails when one unit of the subsystem is down and each failed unit is repaired.
(4) There is a preventive maintenance provided to each unit in the subsystem before it fails.
(5) There are a single repair facility and a single maintenance facility available,(i.e., in the same time one bad unit only belong to any subsystem under repair or maintenance).
(6) All distributions of the time for repair, maintenance, and time to failure are general.
(7) The model has nine states. All possible states and transitions between them are shown in ""Excerpt 7"".

Let's remind the definition of reliability: reliability of a system is the ability of a) performing its purpose adequately (i.e. either with no failures, or with no down-state of any type) b) for the period of time intended 0¨t, and c) under stated operating and environmental conditions. When anybody deals with reliability he MUST consider and specify all the three points above. [17]

Let's now analyse the point (2) «At time t = 0, the system is up and it fails when the two subsystems fail at the same time.» Let's suppose that your system is made of two cars A and B; tomorrow you have to go to work (your mission!). You decide to use the car A and you realize that A is "under Preventive Maintenance, PM"; to go to work you then revert to use the car B: unfortunately you realize that B, as well, is "under Preventive Maintenance, PM"; can you go to work? NO! Your system of the two cars is not available, i.e. it is DOWN, in spite of the fact that both the cars are not failed! LOGIC!

THEREFORE the statement «All possible states of the model are given by Up states : S1(A Up, B Up), S2(A PM, B Up), S3(A Up, B PM), S4(A Down, B Up),S5(A Up, B Down), S6(A PM, B PM),S7(A PM, B Down), S8(A Down, B PM), Down state : S9(A Down, B Down).» is not suitable for describing the probabilistic system behaviour. [excerpt 7!]



Excerpt 7. Parallel redundant system with PM, from [42]

Actually the system has 4 downstates (in the yellow oval, fig. 4): B (where both A and B are failed, and under repair), A (where both B and A are failed, and under repair), B* (where B is failed and under repair, and A, indicated as A', is under PM), A* (where A is failed and under repair, and B, indicated as B', is under PM); *we assume* that the PM is made intelligently and only one of the two items A or B can be under PM!

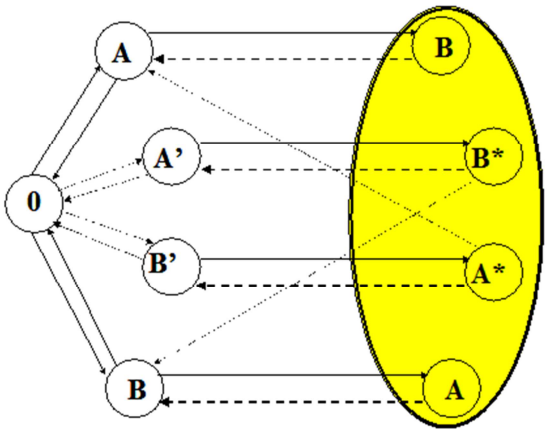


Figure 4. *Reliability of a parallel system with PM (Galetto ideas).*

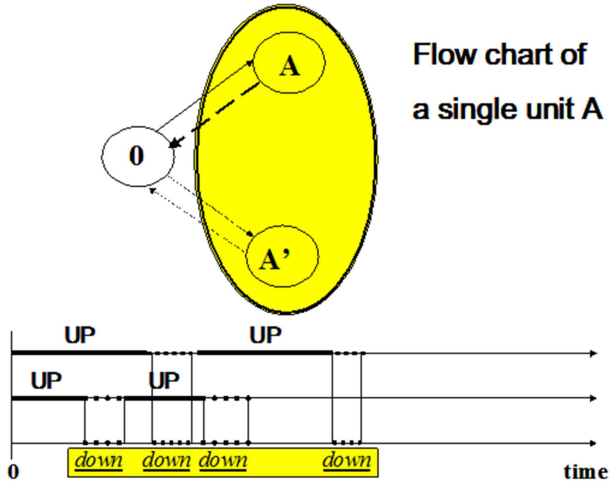


Figure 5. *Reliability of a single unit with PM (Galetto ideas).*

To make the reader understanding easy, we use first the probabilistic behaviour of a single unit A, with PM (Preventive Maintenance); as one can see in the following fig. 5, any time a failure happens the unit makes the transition from the state 0 to the state A [with a downtime due to repair], while any time a PM happens the unit makes the transition from the state 0 to the state A' [with a downtime due to PM]; since the transition depends on independent distributions the two types of downtimes add together (3rd arrow in the bottom figure). It is clear that the reliability $R_A(t)$ is the probability that the unit A stays in the up-state 0 for the whole interval $0^{----}t$. The availability A(t), on the contrary, is the probability that the unit A is in the up-state 0 at the time instant t.

In any case, it is clear that the PM reduces both the R(t) and the A(t): there is no need to make any calculation!!! ONLY Logic is needed! Letting T_A, $T_{A'}$ the RVs "time to the downstates", the RV $T=\max(T_A, T_{A'})$ does not comply with excerpt 7.

Let's go back to Excerpt 2 taken form the paper [42]; the authors of the paper [42] M. A. El-Damcese, A. N. Salem, and N. S. Temraz "Semi-Markov Model of a Series-Parallel System Subject to Preventive Maintenance", J. Stat. Appl. Pro. 2, No. 3, 307-318 (2013), use the Semi-Markov Stochastic Processes Theory to make their analysis.

We apply our considerations to the single unit A, using the Semi-Markov Stochastic Processes Theory: since there are 3 states, 0 the up state, 1 [state A, in fig. 5] and 2 [state A', in fig. 5] the down states, for the single unit A we have, according the Integral Theory of Availability [17], 3 availabilities $A_0(t)$, $A_1(t)$, $A_2(t)$; the transition rates are constant λ (for the failures), λ' (for the system going under the PM), and μ (for the repairs), and μ' (for the system coming back from the PM). We write the system of integral equations

$$A_0(t) = \exp[-(\lambda+\lambda')t] + \int_0^t \lambda \exp[-(\lambda+\lambda')r] A_1(t-r)dr$$
$$+ \int_0^t \lambda' \exp[-(\lambda+\lambda')r] A_2(t-r)dr$$
$$A_2(t) = \int_0^t \mu \exp(-\mu r) A_0(t-r)dr$$
$$A_2(t) = \int_0^t \mu' \exp(-\mu' r) A_0(t-r)dr$$

The 3 availabilities [17] tend to the same value A_{SS}, the steady state availability, as $t \to \infty$. We have

$$A_{SS,\ \text{single unit}} = 1/[1+\lambda/\mu+\lambda'/\mu']$$

It is clear that IF λ'=0 (NO Preventive Maintenance) THEN A_{SS} is better, for a single unit; the same is for $\mu' \to \infty$ (0 time for PM=immediate PM!).

It is *self-evident* that PM is useless for exponential reliability (constant failure rate), since the exponential distribution has the "*memoryless property*": at any instant t a unit with exponential reliability (constant failure rate) is GAN [as *Good As New*!] : see excerpt 2, with the silly figure 0.

For a parallel system of two units A and B, *assuming* a repair crew for A and another repair crew for B, we have

$$A_{SS}=1\ [1+\lambda_A/\mu_A+\lambda'_A/\mu'_A] + 1/[1+\lambda_B/\mu_B+\lambda'_B/\mu'_B]$$
$$-1/\{[1+\lambda_A/\mu_A+\lambda'_A/\mu'_A]\ [1+\lambda_B/\mu_B+\lambda'_B/\mu'_B]\}$$

The data used by El-Damcese, Salem, and Temraz for this case are in the excerpt 8

γ_1	γ_2	γ_3	γ_4	γ_5	γ_6	γ_7	γ_8
0.001	0.002	0.003	0.004	0.008	0.009	0.005	0.006

Excerpt 8. Data for the Case (ii) with PM, from [42]

where γ_1 and γ_2 are the constant failure rates of the units comprising the serial systems A and B, γ_3 and γ_4 are the constant PM rates of the units comprising the serial systems A and B, γ_5 and γ_6 are the constant repair rates of the serial systems A and B, γ_7 and γ_8 are the constant restoring rates for PM of the serial systems A and B; El-Damcese, Salem, and Temraz for this case find the steady state availability

$$A = 0.9769$$

Excerpt 9. Steady state Availability for the Case (ii) with PM, from [42]

The value computed by El-Damcese, Salem, and Temraz is absolutely WRONG (more than 100% error!!!!)

PM is dangerous when the failure rates are constant, as any intelligent student knows……

The authors, El-Damcese, Salem, and Temraz, do not know the basics of Probability Theory: IF T is the RV "time to failure" and T' the RV (life-time) for the PM, the RV (Y|x)=min[T'=x, T] has the mean E[(Y|x)]; integrating with the pdf g(x) we have the mean E[Y]=Mean Up Time, well known to any intelligent student in Engineering,

$$E[Y] = \int_0^\infty E[Y \mid x] g(x)dx = \int_0^\infty \int_0^x R(r)drg(x)dx$$

If the RVs are *Exponential*, T~Exp(λ) and T'~Exp(λ'), then the Mean Up Time is E[Y]=1/(λ +λ'). NO NEED of Semi-Markov Processes! IF there no PM the MUT=1/λ.

The authors, El-Damcese, Salem, and Temraz, makes big errors also for the CASE (i), where the distributions are all of the Weibull type (with shape parameter=2), as in excerpt 10

$$F_1(t) = 1 - e^{-\beta_1 t^2/2}, F_2(t) = 1 - e^{-\beta_2 t^2/2},$$
$$G_1(t) = 1 - e^{-\beta_3 t^2/2}, G_2(t) = 1 - e^{-\beta_4 t^2/2}$$
$$H_A(t) = 1 - e^{-\beta_5 t^2/2}, H_B(t) = 1 - e^{-\beta_6 t^2/2}$$
$$K_A(t) = 1 - e^{-\beta_7 t^2/2}, K_B(t) = 1 - e^{-\beta_8 t^2/2}$$

β_1	β_2	β_3	β_4	β_5	β_6	β_7	β_8
0.01	0.015	0.02	0.018	0.025	0.03	0.026	0.034

Excerpt 10. Case (i) with PM, from [42]

The authors, El-Damcese, Salem, and Temraz, show their reliability ignorance when the use the Stochastic Semi-Markov Processes; they say:

The purpose of this paper is to analyze a series-parallel system by using semi-Markov process.

Excerpt 11. Parallel-series system with PM, from [42]

They do not know that, modelling the system with the use of the Stochastic Semi-Markov Processes, one assumes that the *system IS RENEWED at any entrance in any state*; THEREFORE the Researcher using the Semi-Markov Processes has the same problem as described in the figure 5 for a single unit A, and general failure and repair distributions: the downtimes for failures and for PM add together! [see figure 5 and the excerpt 2, with the silly figure 0]

Now the 3 integral equations are the following (where $b_{ij}(s)ds$ are the transition probabilities from the state i to the state j, in the interval s⁻⁻s+ds. R(t) is the probability that there is no transition out of the state 0 (up-state), both for failure and PM, in the interval 0⁻⁻t.)

$$A_0(t) = R(t) + \int_0^t b_{01}(s)A_1(t-s)ds + \int_0^t b_{02}(s)A_2(t-s)ds$$

$$A_2(t) = \int_0^t b_{10}(r)A_0(t-r)dr$$

$$A_2(t) = \int_0^t b_{20}(r)A_0(t-r)dr$$

Letting η_A be the characteristic parameter of the unit A for failures, δ_A be the characteristic parameter of the unit A for repairs, η'_A be the characteristic parameter of the unit A for PM, δ'_A be the characteristic parameter of the unit A for restoring due to PM, the Steady State Availability for the unit A is [according to excerpt 10]

$$A_{SS,\ single\ unit} = 1/[1+(1/\eta\delta)^2+(1/\eta'\delta')^2]$$

It is clear that IF $\eta' \to \infty$ (NO Preventive Maintenance) THEN A_{SS} is better, for a single unit; the same is for $\delta' \to \infty$ (0 time for PM=immediate PM!).

For a parallel system of two units A and B, *assuming* a repair crew for A and another repair crew for B, we have

$$A_{SS}=1/[1+(1/\eta_A\delta_A)^2+(1/\eta'_A\delta'_A)^2]+$$
$$+1/[1+(1/\eta_B\delta_B)^2+(1/\eta'_b\delta'_B)^2] - 1/\{[1+(1/\eta_A\delta_A)^2+(1/\eta'_A\delta'_A)^2][1+(1/\eta_B\delta_B)^2+(1/\eta'_b\delta'_B)^2]\}$$

El-Damcese, Salem, and Temraz for this case find the steady state availability [see excerpt 2, with the silly figure 0].

$$A = 0.91688$$

Excerpt 12. Steady state Availability for the Case (i) with PM, from [42]

The value computed by El-Damcese, Salem, and Temraz is absolutely WRONG (more than 100% error!!!!)

PM is dangerous when the system is modelled by a Semi-Markov Process [the *system IS RENEWED at any entrance in any state*], as any intelligent student knows… We can repeat what we said before (see, between excerpts 9 and 10) «The authors, El-Damcese, Salem, and Temraz, do not know the basics of Probability Theory: … E[Y]=Mean Up Time, well known to any intelligent student in Engineering,… NO NEED of Semi-Markov Processes!»

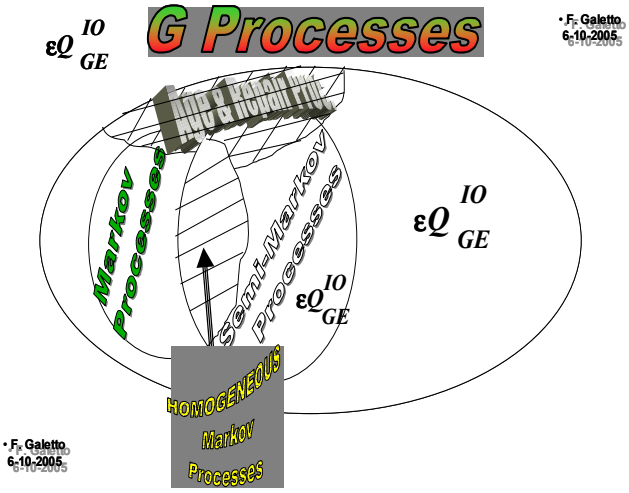


Figure 6. *G-Processes for correct analysis of systems.*

To find the correct solution the authors should have had to use the G-Processes (figure 6), that model also the Age&Repair Processes: IF one wants to make the preventive maintenance PM effective and advantageous he MUST renew the unit with the PM, leaving all the other units Old as they are (BAO=Bad As Old)!

Now we see another case about Maintenance [54], a thesis at Worcester Polytechnic Institute; it is the proof that also some professors do not know the subject they have to analyse:

From a systems or components perspective, failure rate is defined as the frequency at which that component fails and is symbolized by the Greek letter λ, Lambda. The failure rate is function that is time dependent. Specifically,

$$\lambda = \frac{\text{number of failures per unit time}}{\text{number of components exposed to failure}}$$

The reliability rate as a function of time is defined as the exponential of a negative integral of λ(t) where time is measured from o to t. Hence, mathematically, it is the exponential part of the equation and can also be written as:

$$R(t) = e(-\lambda t)$$

Excerpt 13. Wrong statements from [54]

1st error: failure rate h(t) is NOT a frequency, neither a pdf, nor a conditional pdf;

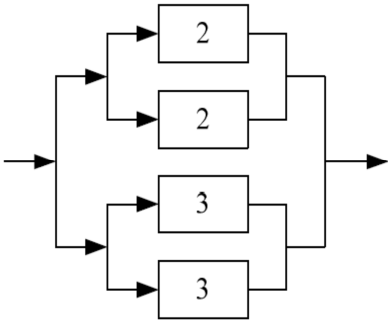
2nd error: failure rate h(t) is NOT estimated by the formula given in the excerpt 13; estimation is a serious matter, and suitable statistical methods are needed;

3rd error: as we said before, putting H(t), the integral from 0 to t of h(x), it is known that [17] the Reliability is R(t)=exp[-H(t)], and, obviously, R(t)≠exp[-h(t)t], (except for the case h(x)=λ=constant). SINCE J. Martinez, said "the failure rate is a function that is time dependent" he CANNOT write R(t)=exp[-λ(t)t]!

A good professor should have found those errors…!

J. Martinez, (2008) and his professors are not alone: see the book [48] M. Lazzaroni, L. Cristaldi, L. Peretto, P. Rinaldi, M. Catelani, (2003), *"Reliability Engineering"* [Springer]. The 5

professors do the same!



Excerpt 14. A double parallel system from [48]

Those authors indicate as $\lambda_P(t)$ the failure rate of each of the two parallels, 2_2 and 3_3; they then write the reliability $R_{P23}(t)$ of the double parallel as, in the following excerpt 15

$$R_{P23}(t) = e^{-\lambda_P(t)t} + e^{-\lambda_P(t)t} - e^{-\lambda_P(t)t}e^{-\lambda_P(t)t} = 2e^{-\lambda_P(t)t} - e^{-2\lambda_P(t)t}$$

$$MTTF_{23} = \int_0^{+\infty} R_{P23}(t)dt = \int_0^{+\infty} \left(2e^{-\lambda_P(t)t} - e^{-2\lambda_P(t)t}\right)dt =$$

$$= 2\int_0^{+\infty} e^{-\lambda_P(t)t}dt - \int_0^{+\infty} e^{-2\lambda_P(t)t}dt$$

Excerpt 15. Reliability of the double parallel system from [48]

NOTICE: they, being incompetent, used the product $\lambda_P(t)t$ as though it were H(t) of each of the two parallels, 2_2 and 3_3; any intelligent student in Engineering knows that $H_P(t) \neq \lambda_P(t)t$]! Letting T_A, T_B the RVs "time to the failure", the RV $T=\max(T_A, T_B)$ does not comply with excerpt 15; this is another way to see that excerpt 15 is wrong!.

The 5 professors were informed of the problem… NO reaction…. IF they will be Peer-Reviewers, which errors will they be able to find?

It is not surprising that the thesis [35], C. Casciano (L. Peretto referee), *Thesis on the Taguchi Method*, Bologna University 2014, is full of mistakes. The student and the professor (L. Peretto referee) were informed of the problem… NO reaction….

4. Conclusion

We analyzed some very few cases, taken from some published documents found on the web: Montgomery, Rade, M. A. El-Damcese [paper 41], M. A. El-Damcese, A. N. Salem, and N. S. Temraz [paper 42] (and other from books [from 44 to 49, M. Xie, Y-S Dai, K-L Poh, (2004), T. Nakagawa, (2005), H. Pham, (2003), H. Wang, H. Pham, (2006), M. Lazzaroni, L. Cristaldi, L. Peretto, P. Rinaldi, M. Catelani, (2003), MONTGOMERY D.C. (2006)] and theses [35, 54]!):

«*Reliability Equivalence Analysis of a Parallel-Series System Subject to Degradation Facility.* Science Journal of Applied Mathematics and Statistics. Vol. 3, No. 3, 2015, pp. 160-164. doi: 10.11648/j.sjams.20150303.19»

«*Semi-Markov Model of a Series-Parallel System Subject to Preventive Maintenance*", J. Stat. Appl. Pro. 2, No. 3, 307-318 (2013)»

See also all the other cases in the references, about Design Of Experiments.

My students were able to find the right solutions because they had the Sound Theory [17]! Montgomery, Rade, M. A. El-Damcese, A. N. Salem, and N. S. Temraz did not have it.

Citing Rade, El-Damcese improves the indexes of Rade! Citing Rade, El-Damcese, Wang, Pham, Xie, Peretto, Montgomery, Fausto Galetto, WHO found them WRONG, improves the indexes of Rade, El-Damcese, Wang, Pham, Xie, Peretto, Montgomery! WHERE is the Quality?

The problem of ignorance is so huge [1-6,12-16,19-23,29,31-38, 44-54] that a profound change of mind (metanoia, Deming) [5,6] is NEEDED.

See all the figures (mostly figures 12, 13, 14, 15).

The following statements of great scientists and managers are important for any person who wants to make QUALITY Decisions on QUALITY matters.

We think that the YOUNG Researchers MUST be ALERT if they want to LEARN: THEY MUST know the THEORY!

The author Galetto always invited people to be intellectually honest in teaching and taking decisions: THEORY is fundamental in both cases. [see the F. Galetto documents, in the references, in the RG database, and in his books]

From above we see that Fausto Galetto taking into account the following statements by great people, as always did, could provide a sensible advice for any Researcher, in any university, and any Manager, in any Company.

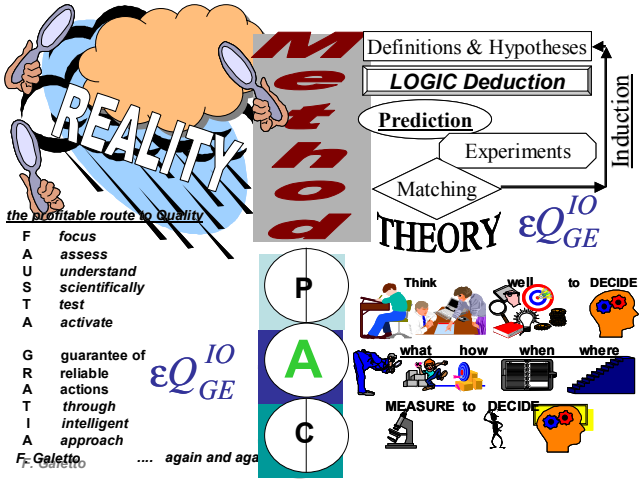


Figure 7. *FAUSTA GRATIA for Quality in order to avoid the Disquality.*

W. E. DEMING "It is a hazard to copy". "It is necessary to understand the theory of what one wishes to do or to make." "Without theory, experience has no meaning." "A figure without a theory tells nothing". <<<The result is that hundreds of people are learning what is wrong. I make this statement on the basis of experience, seeing every day the devastating effects of incompetent teaching and faulty applications.>>>

M. GELL-MANN "In my university studies …, in most of the cases, it seemed that students were asked simply to

regurgitate at the exams what they had swallowed during the courses.". Some of those students later could have become researchers and then professors, writing "A_scientific" papers and books … For these last, another statement of the Nobel Prize M. Gell-Mann is relevant: <<<<<"Once that such a misunderstanding has taken place in the publication, it tends to become perpetual, because the various authors simply copy one each other.".>>>>>, similar to "Imitatores, servum pecus" [Horatius, 18 B.C.] and "Gravior et validior est decem virorum bonorum sententia quam totius multitudinis imperitiae" [Cicero].

P. B. CROSBY Paraphrasing P. B. CROSBY one could say "Professors may or may not realize what has to be done to achieve quality. Or worse, they may feel, mistakenly, that they do understand what has to be done. Those types can cause the most harm."

What do have in common Crosby, Deming and Gell-Mann statements? The fact that professors and students betray an important characteristic of human beings: rationality [the "Adult state" of E. Berne]

A. EINSTEIN "Only two things are infinite: the Universe and the Stupidity of people; and I'm not sure about the former".

GALILEO GALILEI Before EINSTEIN, GALILEO GALILEI had said [in the Saggiatore] something similar "Infinite is the mob of fools".

The scientific community as a whole must judge [κρινω] the work of its members by the objectivity and the rigor with which that work has been conducted; in this way the scientific method should prevail. Any professor and any Statistical Consultant should know Probability Theory and Statistics!

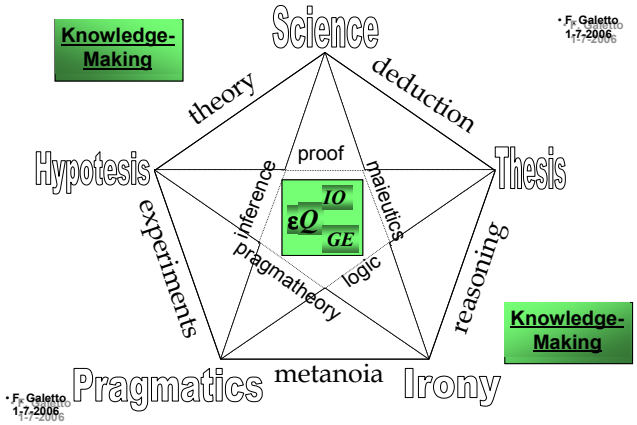


Figure 8. *Quality Tools and Quality Methods: avoid the Disquality.*

I always was used to say to my students: «««««IF a guy suggests books and papers written by incompetents he is TWICE incompetent, because he does not recognize wrong ideas and suggests to read wrong ideas»»»»». Unfortunately several Professors do not practice the two important methods used here, the Logic and the Scientific Theory (Mathematics, Probability, Statistics, Physics,…). See the references…

Please see well the figures 7, 8, 9 and 10, and see IF …

Researchers shall use their intelligence in order to make knowledge for the improvement of people and their life.

Researchers MUST not cheat people and act according to the figures 7 and 8.

Any Intellectually hOnest person that loves QUALITY and hates DISquality will Focus on the problems [potential and/or actual], Assess their importance (money, impact, consequences, risks, …), Understand all the previous items SCIENTIFICALLY and SCIENTIFICALLY Test for finding the causes; when a solution is found anybody will Activate to implement the solution, in order to Guaranty that Reliable Actions (preventive and corrective) are taken Through an Intelligent Approach (approach that uses intelligence, ingenuity and science, avoiding misdeeds). [figure 7]

Eric Berne [32] devised the Transactional Analysis "Theory" [that actually is not a theory in the scientific sense] with the 3 EGO_States: Parent, Adult, Child.

The Parent ego_state is a set of thoughts, feelings, and behaviours that are learned or "borrowed" from our parents or other caretakers. Two parts are comprised: the Nurturing Parent ego_state soft, loving, and permission giving, and Prejudiced Parent, the part of our personality that contains the prejudged thoughts, feelings, and beliefs that we learned from our parents.

The Adult ego_state is our data processing centre. It is the part of our personality that formulate hypotheses to be verified by experiments, uses LOGIC and SCIENCE, invents METHODS to test ideas and to process data accurately, that sees, hears, thinks, and can come up with solutions to problems [potential and/or actual] based on the facts and not solely on our pre-judged thoughts or childlike emotions: it denounces misdeeds. You can see its capacities on the right hand of the figure 7. Qualitatis FAUSTA GRATIA is related to the Adult ego_state.

Figure 9. *The epsilon-Quality to avoid the Disquality.*

The Child ego_state is the part of our personality that is the seat of emotions, thoughts, and feelings and all of the feeling state "memories" that we have of ourselves from childhood. The Child ego_state can also be divided into two parts: the Free Child ego_substate is the seat of spontaneous feeling and behaviour. It is the side of us that experiences the world in a direct and immediate way. Our Free Child ego_substate can be playful, authentic, expressive, and emotional, and the Adapted

Child ego_substate that is the part of our personality that has learned to comply with the parental messages (from everywhere and everybody) we received growing up; if we are faced with parental messages (from everywhere and everybody) that are restricting, instead of complying with them, we rebel against them.

The Adult ego_state [17,18,29]is embodied in the εQ_{GE}^{IO} *symbol*(the epsilon-Quality, see also figure 9).

Intellectually hOnest people use as much as possible their rationality and Logic, in order not to deceive other people.

Deming, Einstein, Gell-Mann are beacons for the Quality Journey.

If we want to achieve QUALITY, MANAGERS (now students) NEED TO BE EDUCATED ON QUALITY εQ_{GE}^{IO} by Quality Professors, EDUCATED on Quality.

I could, at last, paraphrase ST John "And there are also many other things, the which, if they should be written everyone, I suppose that even the world itself could not contain the books that should be written."[1-54]

Will someone want to see the truth? Only God knows that …

The personal conclusion is left to the Intellectually Honest reader to whom is offered the Quality Tetralogy: Prevent, Experiment, Improve, Plan, SCIENTIFICALLY to avoid disquality, to eliminate disquality, to achieve Quality, to assure Quality, using Intellectual Honesty: we wish them to use correctly the Decision-Making Tetrahedron (fig. 10).

Quality Tetralogy and Decision-Making are much better than ISO 9004:2008 (and 2015, as well) because Quality Tetralogy and Decision-Making Tetrahedron take into account explicitly the need for scientific behavior either of people or of organizations that really want to make Quality. Moreover they show clearly that prevention is very important for Quality and Good Management is strongly related to Good Knowledge for Business Excellence.

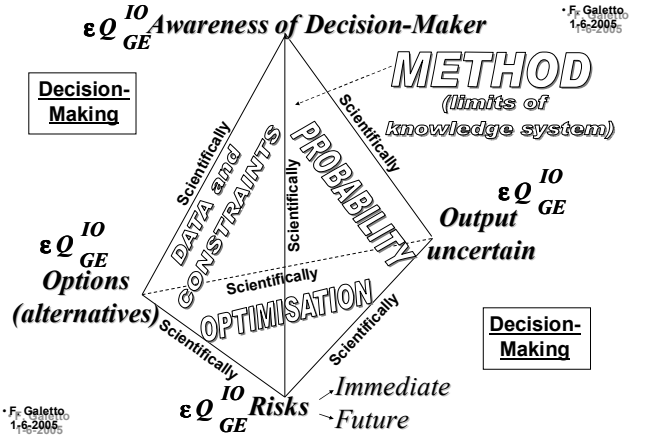


Figure 10. *The Decision-Making Tetrahedron.*

Brain is the most important asset: let's not forget it, IF we want that our students (Future Managers or Future Researchers) be better than their professors.

We repeat

YOUNG Researchers MUST be ALERT

if they want to LEARN:

THEY MUST know the THEORY!

««The truth sets you free»»

Professors and researchers WHO DO NOT ARE Intellectually hOnest will not grow students and researchers fond of Quality (see figures 1, 6, 7, 8, 9, 10) and [32].

References

[1] BARONE S, ERTO P, LANZOTTI A (2001), "Beyond robust design methodologies: an elementary example of synergy between statistics and advanced engineering design", SIS Sperimentare per la Qualità, Turin February 2001

[2] BORSELLINO C., LO CASTO S., MARAGIOGLIO G., RUISI V. (1999), "Thermovision temperature mapsevaluation in turningoperation", 3rd AITEM 99, Brescia

[3] CAPELLO E., SEMERARO Q. (1999), "Residual stresses in turning", 3rd AITEM 99, Brescia

[4] CARRINO L., GIULIANO G., POLINI W. (2000), "New method to characterise superplastic materials in comparison with alternative methods", Int. Manufacturing Conference in China, Hong Kong

[5] DEMING W.E. (1986), Out of the crisis, Cambridge Press

[6] DEMING W.E. (1997), The new economics for industry, government, education, Cambridge Press

[7] GALETTO F. (1978), "An application of experimental design in the Automotive field", SIA Congress

[8] GALETTO F. (1984)"Assessment of Product Reliability", World Quality Congress '84, Brighton

[9] GALETTO F. (1986)"Quality/Reliability: How to get results", EOQC (Automotive Section), Madrid

[10] GALETTO F. (1987)"Quality and Reliability, the Iveco way", Mgt Dev. Review by MCE, Brussells

[11] GALETTO F. (1988)"Quality and reliability. A must for industry", ISATA, Montecarlo

[12] GALETTO F. (1989)"Quality of methods for quality is important", EOQC Conference, Vienna

[13] GALETTO F. (1990)"Basic and managerial concerns on Taguchi Methods", ISATA, Florence

[14] GALETTO F., LEVI R. (93)"Planned Experiments: key factors for product Quality", 3rd AMST 93, Udine

[15] GALETTO F. (1993) "DOE. Importanti idee sulla Qualità per i manager", DEINDE, Torino

[16] GALETTO F. (1993) "Which kind of Quality? Of products, of processes, of Management?", 1st AITEM, Ancona

[17] GALETTO F. (1995) Affidabilità, Volume 1: Teoria e Metodi di Calcolo, CLEUP, Padova.

[18] GALETTO F. (1995) Affidabilità, Volume 2: Prove di affidabilità, CLEUP, Padova.

[19] GALETTO F. (1996)"Managerial Issues for Design of Experiments", 4th AMST 96, Udine

[20] GALETTO F. (1997)"We need Quality of Managers", Quality 97 6th Int. Conf., Ostrava, Czeh Republic

[21] GALETTO F. (1998)"Quality Education on Quality for Future Managers", 1st Conference on TQM for Higher Education Institutions, Toulon

[22] GALETTO F. (1999)"GIQA, the Golden Integral Quality Approach: from Management of Quality to Quality of Management", Total Quality Management, Vol. 10, No. 1

[23] GALETTO F. (1999)"Quality Methods for Design of Experiments", 5th AMST 99, Udine

[24] GALETTO F. (1999)"Quality Function Deployment, Some Managerial Concerns", AITEM99, Brescia

[25] GALETTO F., GENTILI E. (1999), "The need of Quality Methods used for Quality",CAPE '99, Durham, UK

[26] GALETTO F., GENTILI E. (1999), "Quality of the Quality Methods", AITEM 99 Conference, Brescia

[27] GALETTO F. (99)"Quality Education on Total Quality Management" 2nd Conf. on TQM for HEI, Verona

[28] GALETTO F., GENTILI E. (2000), "In search of Quality in QFD and Taguchi methods", CAPE

[29] GALETTO F. (2000) Qualità. Alcuni metodi statistici da Manager, CLUT, Torino

[30] MONTGOMERY D.C. (1996), Introduction to Statistical Quality Control, Wiley & Sons (many drawbacks)

[31] PARK S. (1996), Robust Design and Analysis for Quality Engineering, Chapman& Hall, London

[32] WATZLAWITCK P. (1976) La realtà della realtà, Astrolabio, Roma

[33] YIN G.Z., JILLIE D.W. (1987), "Orthogonal Design for Process Optimisation and its Application in Plasma Etching", Solid State Technology, (may 87)

[34] W. Eureka, N. E. Ryan The Customer driven Company: Managerial Perspectives on QFD, ASI Press, 1989

[35] C. Casciano (L. Peretto referee), Thesis on the Taguchi Method, Bologna University 2014

[36] J. Z. Zhang et al., "Surface roughness optimization … using the Taguchi design Method", Journal of Material Processing Technology 184(2007) 233-239

[37] Research Gate, Papers and Questions&Answers

[38] GALETTO F. (2014) "Bibiliometrics: Help or Hoax for Quality?" UJER 2(4), DOI: 10.13189/ujer.2014.020404

[39] GALETTO F. (2014) QualityPedia Project. Volume 1, Chapter 1, Research Gate

[40] GALETTO F. (2014) "Riemann Hypothesis Proved", Academia Arena 2014;6(12):19-22]. (ISSN 1553-992X).

[41] M. A. El-Damcese. "Reliability Equivalence Analysis of a Parallel-Series System Subject to Degradation Facility." *Science Journal of Applied Mathematics and Statistics*. Vol. 3, No. 3, 2015, pp. 160-164. doi: 10.11648/j.sjams.20150303.19

[42] M. A. El-Damcese, A. N. Salem, and N. S. Temraz "Semi-Markov Model of a Series-Parallel System Subject to Preventive Maintenance", J. Stat. Appl. Pro. 2, No. 3, 307-318 (2013)

[43] GALETTO F. (2014) "Hope for the Future: Overcoming the DEEP Ignorance on the CI (Confidence Intervals) and on the DOE (Design of Experiments)". *Science Journal of Applied Mathematics and Statistics.* Vol. 3, No. 3, 2015, pp. 99-123. doi:10.11648/j.sjams.20150303.14 DOE 10.11648. j.sjams.20150303.14

[44] M. Xie, Y-S Dai, K-L Poh, (2004) Computing System Reliability, Kluwer Academic Publishers

[45] T. Nakagawa, (2005) Maintenance Theory of Reliability, Springer

[46] H. Wang, H. Pham, (2006) Reliability and Optimal Maintenance, Springer

[47] H. Pham (2003), Handbook of Reliability Engineering, Springer

[48] M. Lazzaroni, L. Cristaldi, L. Peretto, P. Rinaldi, M. Catelani, (2003), Reliability Engineering, Springer

[49] MONTGOMERY D.C. (2006), Introduction to Statistical Quality Control, 6th edition, Wiley & Sons (many more drawbacks than 1996)

[50] K. Bouacha, M. A. Yallese, S. Khamel, S. Belhadi, Analysis and optimization of hard turning operation using cubic boron nitride tool

[51] D. Jurków, application of design of the experiment(DoE) in simulations of passive low temperature co-fired ceramics (LTCC) coolers

[52] D. Jurków, Application of Design of the Experiment in Preliminary Investigations on the end Milling of Low Temperature Co-fired Ceramics, Int. J. Appl. Ceram. Technol., 10 [4] 671–681 (2013) DOI: 10.1111/ j.1744-7402.2012.02763.x

[53] M. S. Sukumar*, B. V. Sudheer Reddy, P. Venkataramaiah, (2015), Analysis on Multi Responses in Face Milling of Ammc Using Fuzzy-Taguchi Method, Journal of Minerals and Materials Characterization and Engineering, 2015, 3, 255-270 Published Online July 2015 in SciRes. http://www.scirp.org/journal/jmmce

[54] J. Martinez, (2008) Application of reliability-Centered Maintenance in Facility Management, Thesis submitted to the Faculty of Worcester Polytechnic Institute.