

# College of Science, Engineering & Technology

## Vision

The College of Science, Engineering and Technology is the responsive, enabling and accessible provider of high quality, relevant, innovative Open Distance Learning Science, Engineering and Technology programmes, research and community engagement in Africa.





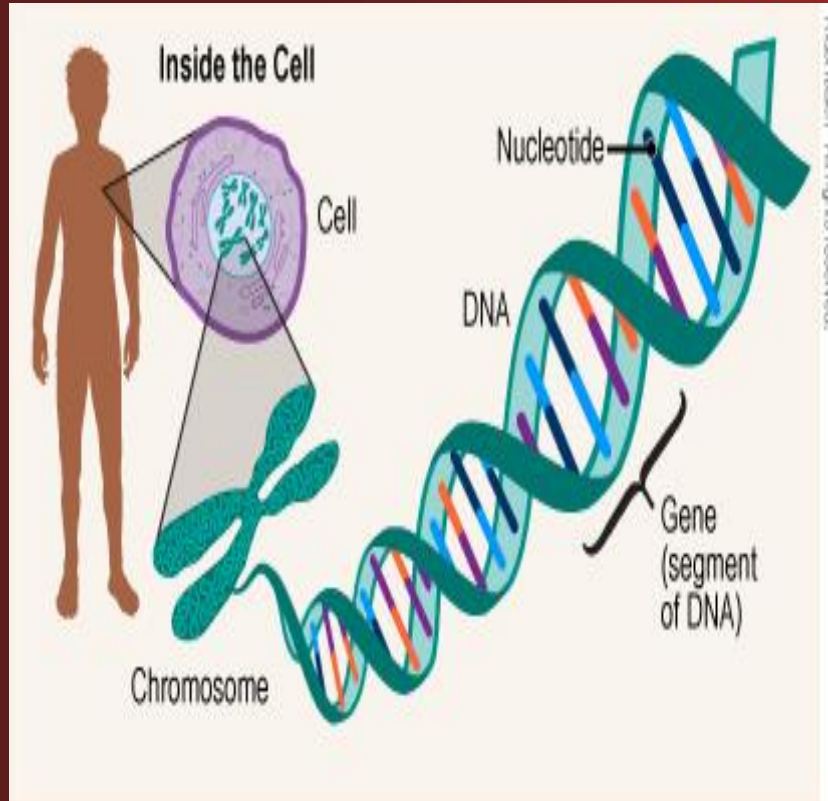
# Inaugural Lecture KR Ramdass



## **Title: Decoding quality from a single cell to organisational optimisation**

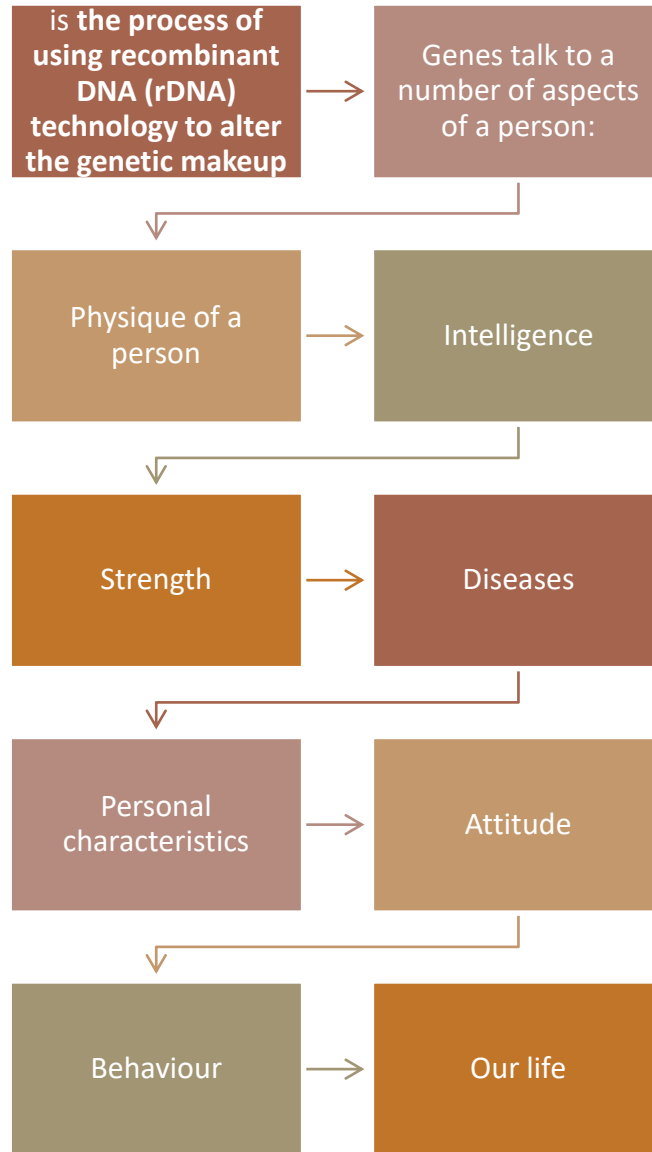
In biology, evolution is the change in heritable characteristics of biological populations over successive generations. These characteristics are the expressions of genes, which are passed on from parent to offspring during reproduction.

# Genetic engineering

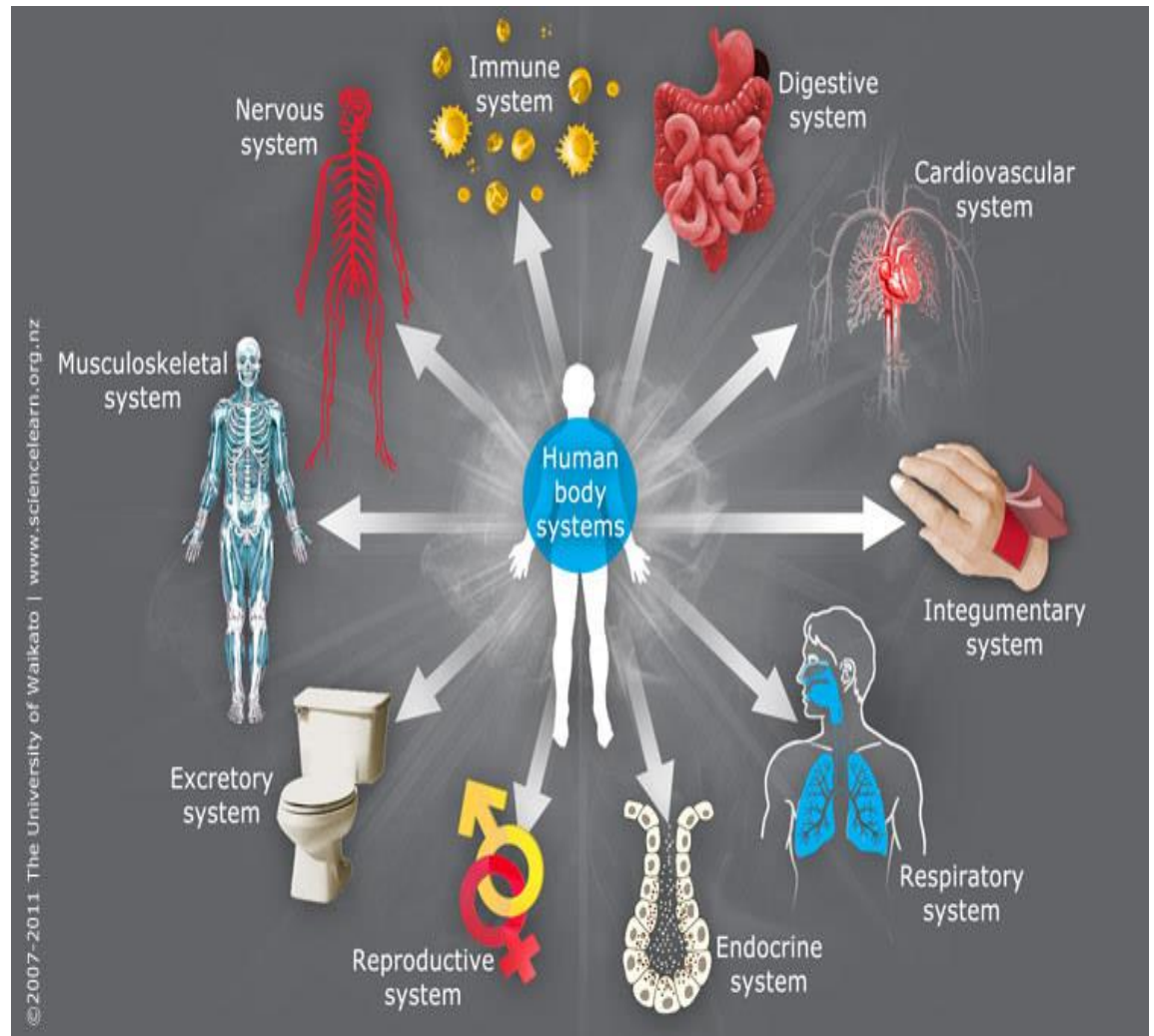


The genetic algorithm is a **method for solving both constrained and unconstrained optimization problems** that is based on **natural selection, the process that drives biological evolution**. The genetic algorithm repeatedly modifies a population of individual solutions.

# Genetic engineering



# Functioning of the systems



# Unrighteous

## WORDS RELATED TO UNRIGHTEOUS

corrupt, deplorable, illegal,  
illegitimate, illicit, immoral,  
scandalous, senseless, unlawful,  
vicious, indecent, unethical, unjust,  
unseemly, untoward, wrong,  
wrongful, disgraceful,  
reprehensible, shameful

# Life's journey

- Development of a person in a number of aspects
- Path of righteousness
- The definition of righteous is someone or something that is in accordance with high moral standards. **When you follow all the rules and do good with your life**, this is an example of behavior that would be described as righteous.
- Righteousness is the **quality or state of being morally correct and justifiable**.





# Quality starts with you

The quality of your genetic makeup determines the type of person you are.

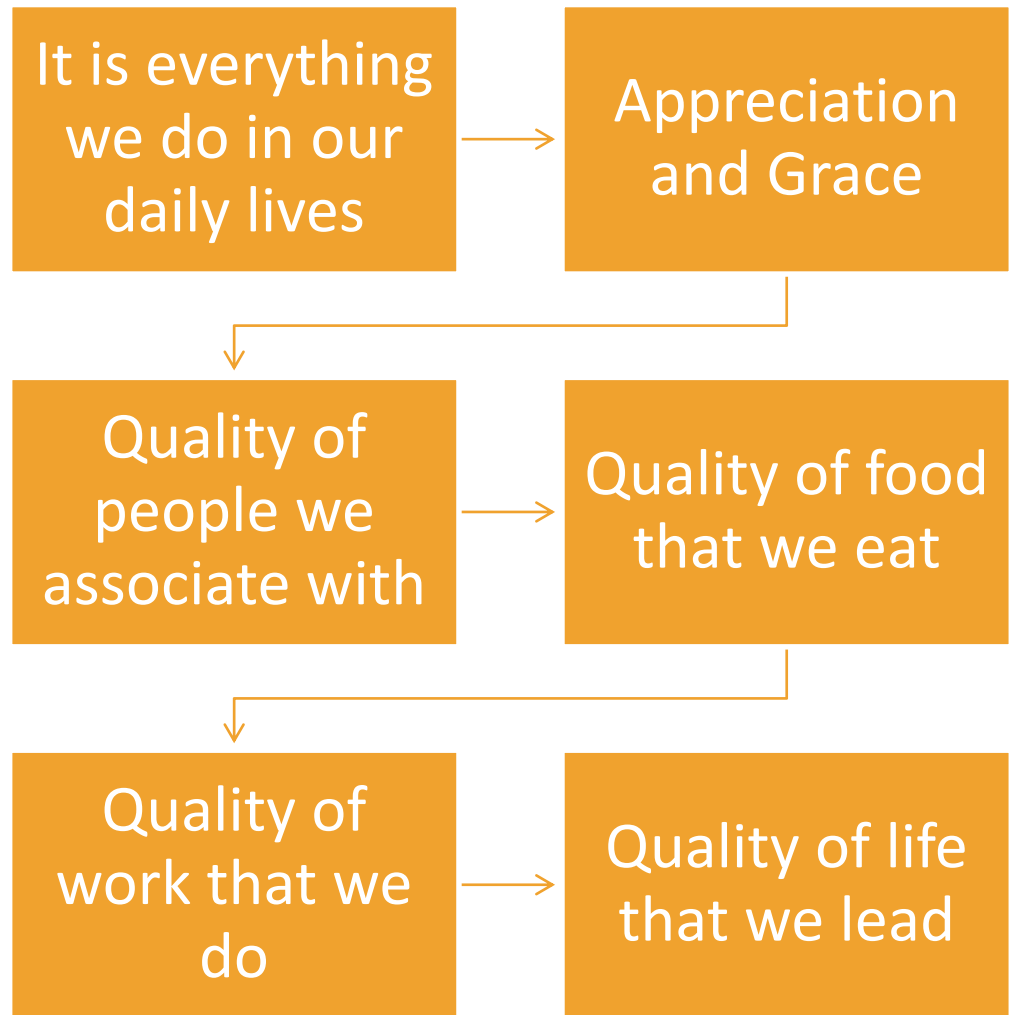
It can be manipulated through education and training, peers, siblings, society, basically everyone we associate with in life.



# Infused with Industrial Engineering and 4IR



# What is quality?



# What is Industrial Engineering

- Industrial engineering is concerned with the design, improvement and installation of integrated systems of people, materials, information, equipment and energy. It draws upon specialized knowledge and skill in the mathematical, physical, and social sciences, together with the principles and methods of engineering analysis and design, to specify, predict, and evaluate the results to be obtained from such systems

# Occupations

- Industrial engineers (IEs) are responsible for the optimal design, implementation, integration, operation, improvement, and management of high-level systems in disciplines of chemical, electrical, electronic, mechanical, or civil components. IE's optimize systems to improve quality and productivity and to reduce costs. Human and physical resources are thus combined and integrated to achieve specific objectives in these organisations.

# Industrial Engineering future

- Analysed research findings show that the future of industrial engineering research would be focused on subjects such as information technology, intelligent systems, optimisation, quality, and supply chain management.

# History of Industrial Engineers

- **Eli Whitney (1765-1825)**. Whitney invented the cotton gin, considered one of the most important contributions to the Industrial Revolution. In addition, the engineer was a proponent of interchangeable parts for machinery
- **FW Taylor – Scientific management – (1856 –1915)**. Principles of Scientific Management. In this, he proposed that by optimizing and simplifying jobs, productivity would increase.)
- **Henry Ford (1863-1947)**, founder of the automotive company bearing his name, is possibly the most famous industrial engineer of all time. Ford exemplifies the definition of an industrial engineer – time to manufacture a car from 12 hours to 2 hours.
- **Lillian Gilbreth (1878-1972)** is considered the "mother of modern management." She pioneered industrial management techniques still used today. Working with her husband, Frank, who focused on the technical aspects of worker efficiency, Lillian aimed to discern the human aspects of time management. As a result of the couple's work, job standardization, incentive wage plans, and job simplification became familiar within the workplace
- **Alphonse Chapanis (1917-2002)** was a pioneer in the field of ergonomics. He authored the first ergonomics textbook, *Applied Experimental Psychology: Human Factors in Engineering Design*. In addition, he created and implemented safety improvements in aircraft cockpits, which are still used today. His research also contributed to the design of the standard telephone touchtone keypad.

# What is Quality - Business?



**Quality as the conformance to standards**

Quality as fitness for purpose

Quality as effectiveness in achieving institutional goals

Quality as meeting customers' needs

The traditional concept of quality, i.e. excellence



**“quality assurance and quality enhancement are seen as a continuum, where quality assurance is mostly retrospective, what has been done, and quality enhancement is mostly forward looking, what can be done – continuous improvement.**



# The century for quality

It is most important that top management be quality-minded. In the absence of sincere manifestation of interest at the top, little will happen below.



*Joseph Juran*



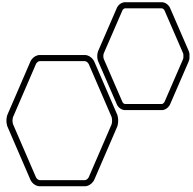
QualityGurus.com

UNISA

college of  
science, engineering  
and technology



**Why Quality is still important?**



# Why Quality is still important

- Customers are becoming more demanding
- Customers are becoming more well informed
- Modern life driven by technology
- World is global village  
...Quality is also Global





# Quality Definition

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- Academic quality is a **way of describing how well the learning opportunities available to students help them to achieve their award**. It is about making sure that appropriate and effective teaching, support, assessment and learning opportunities are provided for them.

# HE Quality

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# QUALITY GURUS

## Quality gurus

### LEADING CONTRIBUTORS TO THEORY



# Contributions

- The field of quality management has evolved significantly over the past several decades, thanks to the contributions of many quality gurus who have shaped and influenced the field. These individuals have developed and introduced new ideas, theories, and methods that have helped organizations improve their performance and achieve their goals. In this blog post, we will highlight nine of the most important quality gurus and their contributions to the field of quality management.

# Contributions

**W. Edwards Deming:** One of the pioneers of quality management, Deming is known for his work in Japan after World War II, where he helped Japanese companies improve their quality and productivity. He is best known for his "14 Points for Management," which outline the key principles of quality management, and his emphasis on the importance of statistical process control and continuous improvement.

**Joseph M. Juran:** He is considered one of the pioneers of the modern quality management movement and is known for his development of the "Juran Trilogy," which consists of three critical components of quality management: quality planning, quality control, and quality improvement. He is also credited with introducing the Pareto principle in the quality field, which states that 80% of the effects come from 20% of the causes. Juran was also the author of several books on quality management, which continue to be used as reference works in the field, including **Juran's Quality Handbook**.

**Philip B. Crosby:** Crosby is known for emphasizing the importance of prevention over inspection in quality management. He introduced the concept of "zero defects," which aims to eliminate defects and errors in a process or product. Crosby is also known for his Four Absolutes of Quality: 1- The definition of quality is conformance to requirements. 2- The system of quality is prevention. 3- The performance standard is zero defects. 4- The measurement of quality is the price of non-conformance. Crosby also introduced the idea of "quality is free," which is the notion that the cost of preventing defects is always lower than the cost of dealing with defects after they occur.



# Contributions

**Kaoru Ishikawa**: Ishikawa is a Japanese quality management expert known for developing the cause and effect diagram, also known as the "Ishikawa diagram" or "fishbone diagram." This tool is used to identify the root causes of a problem and is a critical tool in root cause analysis. Ishikawa is also known for emphasizing the importance of involving all employees in the quality management process. Ishikawa also introduced the concept of "total quality control," involving all employees in the quality control process and using data and statistical analysis to drive continuous improvement.

**Shigeo Shingo** - Shigeo Shingo was a Japanese industrial engineer and business consultant. Shingo is known for his contributions to lean manufacturing, including developing the "Toyota Production System." He emphasized the importance of eliminating waste and increasing efficiency in the production process. Shingo is also credited with introducing the concept of "poka-yoke," which prevents defects in a product or process by designing it so that mistakes are difficult or impossible to make. He also developed the Single Minute Exchange of Die (SMED) concept.

**Armand V. Feigenbaum** - Feigenbaum is known for developing the concept of total quality control, which focuses on integrating all aspects of an organization's operations to achieve quality. He also introduced the idea of the "cost of quality" as a way to measure the impact of poor quality on an organization.

# Contributions

**Walter Shewhart** - Walter Shewhart is credited with developing the concept of "statistical process control," which involves using statistical methods to monitor and control manufacturing processes to produce goods of consistent quality. Shewhart also introduced the idea of "control charts," which are graphical tools used to monitor process performance over time and identify when a process is out of control. His ideas have been widely adopted by industries worldwide and have played a significant role in developing modern quality control techniques.

**Taiichi Ohno** - Taiichi Ohno was a Japanese industrial engineer and businessman known for contributing to the Toyota Production System (TPS) development. Ohno is considered the father of the TPS, a manufacturing methodology focusing on maximizing efficiency and minimizing waste. He is credited with developing the "just-in-time" production method, which involves producing only the amount of goods needed at a given time, and the "kanban" system. This visual signalling system helps coordinate the flow of materials within a factory. Ohno's ideas have been widely adopted by companies worldwide and have helped to transform the way goods are produced.

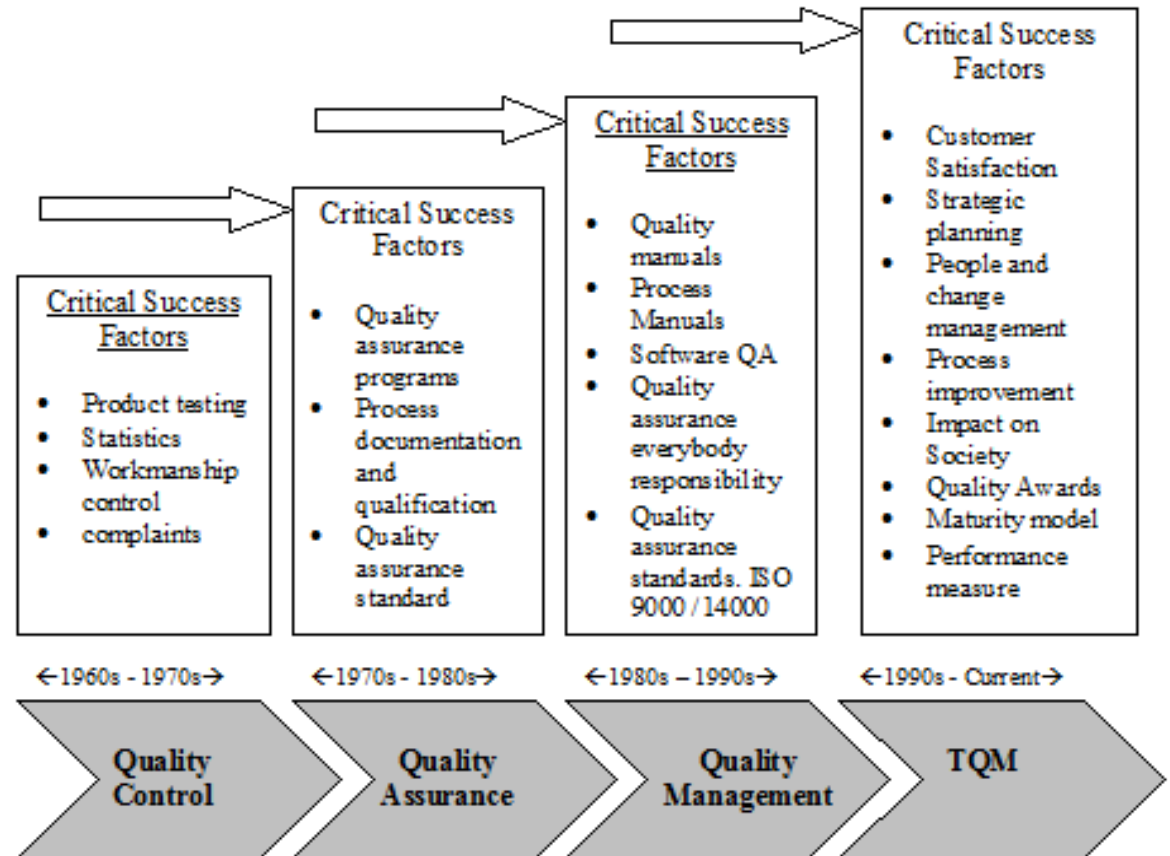
**Genichi Taguchi** - Taguchi was a Japanese engineer and quality control expert known for his contributions to the statistics and quality control field. He developed the concept of "loss function," which measures the deviation of a product from its target specification. He also introduced the idea of using "robust design" to create products insensitive to variations in manufacturing processes. Taguchi's methods are widely used worldwide to improve the quality of products and reduce manufacturing costs.

# Evolution

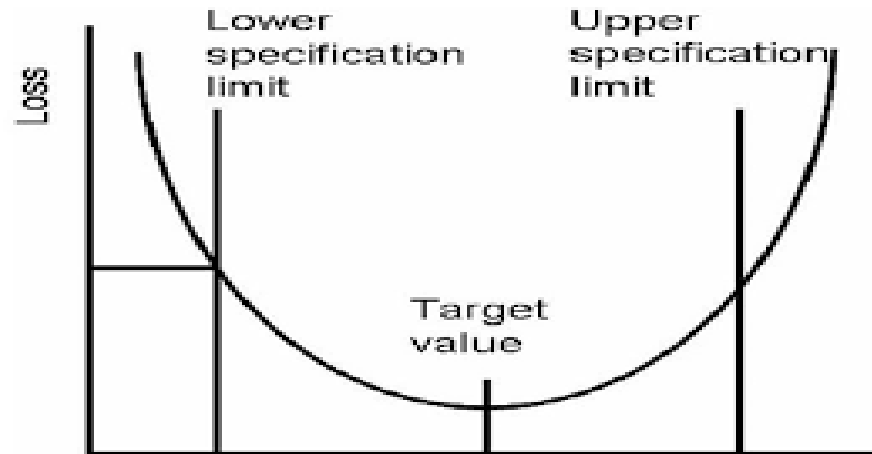


Images by: <http://www.rajeshitimane.com>

# From QC to TQM



# Loss function



The quality loss function as defined by Taguchi is **the loss imparted to the society by the product from the time the product is designed to the time it is shipped to the customer**. In fact, he defined quality as the conformity around a target value with a lower standard deviation in the outputs.

# Levels of quality

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# Different levels of Quality



**Micro-Quality: Quality Professionals** contribution to the field.



**Meso-Quality:** Implementation of Quality Improvement Programs, Standards, Excellence Models in the **Organisations**.



**Macro-Quality: Policies** defined for Quality at the global level.



University

# Adaptable to change

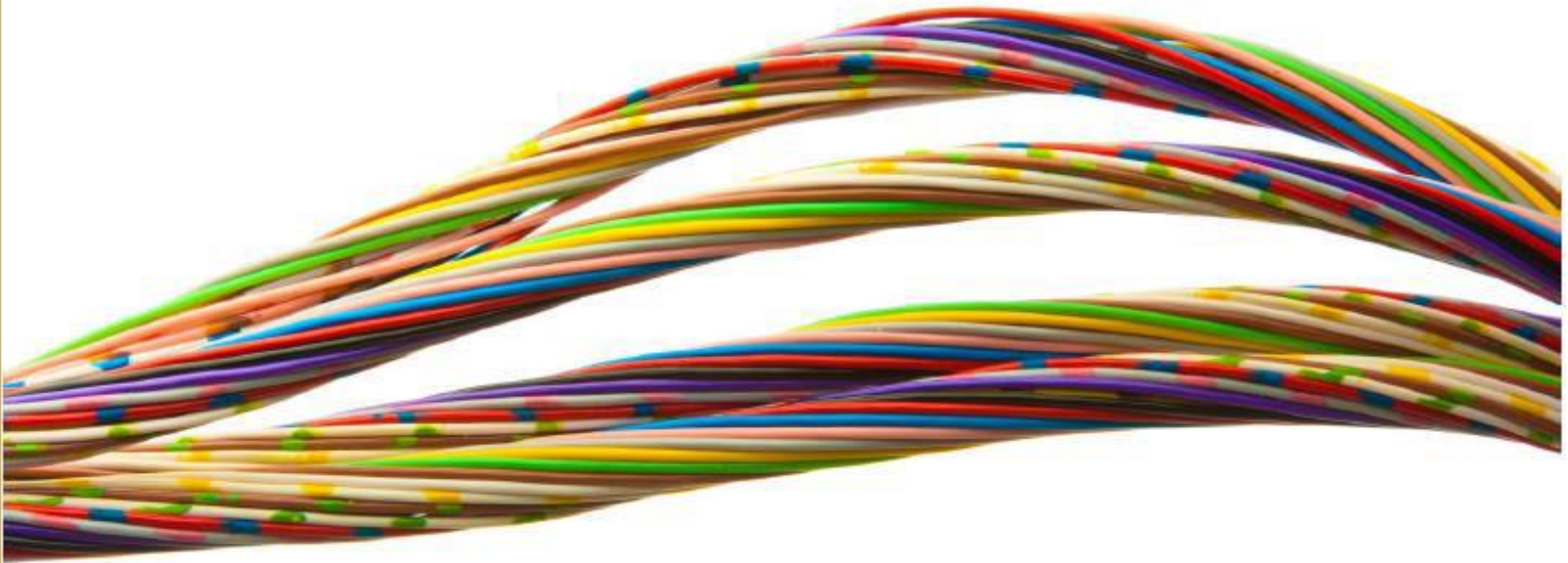
- Not the strongest nor the most intelligent.
- But the most adaptable



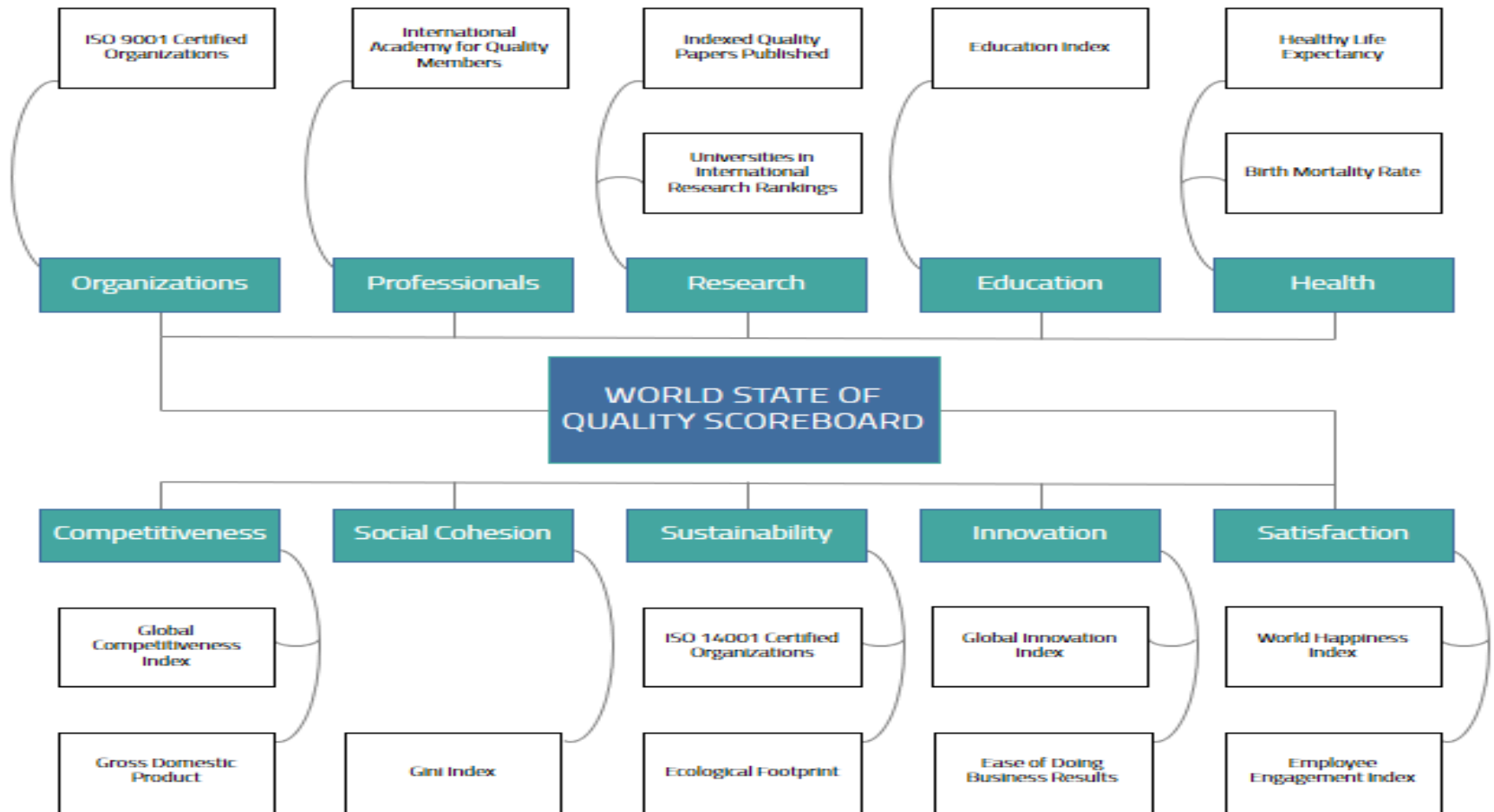


# Agile

Given the complexities of today's interconnected world, isolated efforts are no longer effective.



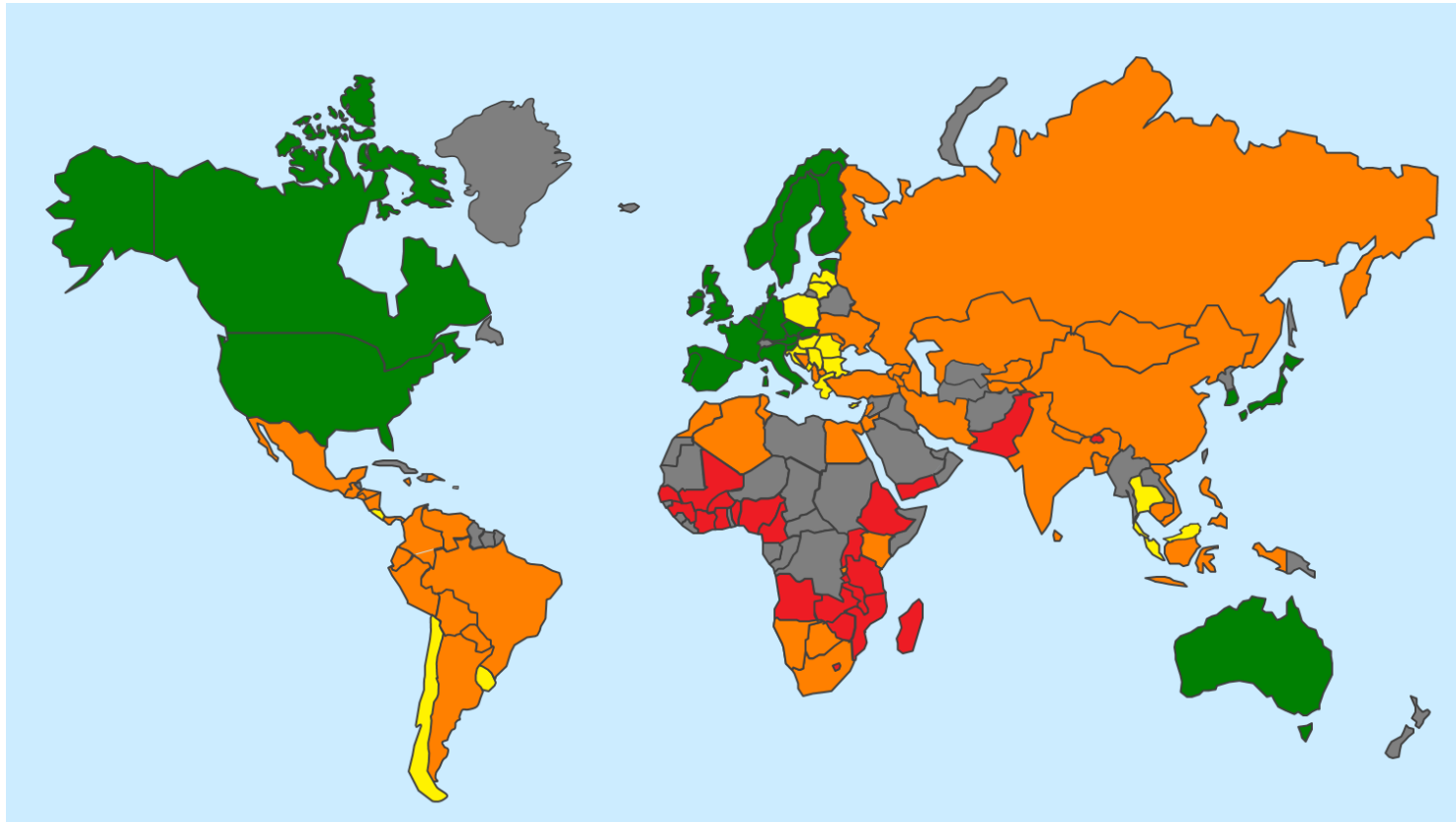
# Honorable past to impressive present



# World status of development

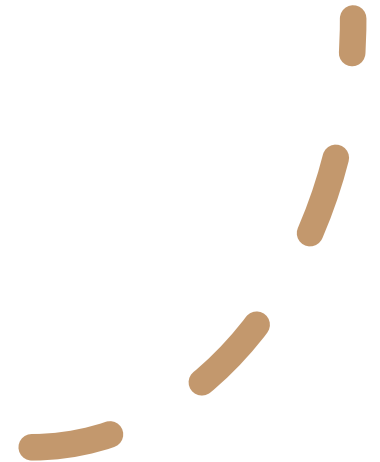


- Green – leader
- Follower – yellow
- Moderate – brown
- Red - beginner



# Best Countries for Quality of Life

- Beyond the essential ideas of broad access to food and housing, to quality education and health care, to employment that will sustain us, quality of life may also include intangibles such as job security, political stability, individual freedom and environmental quality.
- Canada
- Denmark
- Sweden
- Norway
- Switzerland
- Australia



# Quality Professionals challenge in a digital environment

The  
INTERNET  
of THINGS



# Quality beyond the 21 century

- Quality is vital to any organization's success and quality professionals carry great responsibility. Quality professionals must work with teams, management, and organizations as a whole to foster quality initiatives. Competing in market environments means organizations must evolve to keep up and even innovate in their areas. Organizations looking to implement quality initiatives must be able to find a quality professional with the right skill set for the job.



# Quality and Technology with 4IR

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- The need for a connection between technology and quality becomes clear as we recognize quality as a strong base for transformation activities.
- **Quality** marks a shift from traditional and conventional quality and is key for recognizing and solving challenges of dealing with production systems where every action is monitored, recorded and assessed in real-time (Evans et al., 2015).

# Quality 4.0



Digital transformation refers to the integration of emerging technology for connection, intelligence and automation, with or without specific quality and performance objectives as drivers.

**Quality 4.0** matches this concept by using traditional quality methods and digital tools to accomplish quality objectives and pursuit performance excellence.



**Quality 4.0** can be considered an Industry 4.0 approach that prioritizes quality and performance goals looking at how individuals, systems and emerging technologies interact to improve connectedness, intelligence and automation (Radziwill, 2020).



**Quality 4.0** is an integral part of the Industry 4.0 phenomenon, one which opens the way for quality to become a leading force in this transition



# Quality 4.0

Quality 4.0 should be considered as a large-scale transformation with implications on culture, leadership, collaboration and compliance and how it can maximize value for the organization (Jacob, 2017).

New era technologies should be used as catalysts of people, products, processes efficiency, performance and innovation. The improvement of human capabilities and the evolution of human-machine interaction open the way to an agile Quality 4.0 transition (Radziwill, 2018).

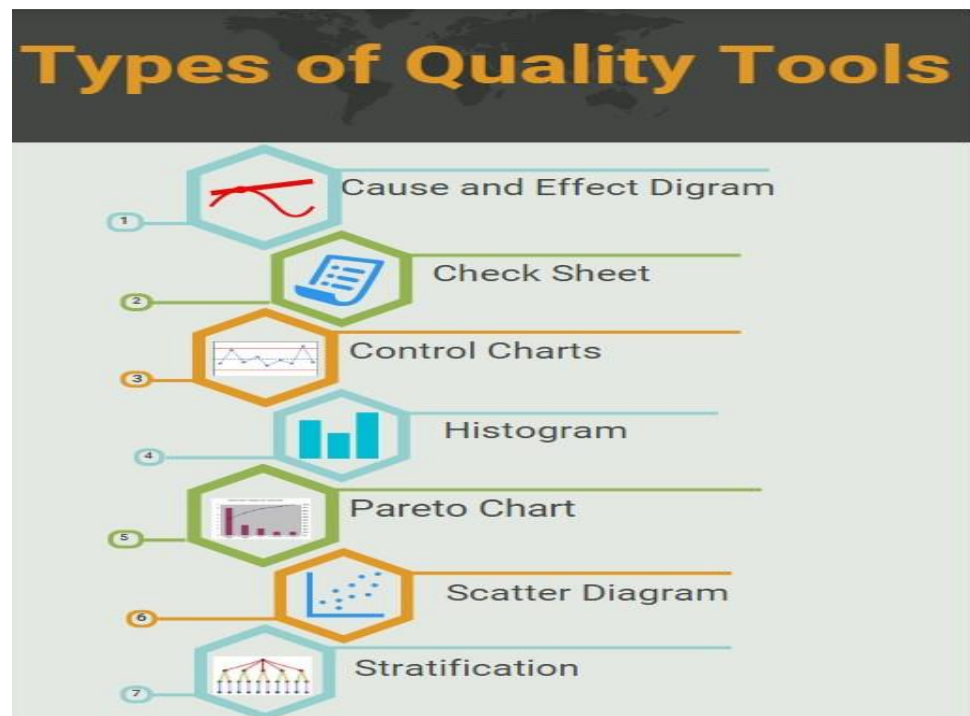
# Quality 4.0 and Technology

- The true benefit of quality lies on the ability to use information (information is based on data) in order to ensure superior performance.
- **Quality 4.0** is focused on two main issues: (1) the quality of data and the ability to extract value from it, and (2) the use of data to enhance traditional tools and methods.



# 7 Basic tools of quality

Quality tools are used to collect data, analyze data, identify root causes, and measure results in problem-solving and process improvement. The use of these tools helps people involved easily generate new ideas, solve problems, and do proper planning.





## Importance of the tools

- Utilizing the 7 QC tools in quality management process helps in taking a systematic approach to identify and understand the risk, assess the risk, control fluctuation of product quality and accordingly provide solutions to avoid future defects

# Quality 4.0 and people

- **Quality 4.0** has a social side by promoting the relation between technology and people.
- **Leadership** is critical for the success of **Quality 4.0** projects... in order to promote a **humanistic culture** for Quality 4.0.



# Quality 4.0 is.....

- Quality Tools and Systems
- User-centric (stakeholder integration)
- Automation
- Leadership (developing skills, training and education)
- Integration
- Technology
- You (customization)
- 4.0 (driven by the 4th Industrial Revolution)



# Quality 4.0

- **Quality 4.0** is the delivery of superior quality, using modern technology to augment the capabilities of both people and quality tools and methods.

# Future of quality

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Future of quality = do it well x do it better x do it differently



The core concept of Quality 4.0 is about aligning the practice of quality management with the emerging capabilities of Industry 4.0; to help drive organizations toward operational excellence.



Right people need to have a purpose, passion, discipline and resilience.

The way to success... needs a LEADER in EVERYONE of US!

## Defining & Creating a Quality Culture



# Accountability and responsibility stems from YOU – Quality starts with YOU

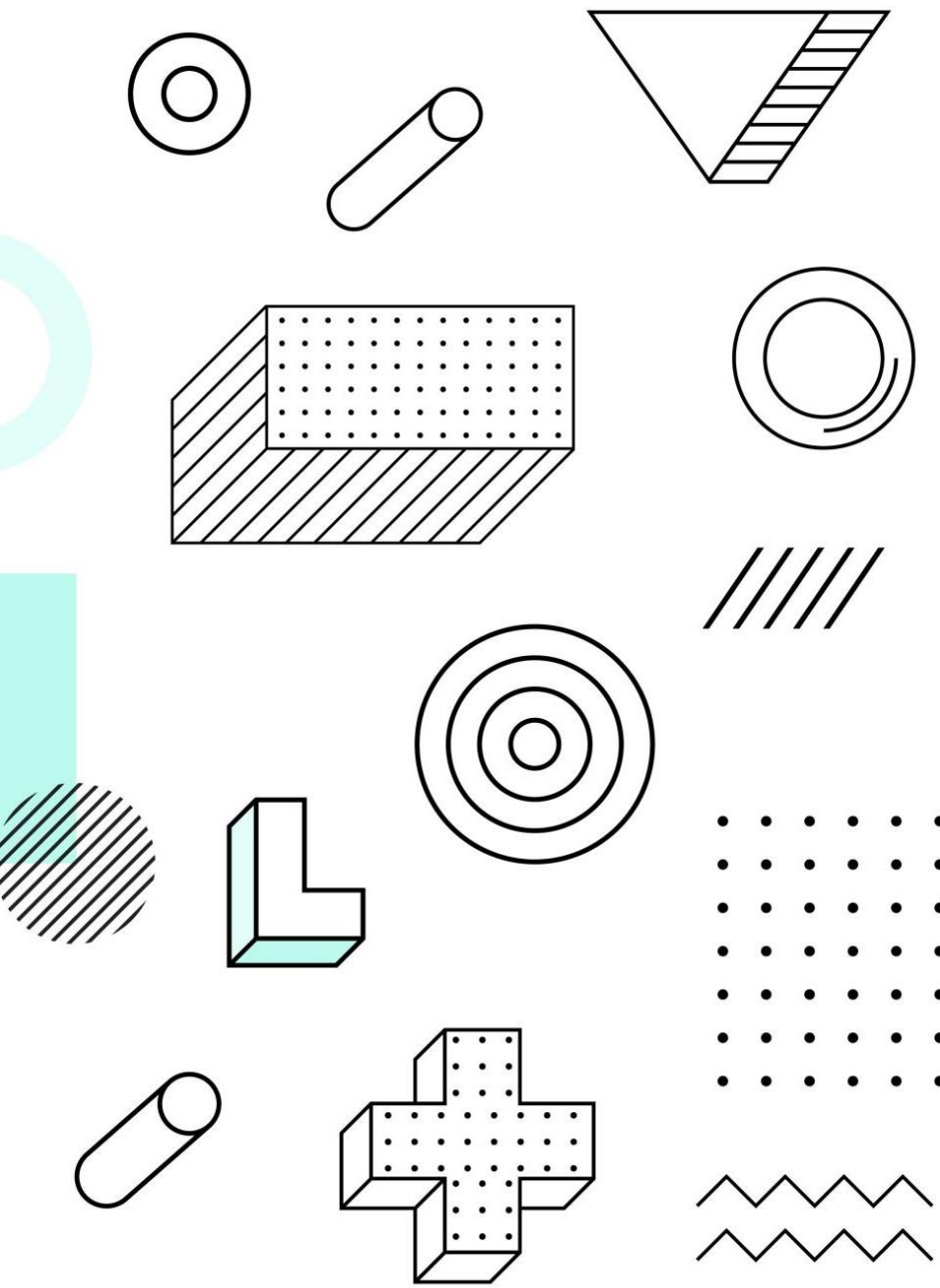


Accountability in the workplace means that **all employees are responsible for their actions, behaviors, performance and decisions.** ... When employees are held accountable, they take responsibility for results and don't assume it's someone else's job.



Responsible employees work to advance company success and strive to perform their daily duties well





# LEAN/ QUALITY/ 4IR

- Lean management can be most simply referred to as a “universal tool for delivering value and optimizing work processes.”
- The primary goal of lean management theory is to “maximize customer value while minimizing waste.”
- This is reinforced by two key pillars of thought, firstly continuous improvement or “kaizen, where processes can always be improved, becoming more efficient over time.
- The second is respect for people, consideration of human elements in all processes, and their effect on these process. Together, these concepts are designed to guide businesses to spark innovation and achieve improved process efficiency.

# 5 Principles of lean

- **Define value** - The first principle of lean management involves defining exactly what “value” means to the end “customer.”
- **Map out the process or “value stream”** - the logical next step is to figure out the specific steps that are required to deliver that value, the process or “value” stream



# LEAN/ QUALITY/ 4IR

- **Create flow with a new process**
- How can we think in a smart, streamlined way to reduce the steps needed to provide the most value to our customer?
- **Establish or respond to “pull”**
- Put simply, this concepts involves influencing demand-driven production rather than merely “pushing” value out, with a focus on what the “student” or “customer” actually wants.



# LEAN/ QUALITY/ 4IR

- “Deliver the right thing, of the right quantity and quality, at the right time, and in the right place.”
- **Seek perfection**
- In the world of lean management, there is always room for improvement! According to this principle, no matter how perfect things may seem, there is always opportunity to discover new and more efficient ways of doing things.



## Experience in HE

- Delay – it occurs when where the customer must wait for the service to occur.
- Duplication – it occurs where the same data has to be recaptured numerous times in a particular process.
- Unnecessary movement – customers must move along the process on the completion of the previous operation. The result is waiting in a queue at the next operation.
- Unclear communications – customers are baffled concerning the next step in the process.
- Incorrect inventory – the advertised service is not available at the present time.
- Opportunity lost – the organisation is unable to hold on to their current customers and conversely they are incapable to win new customers
- Errors – it occurs when mistakes are made during the provision of the service.

# Experience in HE

- Poor processes
- Productivity and efficiency challenges
- Waste of resources
- Leadership challenges
- Poor communication
- Lack of accountability and responsibility





# What we can do to improve

- Implement Industrial Engineering methodology, Quality Management and Lean.
- Take responsibility and accountability
- Leadership that understands and respects people
- Teamwork
- It all starts with us

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An aerial photograph of a teal-colored body of water. A multi-lane highway bridge spans across the water, with a few vehicles visible on it. A large, white, brushstroke-style graphic is overlaid on the water, partially covering the bridge. The text "Thank you" is centered within this white graphic.

**Thank you**