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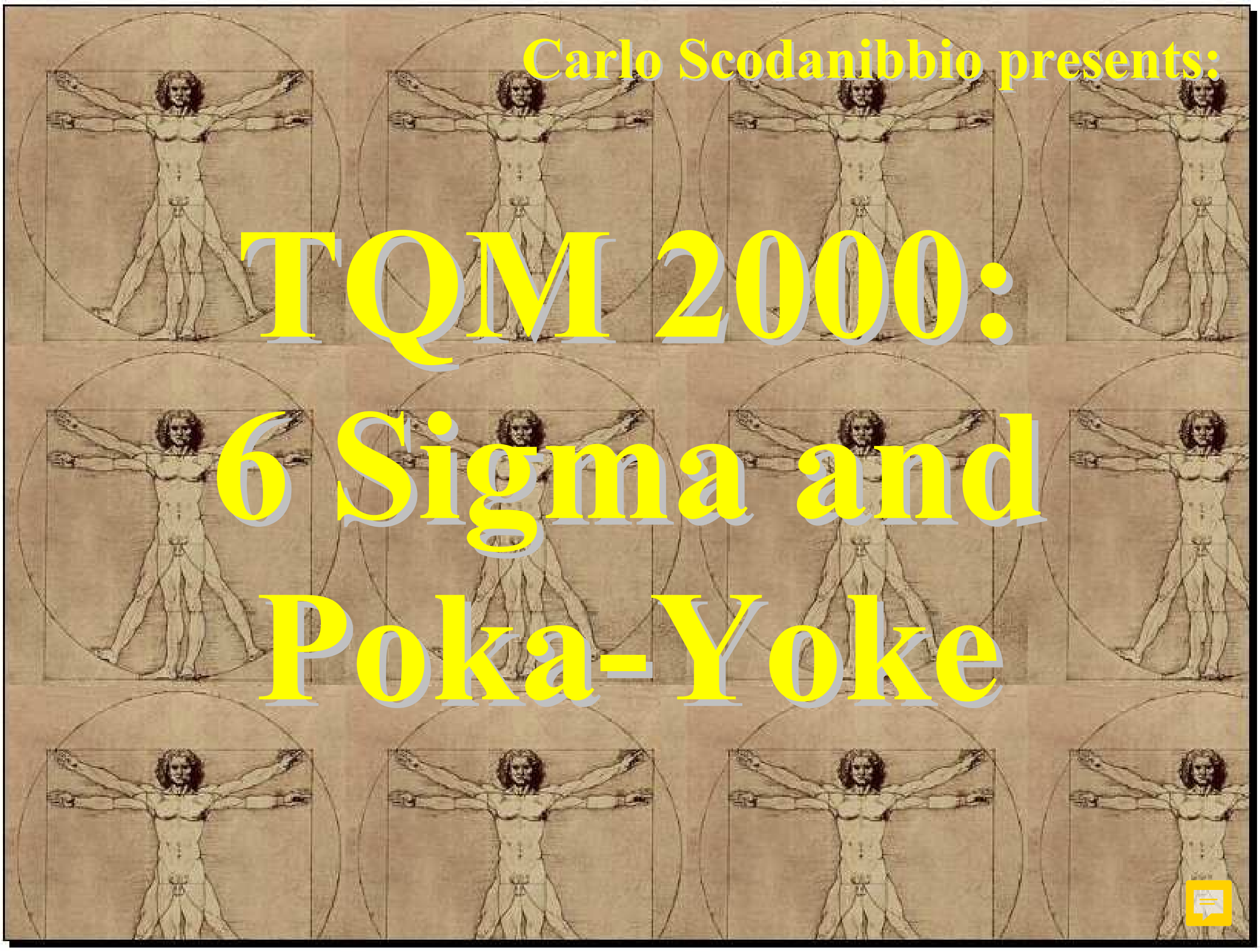

e-book: TOTAL QUALITY MANAGEMENT 2000 - 6 Sigma and Poka-Yoke
April 2009

"Total Quality Management 2000: 6 Sigma and Poka-Yoke"
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Dear e-Participant,

Welcome to this e-Course! I am confident you will find it of interest, beneficial and, at times, also a bit entertaining.

To begin with, a quick presentation: I am Carlo Scodanibbio, Italian, Engineer, graduated in 1970, and with over 49 years of post-graduate experience in Project Engineering, Plant Engineering, Project Management, Industrial Engineering and Operations Management Consulting – as at the date of releasing the new version of this e-course.
I have been a free-lance Industrial Consultant for the past 40 years, and a HR Trainer for the past 30.
My field of activity is: World Class Performance in the Small and Medium Enterprises.
I have operated in several Countries, including Italy, Romania, Malta, Turkey, Cyprus, Lebanon, Cape Verde, Kenya, Mauritius, Malaysia, India, Saudi Arabia, South Africa and neighbouring Countries.

My "real-world" training style is very interactive. I am afraid this won't be possible in the case of an e-Course, such as this one.

And yet, as a participant in this e-Course, you are entitled to contact me for clarifications or further explanations with regard to the topics of this Course.
You may do so by e-mail: mail@scodanibbio.com

And now let's start.
The title of this Course is:

"Total Quality Management 2000: 6 Sigma and Poka-Yoke"

Let me introduce today's concept of Total Quality Management and its allied disciplines 6 Sigma and Poka-Yoke: we have to look at it under a wider perspective, the World-Class Performance perspective.

WORLD-CLASS PERFORMANCE

There is new terminology used today, sometimes abused, sometimes mis-used.
The term "**world-class**", for instance, has become very fashionable. Airlines use it, Insurance Companies use it, Car Manufacturers use it… in fact it is widely used.
To indicate what?
To indicate a "standard", a "level" which seem to be the *best under the circumstances*.
So there are world-class enterprises, world-class services, world-class products…

Meaning: that enterprise, that service, that product, is of "world-class" calibre, or "of a standard comparable to that of the best in the classroom" where the classroom is the entire world.

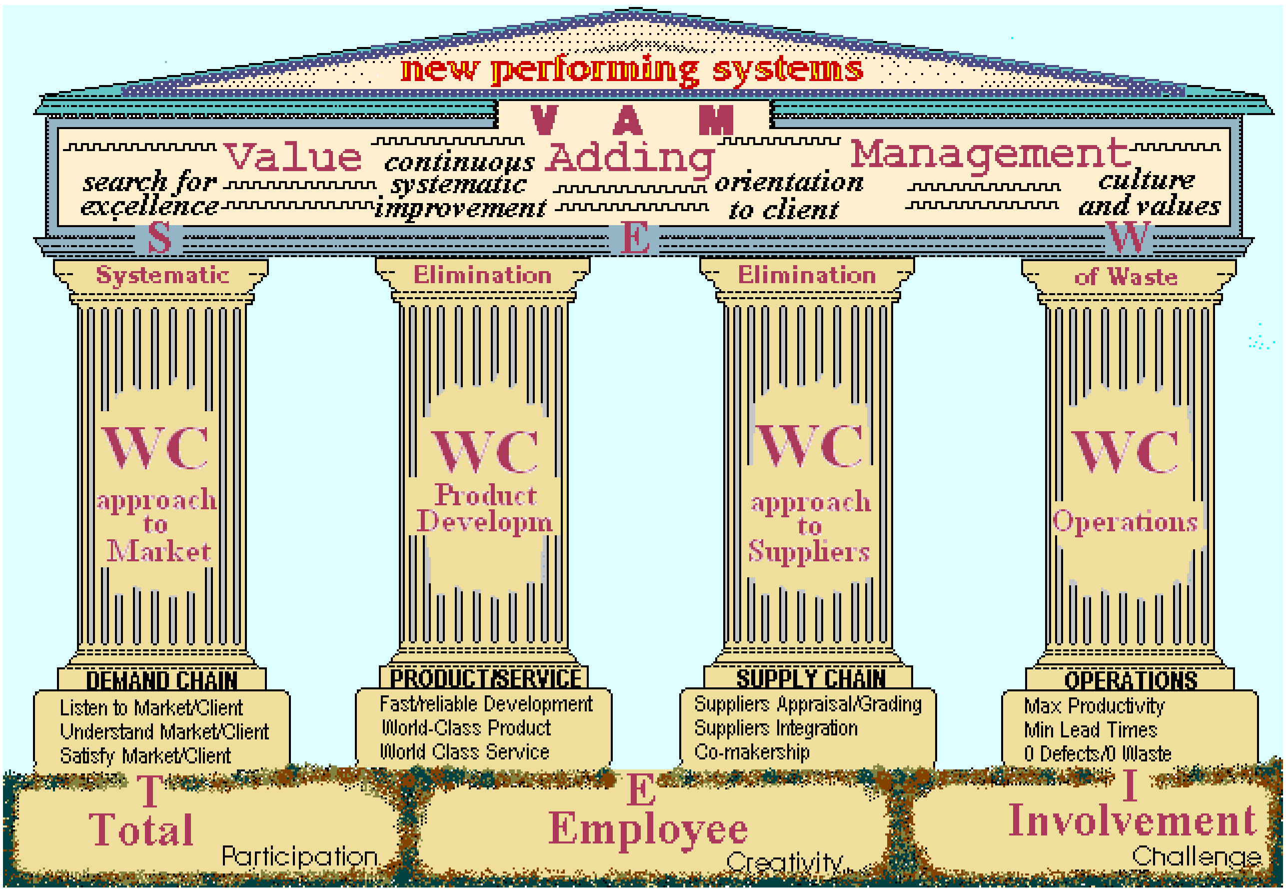
So, the term "world-class" has silently become a sort of unit of measure, a non-always-clearly-defined way of attaching a label (a good label) to something, be it a enterprise, a product, or whatever.

Well, we shall go along with this fashion, obviously taking a note that a better definition might be given. And state that,

today's enterprises need to operate and perform in an adequate manner, following a "new model" – and, according to our knowledge of today, it would appear that the most fit model is that adopted by enterprises which consistently distinguish themselves for their overall performance - and as such it is a valid model, a model to follow

Like to say that: being unable to arrive at a theoretical model that could be valid for all enterprises of the new world, the best we can do is to look at excellent enterprises (those that are called "world-class" enterprises) and take hints from them in order to achieve a satisfactory or excellent level of performance in other enterprises.

Let's give a more operational (and architectural) representation of a "world-class" enterprise performance:



It appears that the main parameters that classify and govern a world-class enterprise's performance are, within others, the following:

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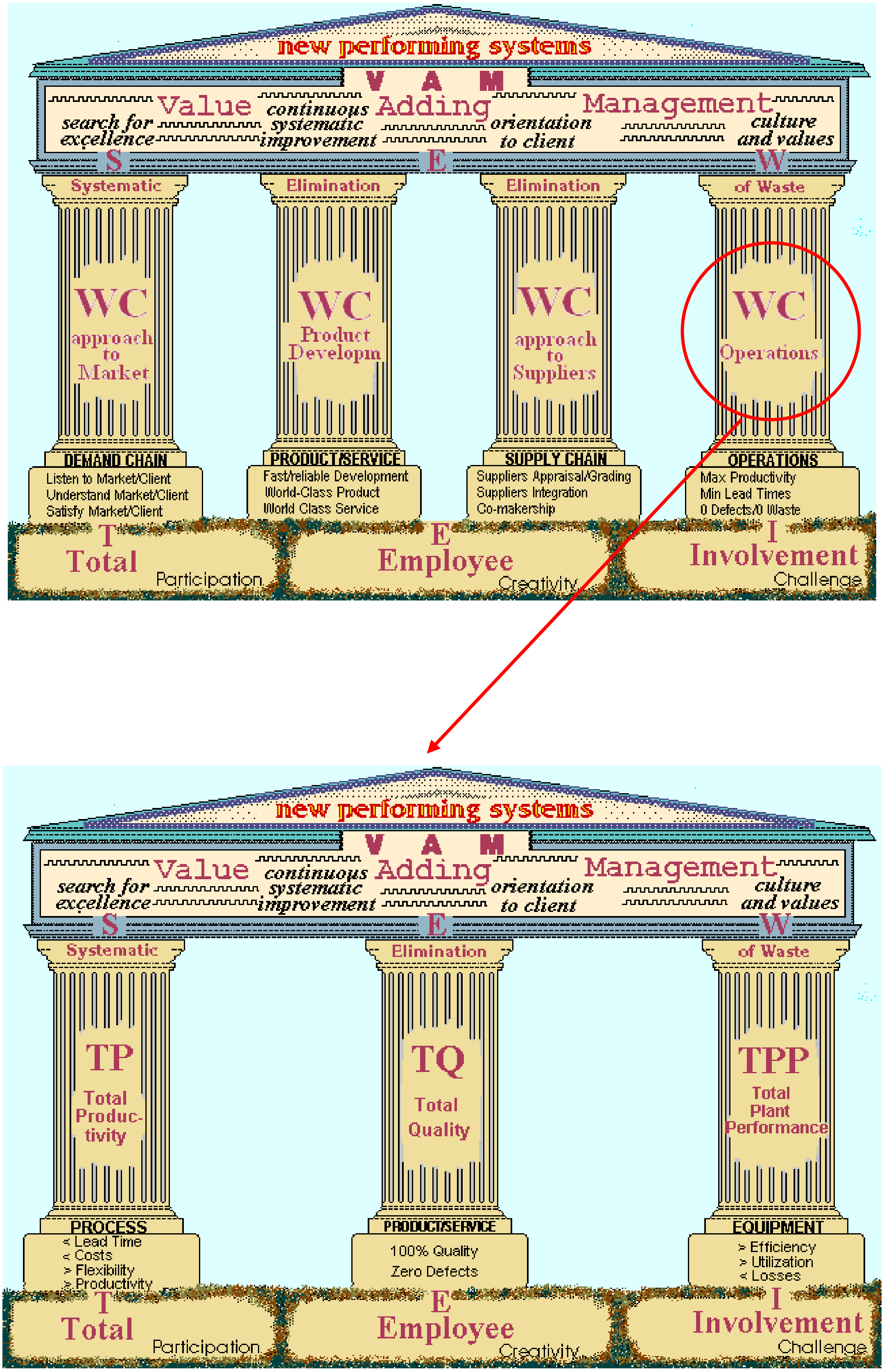


World-Class Operations are today based on 3 pillars, standing on the usual solid foundations (People), under the usual “ceiling” (Value Adding Management).

The 3 pillars represent:

- The **Productivity** aspect of the **PROCESS area**. This area is the “heart” of the operational process. The targets are:
  - Shortening to a bare minimum all Lead Times (especially the “throughput” time, or time required to process and output a product or a service)
  - Reducing processing Costs to a bare minimum. This is achieved by chopping process’ “*waste*” to the roots and beneath.
  - Maximising process’ Flexibility and Reactivity to Clients’ needs and expectations.

  The state of the art disciplines in this area are: ***Lean Manufacturing*** (for the manufacturing industry) – ***Lean Project Management*** & ***Lean Construction Management*** for the project-driven and construction industries – ***Lean Flow Processing*** for the service industry.

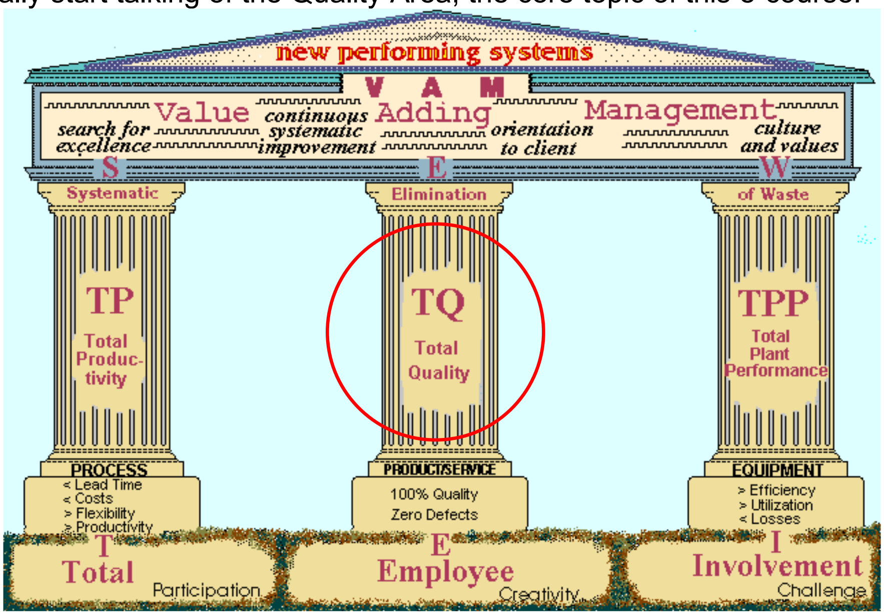
- The **Quality** aspect of the **OUTPUT PRODUCT OR SERVICE area**. This area goes hand-in-hand with the previous one: the name of the game is “integration”. The targets are simple and drastic:
  - 100% output quality
  - Zero defects all along the processing operations, up to the client and eventually the end-user.

  The state of the art discipline in this area is: “modern ”***Total Quality Management***” and its allies, i.e. **6-Sigma** approaches and **Poka-Yoke** techniques. This is the area we are going to study in this e-course.

- The **Performance** area of the **EQUIPMENT area** (technological components of the process, e.g. plant, machinery and, in general, technology). Also this area goes hand-in-hand with the previous ones: the name of the game is always “integration”. The targets are:
  - Maximum equipment efficiency.
  - Maximum equipment utilisation.
  - Minimal equipment-related losses (such as breakdowns, stoppages, set-ups, etc.).

  The state-of-the-art philosophy in this area is still: ***Total Productive Maintenance*** (***TPM***), in strict relationship with its “technical” allies (**Predictive Maintenance – Reliability Centred Maintenance – Risk Based Inspections – Instruments Protective Functions** – and others).

Now we can finally start talking of the Quality Area, the core topic of this e-course:



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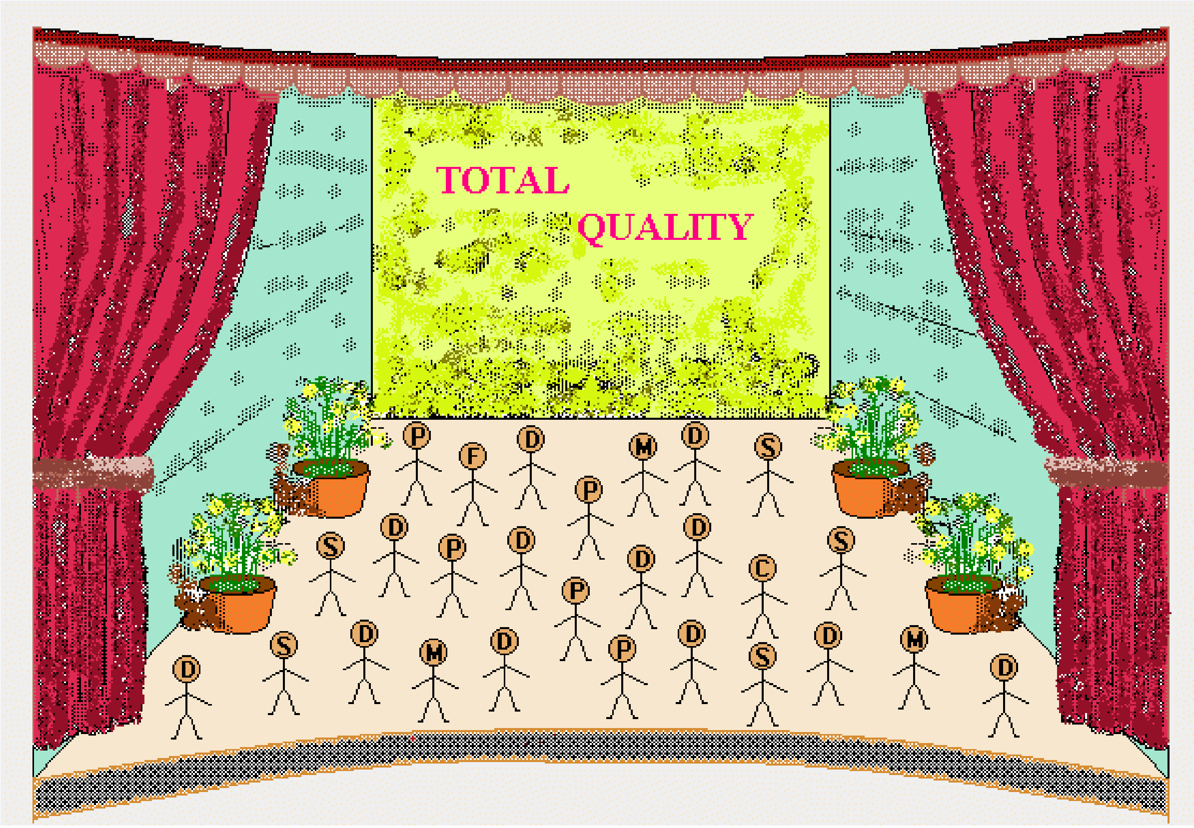

QUALITY MANAGEMENT or QUALITY OF MANAGEMENT?
Quality is not a technical function nor a department task, but rather a systematic process diffused throughout the Organisation - Quality must be seen as everybody's task: but it will become nobody's task, unless it is supported by a well structured Quality System.
The concept of continuous improvement must be emphasised in all departments, not only within production - effectiveness will be achieved only through everybody's conscious participation, and not merely employing Quality Control Professionals - the Organisation must decentralise, and responsibilities must be distributed at all levels - flexibility, adaptability, rapidity and reactivity to environment changes are essential features of the New Performing Systems - strategic innovation, adaptability of all personnel to innovation, and well diffused desire of innovation are extremely important factors in a Total Quality System - team-work must develop at all levels.
Quality is to be perceived as an essential requirement of Clients: Quality is what Clients want to satisfy their needs, and not only what internal departments (commercial, production....) want to satisfy their internal needs of image, prestige and efficiency - relationships Supplier-Client must be based on deep reciprocal involvement and "partnership" concepts - Quality of Product must be indissolubly linked to Quality of Service - this can be achieved only when there is a Client-oriented Total Quality System, understandable by all personnel, in which everybody can believe, and to which everybody wants to belong.
[Anastas Kèhayoff]

A quick refresh on some **core TQM principles**:

- **Quality is defined by Customers**
  Customers define quality, they quality they want, need, expect or dream of. So much has been said on this point that it will be pointless to discuss it any longer. However, let's not forget that there is an "explicit" quality and an "implied" quality: explicit quality goes along with "quality standards" (see principle below) – implied quality is specified nowhere, it's quality that must just be there! A fridge is supposed to cool well, a book is supposed to be printed without spelling mistakes. Finito. That's just given for granted.
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- **Continual learning, training and application of TQ principles and techniques is the never ending responsibility of everyone in the Organisation.**
  Very little to comment – self-explanatory.

In a nutshell:
TQM is the philosophy for Quality in the years 2000 – and an operational discipline.

Today's TQM target is extremely simple and also very drastic:

100% Quality = Zero Defects

In the new millennium, Clients are no longer prepared nor willing to tolerate any defect, any non-conformity, any non-quality.
This applies to quality of products and quality of service: simply, there is no room for errors, mistakes and poor product/service performance. Full stop.

How can we achieve that?

The possible and available solutions are:
- **Traditional Quality Control and SPC – Statistical Process Control**
- **100% Testing**
- **6 Sigma methods**
- **Poka-Yoke techniques**

One-by-one:

TRADITIONAL QUALITY CONTROL
STATISTICAL PROCESS CONTROL
Both disciplines are rather dated – in fact they are rapidly becoming out-dated.
Why? Because of their "traditional" conception:
1) quality is controlled by "external" (external to the process) resources, and not by resources "in-the-process"
2) generally, a "sample" is controlled, with the aim of transferring results of tests to entire lots

Both the above points are today considered serious draw-backs. Why?
1) External control is more and more considered, under the LEAN angle of view, as non-value-adding – actually, to be a bit more drastic, it is considered ***waste***.
2) External control is detrimental to morale, sense of responsibility and accountability of "in-process" people. The mechanisms is rather simple: "*…if someone else will take care of controlling the quality of whatever I am doing or producing, why should I care for it?*" Rather tragic.
3) Traditional QC and SPC, in all their forms, DO NOT reveal ALL defectiveness and non-conformities: they simply "contain" them to (what is considered) an acceptable level. Therefore defectiveness and non-conformities are still there. No longer acceptable!

100% TESTING
This means texting and checking ALL what is produced: products and non-products (for instance, some paperwork may get checked for correctness).

100% Testing may be performed “in-process” (by those resources actually doing the job or producing the product) or “externally”. In the first instance, draw-back N. 2 above is eliminated. In the second instance it remains.
The positive aspect of 100% Testing is that it reveals ALL defects and non-conformities. Therefore, non-conformities are not transmitted to downstream processing points and, eventually, to the customer.

The negative aspect is that it does nothing to eliminate defects and non-conformities in the first instance.
The major drawback, however, is that 100% Testing is not always possible. If you produce ice creams, you cannot test all of them for quality or you won’t sell any ice cream at all….

Under the modern TQM angle of view, 100% Testing performed by process operators “in-process” in a as-little-time-consuming-fashion as possible is well acceptable and encouraged. Also the LEAN (Lean Thinking and Lean manufacturing) disciplines are well in favour of such an approach. If tests and inspections are to be done, then Inspection Department IS the Production Department (which eliminates the need for double-checks and double-inspections or external inspections). The ideal situation is when a 100% Testing program targeting at revealing defectiveness is associated with a program targeting at eliminating the causes of defectiveness!

6 SIGMA METHODOLOGY
This is one of the two main topics of this e-course.
The 6 Sigma approach targets at eliminating all causes of defectiveness so that the **0 Defects** target is met.

POKA-YOKE TECHNIQUES
This is the other main topics of this e-course.
Poka-Yoke techniques have exactly the same targets as 6 Sigma: **0 Defects**.

Now we can go deep into them.

THE SIX SIGMA METHODOLOGY

Six Sigma (also called Six-Sigma, 6 Sigma, 6S, etc.) is a methodology that provides the tools to improve the **capability** of business processes, increasing their **performance** and decreasing their **variability**.

This leads to defect reduction and improvement in profits, employee morale and quality of product.

> From the definition, immediately we can focus on 2 core keywords: **business** and **processes**.
> Contrary to what one may imagine, the methodology can be deployed in any type of business process, not only in the manufacturing, operational/production process.
> The fact that 6 Sigma focuses on processes of any nature – and not on “activities” – is also of paramount importance. What comes under scrutiny is an entire process, or a sub-process, or part of it – as such, more than a single activity.

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- **Mean**: a measure of the location of a Distribution. The so-called "*Centroid*". For a number N of variables xi the Mean is

$$\text{Mean} = \bar{X} = (x_1 + x_2 + \ldots + x_n)/N$$

Example:
The "mean" Customer Waiting Time at SuperBank Ltd. on that Day, at that Time, and for that Sample of Customers was

(1,00+1,25+1,45+1,75+2,00+2,00+2,00+2,15+2,15+2,15+2,15+2,15+
2,15+2,45+2,45+2,75+2,75+2,90+3,00+3,35) / 20 = 2,20 minutes

- **Mode**: the most frequent Value of a variable in a Distribution

Example:
Customer Waiting Time in minutes at SuperBank Ltd.

Distribution:

1,00	1,25	1,45	1,75	2,00	2,00	2,00	2,15	2,15	2,15
2,15	2,15	2,15	2,45	2,45	2,75	2,75	2,90	3,00	3,35

Mode = 2,15 minutes (6 times)

- **Range**: is a measure of "dispersion" which is the difference between the largest observed value and the smallest observed value in a given Sample.

Example:
Customer Waiting Time in minutes at SuperBank Ltd.

Distribution:

1,00	1,25	1,45	1,75	2,00	2,00	2,00	2,15	2,15	2,15
2,15	2,15	2,15	2,45	2,45	2,75	2,75	2,90	3,00	3,35

Range = xmax – xmin = 3,35 – 1,00 = 2,25 minutes

An important remark:
To understand process' variation, **mean** and **mode** are often meaningless, and the **range** may be misleading. We need other tools.

- **Standard Deviation σ**: a significant measure of variability. The standard deviation **s** of a set of N sample's values is a measure of variation of values about the **mean**, and is defined by the following formula:

$$\sigma = \sqrt{\frac{\sum (x - \bar{x})^2}{N}}$$

Example:
Customer Waiting Time in minutes at SuperBank Ltd.
Standard Deviation from the **mean** = 0,57 minutes

Example of practical use of Standard Deviation.
SuperBank want to compare their Teller Process Performance with that of their competitor, BankExtra Ltd.
An observer records ("incognito") the following values of Customer Waiting Time in the same Day as from the same Time (9:30 am):

1,85	1,85	1,95	1,95	2,00	2,05	2,10	2,15	2,15	2,15
2,15	2,20	2,25	2,30	2,35	2,40	2,45	2,55	2,55	2,60

The mean is the same: 2,2 minutes
The mode is the same: 2,15 minutes (4 times)
The range is lower: 0,75 minutes (compared to 2,25 minutes of S.Bank)
The Standard Deviation is lower: 0,22 minutes (or 40% of that of Superbank)

If the exercise would be extended to consider:
- Different Days of the week
- Different Times of the Day
- A wider Sample of Customers' Waiting Time

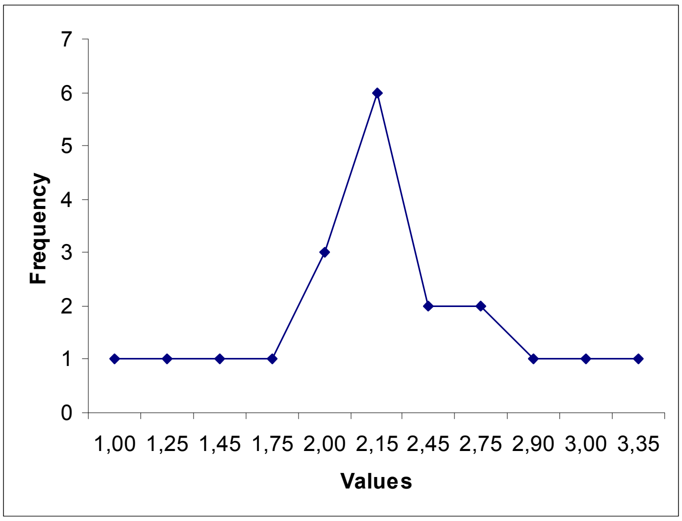
and the results of the exercise would be the same as in the example, the net conclusion is that **ExtraBank Customers stand a high chance (more than double) to wait less for a Teller transaction than SuperBank Customers - in spite of the "average" Waiting Time being the same in the 2 cases** (the 2 Banks have the same measures of central tendency).

This means that the "Carrying-out-a-Teller-transaction" process at BankExtra is more "**stable**" than at SuperBank (for a number of contributing factors). Which Bank would you choose?

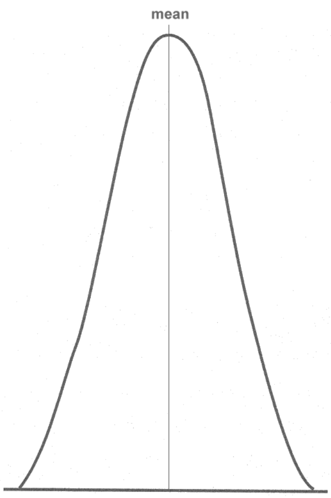
Graphic representation of a Distribution
A Distribution is conveniently represented graphically.

Example:
Customer Waiting Time in minutes at Teller queue
(SuperBank Ltd. - Day: dd/mm/yyyy – 9:30am - Sample: 20 customers)

1,00	1,25	1,45	1,75	2,00	2,00	2,00	2,15	2,15	2,15
2,15	2,15	2,15	2,45	2,45	2,75	2,75	2,90	3,00	3,35



- **Normal Distribution (Gaussian Distribution)**: this is the most common continuous Distribution encountered in Six Sigma projects.
  When the **probability density** function (**frequency**) of the Distribution **data** (**values**) is plotted, the graphical result is the well-known "**bell curve**" (normal/Gaussian curve):



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CTQs represent the product or service characteristics that are defined or expected by the customer (internal or external). They may include the **Upper and Lower Specification Limits** or any other factors related to the product or service.

A **CTQ** usually must be translated from a qualitative customer statement or verbatim into an actionable, quantitative business Specification (typical QFD approach).

In a nutshell, **CTQs** are what the customer expects of a product or a service... the spoken or unspoken needs/expectations of the customer.

All the above definitions require an example to be well understood.

Example:
SuperBank Ltd. Customer Waiting Time at Tellers

CTQ Specification: Waiting Time not to exceed 1,75 minutes
Defect: Any Waiting Time longer than 1,75 minutes
Unit: Time (waiting, in the cue)
Opportunity: Any Customer of the Bank cueing at Tellers (all Bank Customers)

1,00	1,25	1,45	1,75	***2,00***	***2,00***	***2,00***	***2,15***	***2,15***	***2,15***
2,15	***2,15***	***2,15***	***2,45***	***2,45***	***2,75***	***2,75***	***2,90***	***3,00***	***3,35***

Defects are in *italic*

Other example:
Business: Book Publisher
Customer Verbatim: 'I don't tolerate typos in books I purchase.'
CTQ Name: Typographic Quality
CTQ Measure: Number of typographical mistakes
CTQ Specification: Zero typographical mistakes
Defect: Any typographical mistakes
Unit: A word
Opportunity: Words per book (all words in a book)

Other example:
Business: Printed Circuit Board Manufacturing
Customer Verbatim: 'PC Boards must work when I plug them in.'
CTQ Name: Board Functionality
CTQ Measure: Non-functioning or improperly functioning boards
CTQ Specification: All boards function properly (a board will not function properly if any individual component or any soldering point is bad)
Defect: Any non-functioning or improperly functioning board
Unit: A board
Opportunity: Total number of parts plus solder points

- **Process Yield**: is calculated by subtracting the total number of **Defects** from the total number of **Opportunities**, dividing by the total number of **Opportunities**, and finally multiplying the result by 100.

Example:
SuperBank Ltd. Customer Waiting Time at Tellers

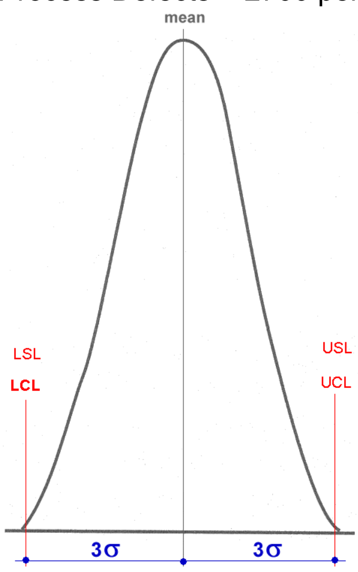
1,00	1,25	1,45	1,75	**2,00**	**2,00**	**2,00**	**2,15**	**2,15**	**2,15**
2,15	**2,15**	**2,15**	**2,45**	**2,45**	**2,75**	**2,75**	**2,90**	**3,00**	**3,35**

Defects: 16
Opportunities: 20
Process Yield = 100 * (20 – 16)/20 = 20%
(only 20% Customers' Waiting Times falling within Specifications)

the six sigma vs. traditional methodology

Under the traditional Quality methodology, a process is defined as "**capable**" (performing) and "**normal**" if a process parameter's natural "**spread**" (plus and minus ***three sigma*** from the **Mean**) is less than the engineering admitted **tolerance**.

This is like to say that the **Lower** and **Upper Specification Limits** are coincident with the "natural" **Control Limits** of the process' parameter expected variation.
Under this traditional assumption of "normality", this *three sigma Quality Level* corresponds to a **Process Yield** of 99,73%. Hence: Process Defects = 2700 per Million



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Simply put, the 6 Sigma Methodology:

> Quantifies the *Process Performance* (**Short Term** and **Long Term Capability**) and, based on the *true Process Entitlement* and **Process Shift**, sets the right strategy to reach the established performance objective.

As the Process Sigma value increases from zero to six, the **variation** of the process around the mean value decreases.

With a high enough value of Process Sigma, the process approaches zero variation – this is the target: practically '**zero defects**'

How to calculate a Process Sigma Level
Yield to Sigma Conversion Table (Zshift = 1,5)

Here is a very handy tool for your calculations:

Process Yield %	Sigma Level	Defects Per Million Opportunities	Process Yield %	Sigma Level	Defects Per Million Opportunities	Process Yield %	Sigma Level	Defects Per Million Opportunities
99,9997	6,00	3,4	99,3790	4,00	6210	69,2000	2,00	308000
99,9995	5,92	5	99,1810	3,90	8190	65,6000	1,90	344000
99,9992	5,81	8	98,9300	3,80	10700	61,8000	1,80	382000
99,9990	5,76	10	98,6100	3,70	13900	58,0000	1,70	420000
99,9980	5,61	20	98,2200	3,60	17800	54,0000	1,60	460000
99,9970	5,51	30	97,7300	3,50	22700	50,0000	1,50	500000
99,9960	5,44	40	97,1300	3,40	28700	46,0000	1,40	540000
99,9930	5,31	70	96,4100	3,30	35900	43,0000	1,32	570000
99,9900	5,22	100	95,5400	3,20	44600	39,0000	1,22	610000
99,9850	5,12	150	94,5200	3,10	54800	35,0000	1,11	650000
99,9770	5,00	230	93,3200	3,00	66800	31,0000	1,00	690000
99,9670	4,91	330	91,9200	2,90	80800	28,0000	0,92	720000
99,9520	4,80	480	90,3200	2,80	96800	25,0000	0,83	750000
99,9320	4,70	680	88,5000	2,70	115000	22,0000	0,73	780000
99,9040	4,60	960	86,5000	2,60	135000	19,0000	0,62	810000
99,8650	4,50	1350	84,2000	2,50	158000	16,0000	0,51	840000
99,8140	4,40	1860	81,6000	2,40	184000	14,0000	0,42	860000
99,7450	4,30	2550	78,8000	2,30	212000	12,0000	0,33	880000
99,6540	4,20	3460	75,8000	2,20	242000	10,0000	0,22	900000
99,5340	4,10	4660	72,6000	2,10	274000	8,0000	0,09	920000

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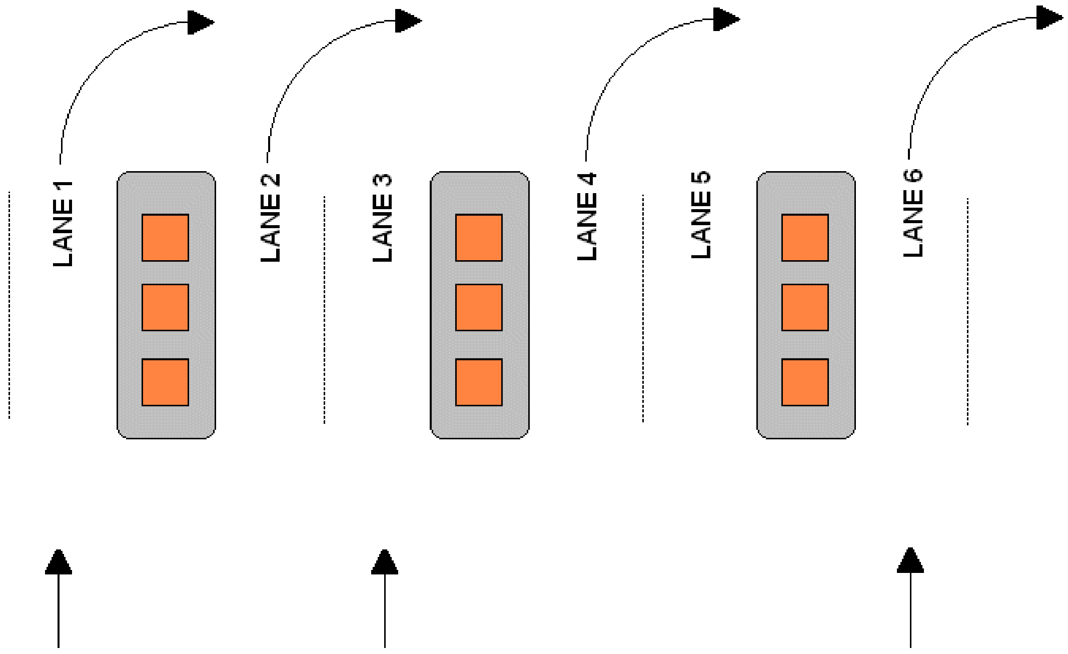
- So, when should this methodology be adopted? When appropriate, pertinent or necessary. In certain very sophisticated and complex processes 6 Sigma is definitely the only way out.
- Generally, however, it is possible to do without this kind of approach. At least in its integrity. It is always extremely beneficial to go through the various DMAIC phases in a simplified mode, especially through the first phase, the Definition phase: it assists considerably in identifying and defining the issue under scrutiny.
- For not-so-complex processes, it might be too wasteful and time consuming going through the entire DMAIC approach, especially the mathematical/statistical part of it (which demands skills and expertise).
- One may easily realise that the 4th step of the DMAIC process (Improve) utilises tools that could be deployed without going through the aggravation of a 6 Sigma comprehensive exercise (for instance: a Poka-Yoke solution). We shall see below how **Poka-Yoke** tools can overcome in a Ziff the complexity of deploying 6 Sigma.
- Also basic principles of **Lean Thinking** can assist considerably. An example follows.

Lean Thinking vs. 6 Sigma

Consider a Petrol Station, an ordinary Petrol Station with 6 main refill/service lanes, as in example:

This is the plan view:



Motorists go to a petrol station for:

- Refuelling only – and/or
- Check levels (oil, water, windscreen washing liquid…..) – refill as required
- Check tyre pressure – reset as required
- Windscreen wash
- Other

Depending on (primary causes of variability):

- Day of the week
- Time of the day
- Special circumstances (like before holiday season or just before a fuel price increase)
- Pure case

there may be a queue in order to get service: a short queue, a long queue, or no queue at all.

The petrol station is always the same, with the same number of "attendants" (pump attendants, service attendants), irrespective of the above 4 reasons that may cause "variability".
The variability, in this case, impacts the motorists' waiting time.

The process is: "*get service*".
The target (the motorist's target) is: "*in the minimum possible time*" (have you ever heard of a motorist who likes to spend a quarter of an hour or more to refill his tank?).

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We have a “variability” problem in a process and we jump onto a 6 Sigma project. We solve the problem (efforts, time). And that’s it.

NOT ENOUGH!

> Every problem is a signal, the signal of an opportunity behind it!
> If, instead of using blindly problem-solving tools and techniques, we **think** (lean) to go around and beyond and behind the problem, guided by the “*maximum value to the customer*” rule, we can get much, much farther!

Let’s go back to the main topic of our course.

TQM target = zero defects

Six Sigma is an excellent tool for the purpose: when justified, when adequate, when pertinent.

What other tools are there?
Not many, as we said earlier on.

But there is Poka-Yoke.

The Poka-Yoke discipline

Poka-Yoke is a term invented in the Japanese industry long time ago, in the era of Just-in-Time.

Poka-Yoke means ***mistake-proofing***, ***error-proofing***.

The Poka-Yoke approach was developed to prevent quality problems, both sporadic and recurring, from happening - by finding creative ways to eliminate the cause/s of the problems.
The target was to invent a “*something*” that would make practically impossible for a mistake or an error to be made, or a defect to appear.
The famous Japanese Quality Circles were often devoting their time to find Poka-Yoke ways to eliminate the quality defects encountered during the day or the shift.

Gradually, the Poke-Yoke approach became more and more popular, and evolved from a simple tool or technique to the status of a “discipline”, a **lean discipline** - as it is rightly considered today.

Today’s Poka-Yoke has two main meanings (complementary to each other):

- Approaches to eliminate causes and root causes of defectiveness (and errors, mistakes…..)
- Methodology for mistake-proofing, in order to **make things right the first time** – to begin with, and once and forever

That’s the concept:

William Tell cannot afford to make a mistake: he must hit the apple at first strike, or he may kill his son!

Likewise, in industry we cannot afford to make mistakes, or produce defects: simply, there is no more space for it.
We have to find ways to aim at zero defects: that’s where Poka-Yoke comes to the rescue.

Techniques for mistake-proofing are well utilised in industry, most definitely in product design/product development. Product designers go for mistake-proofing rather regularly, but often in a spontaneous, naïf way: not at all systematic nor scientific.

Actually, it’s horrifying to see how many bad product design examples we still see nowadays.

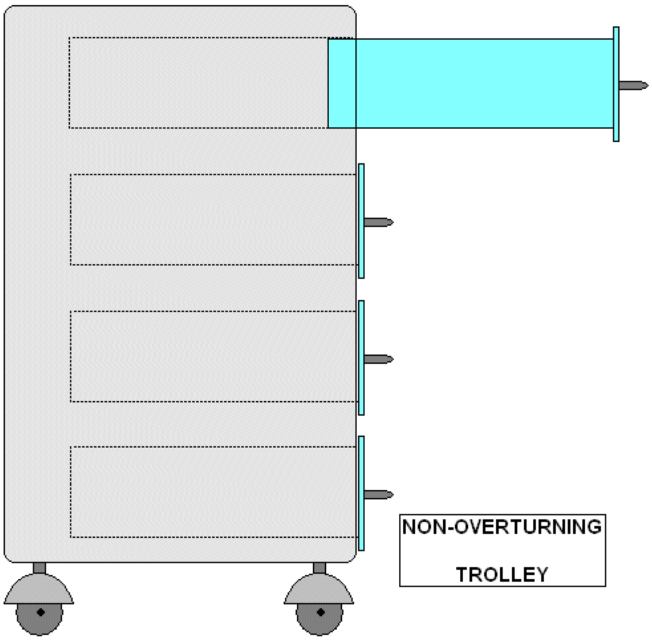
Last year I was in Italy, for a mission. I landed at Rome Fiumicino airport, then go straight away to grab my hired car. This time they give me a Fiat Gran Punto.

So, load all my goodies, adjust mirrors, check indicator lights, buckle-up safety belt, start and

SBLONGGGGGGGG!!!

What the heck is this?? I say….

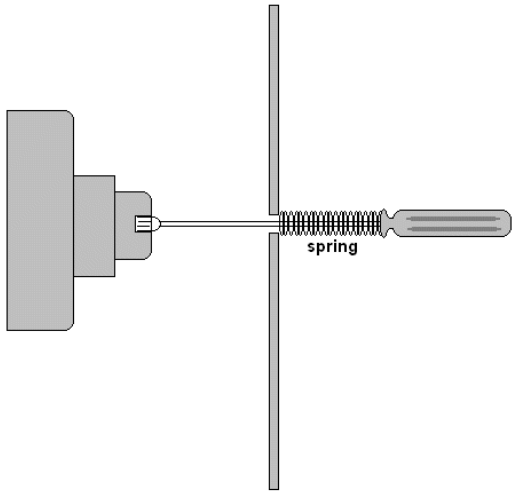
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX **Omissis**



Filing Cabinets, Tool Cabinets and the like could overturn if all drawers are open at once. But if only one drawer at a time can be open, the possibility of overturning is eliminated.

The two machine components above can only be assembled in one way, the correct way: the poka-yoke design eliminates the possibility of assembly mistakes.

Products can be "poka-yoked".
Methods can be "poka-yoked".



In the example, a machine needed to be set-up rather often: to the purpose, a technician would use a socket screwdriver, inserted through a transparent cover.
Since the operation had to be done very frequently, the bad habit of leaving the tool hanging in the transparent cover developed.

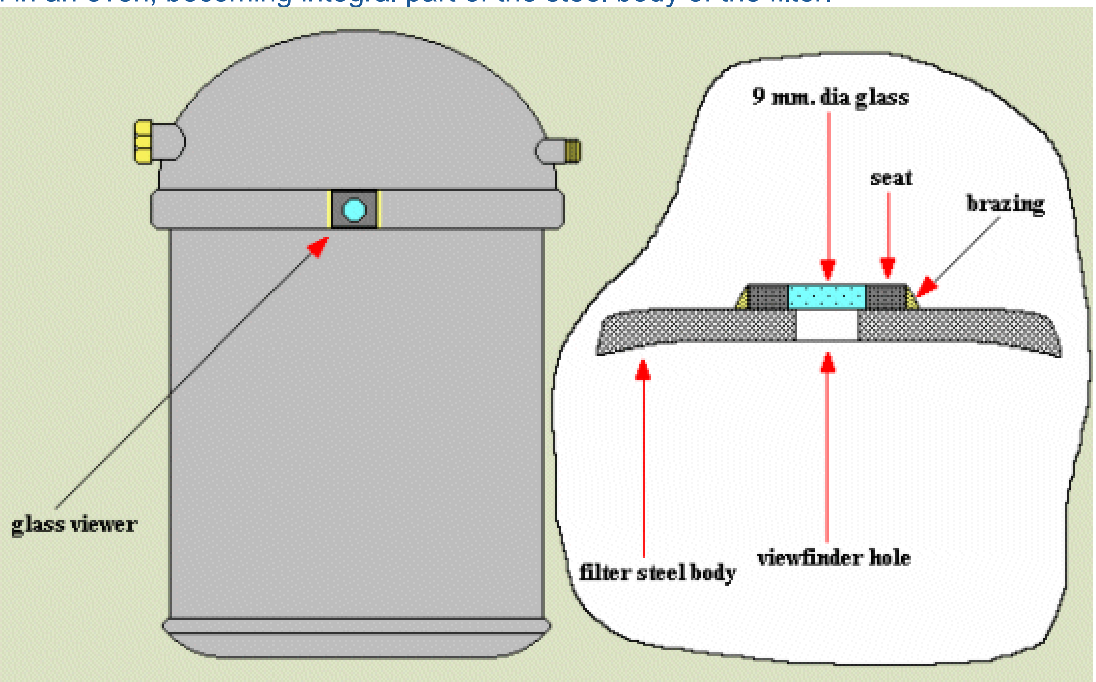
To eliminate the bad habit, it was sufficient to fit the tool with a spring, thus preventing lazy technician from removing it altogether.

The working method was "poka-yoked".

Processes can be "poka-yoked".
I think it's time I give you a good exercise on how to "poka-yoke" a process.

INDIVIDUAL EXERCISE: POKA-YOKE PROCESS IMPROVEMENT
AUTOMOTIVE AIR CONDITIONING FILTERS
REMOVAL OF EPOXY PAINT FROM GLASS INSPECTION VIEWER

The Case:
A Manufacturer of Automotive Air Conditioning Filters, operating under a strict Quality Assurance system, has a recurring quality problem with one of the products. The particular model has a glass viewer to allow inspection of filter conditions. A circular glass, dia. 9 mm. is melted into position in an oven, becoming integral part of the steel body of the filter.



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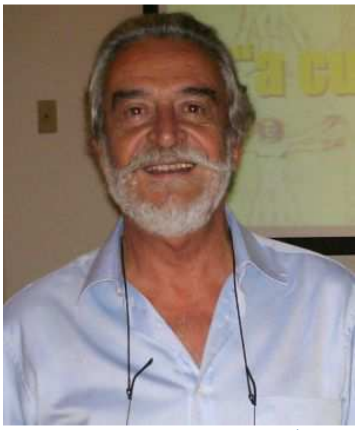

Carlo Scodanibbio, born in Macerata (Italy) in 1944, holds an Italian doctor degree in Electrical Engineering (Politecnico di Milano - 1970).
He has over 49 years of experience in Plant Engineering, Project Engineering and Project Management, as well as Industrial Engineering and Operations Management.
Free-lance Consultant since 1979, he has worked in a wide spectrum of companies and industries in many countries (Southern Africa - Italy - Cape Verde - Romania - Malta - Cyprus - Lebanon - Mauritius - Malaysia - Nigeria - Kenya - India - Saudi Arabia - Seychelles), and operates as an Independent Professional Consultant and Human Resources Trainer to industry. His area of intervention is: World Class Performance for Small and Medium Enterprises in the Project, Manufacturing, and Service sectors.
His favourite area of action is: the "lean" area.
He has co-operated, inter-alia, with the Cyprus Chamber of Commerce, the Cyprus Productivity Centre, the Malta Federation of Industry, the Mauritius Employers' Federation, the Romanian Paper Industry Association, the United Nations Industrial Development Organisation and the University of Cape Town.
His courses and seminars, conducted in English, Italian and French, have been attended by well over 20.000 Entrepreneurs, Managers, Supervisors and Workers. They feature a very high level of interaction, and are rich in simulations, exercising and real case studies. The approach is invariably "hands-on" and addressed to immediate, practical application.