



**International Council on Systems Engineering**  
*A better world through a systems approach*

# Quality Management and Resilience

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# What is was was Resilience

- The definition of resilience, as agreed by the RSWG, is that System Resilience is the ability of an engineered system (or System of Systems) to provide required capability when facing adversity.
- The term engineered system is limited to human-made systems containing software, hardware, humans (e.g. socio-technical), infrastructures, concepts, and processes.
- For the purpose of resilience, an adversity is anything that might degrade the capability provided by a system. Achieving resilience requires consideration of all sources and types of adversity; e.g., from environmental sources human, sources, or system failure; from adversarial, friendly, or neutral parties; adversities that are malicious or accidental; adversities that are expected or not. Adversities may be issues, risks, or unknown-unknowns. Adversities may arise from inside or outside the system.
- The fundamental objectives of resilience are avoiding, withstanding, and recovering from adversity.
- The means of achieving these fundamental objectives include Adaptability, Agility, Anticipation, Continuity, Disaggregation, Evolution, Graceful Degradation, Integrity, Preparation, Prevention, Re-architecting, Redeploying, Robustness, Situational Awareness, Tolerance, Transformation, and other methods.
- Resilience focuses on providing required capability - not necessarily with maintaining the architecture or composition of the system.

# Resilience and Quality Management ?

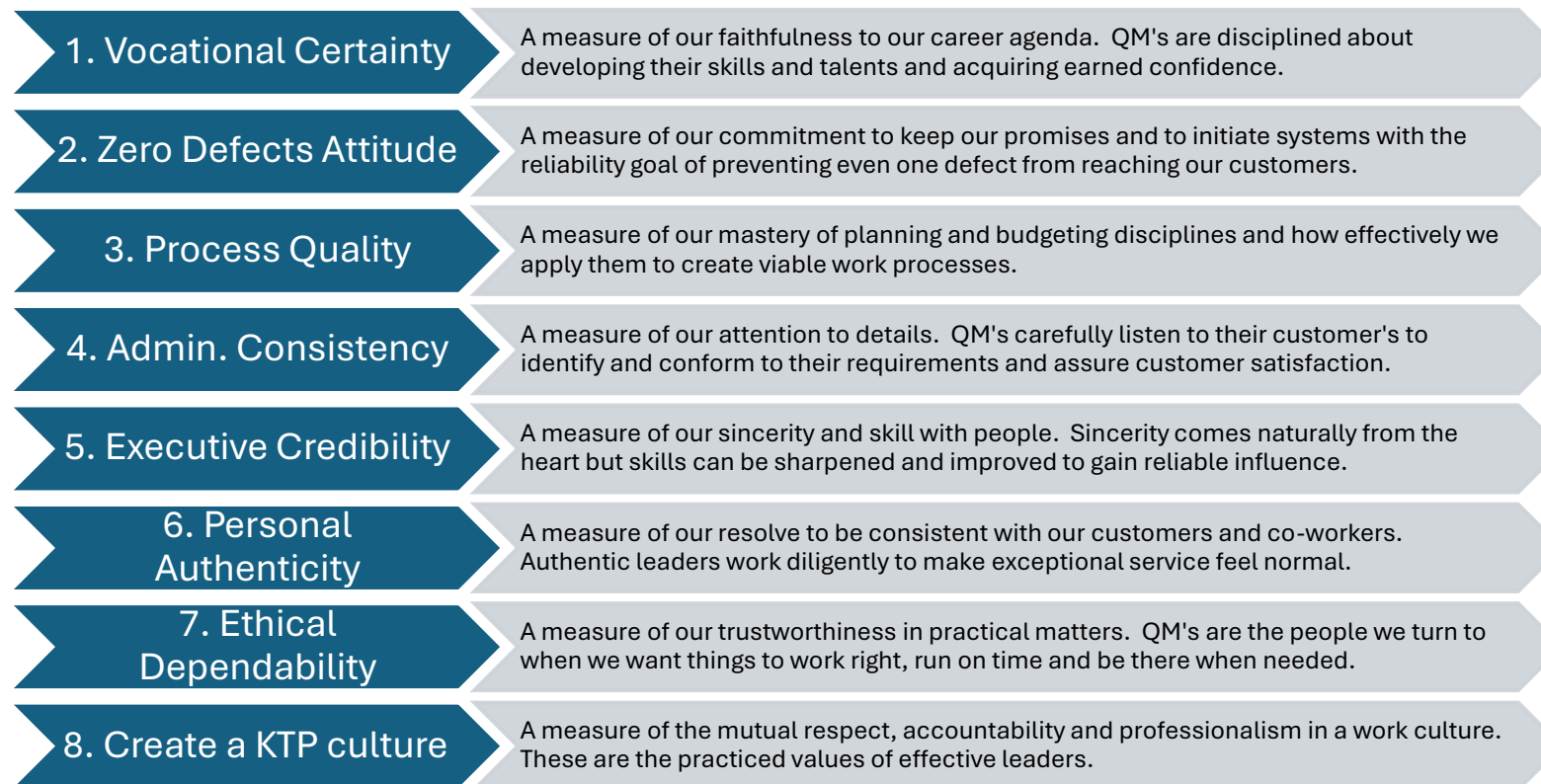
- If Resilience focuses on providing required capability when facing adversity, including disruptive events, then a follow on discussion might be “What is a suitable approach to determining those possible events, reactions and outcomes”?
- Systems Engineers live on requirements, and as noted (J. Brtis, 2016) resilience requirements are often compound requirements combining functional, performance and environment needs.
  - It can take a concerted approach and systems analysis effort to develop capabilities measures and targets (J. Brtis, 2016).
  - That in turn requires SME’s and a focus on specific activities and sections of an business or company to provide successful solution to resilient requirements.
- This often is translated to additional testing or more procedures
  - Quality Control (QC) often employed but focuses on eliminated defects. An after action response.
  - Quality Assurance (QA) attempts to design the quality into the product or service. Can drive whole lifecycle development. Statistical probabilities and failure calculation are key tools.
- For many companies, their resilience ability or capability is the key to their success. The need to know, collaborate, and understand the issues behind possible adverse activities or occurrence is key to continued success. Will a better QA, QC or lawyer approved SLA keep your business running and your customers satisfied if your services or products fail

# Resilience and Quality Management

- In reality, a cultural, not technical or process improvement solution could offer the best way forward to improved resilience engineering and solutions. And that solution is often based upon improved quality and leadership.
- Quality Management (QM) is a larger picture approach to Quality. It includes QA and QC but adds other management and cultural concepts to what is known as a Quality Culture that can be adopted by a business or agency.
- Conformance to requirements is a common definition of both QM and Systems Engineering
  - What the Customer Needs, Wants or Expects in a Product, Service or system
  - Balancing between the Cost of doing things wrong vice the Cost of doing things right.
  - Adopting company wide quality culture standards like zero defects attitude, vocational certainty, and personal authenticity can impact the resilience products and activities of a company.

# Values: Keys to Quality Management Adoption

- Managing Quality requires:
  - QM Methods, QM Values and Reasonable Discussions with involved parties.
  - Quality Management is a cultural adoption based upon 8 attributes



# QM and Systems Engineering

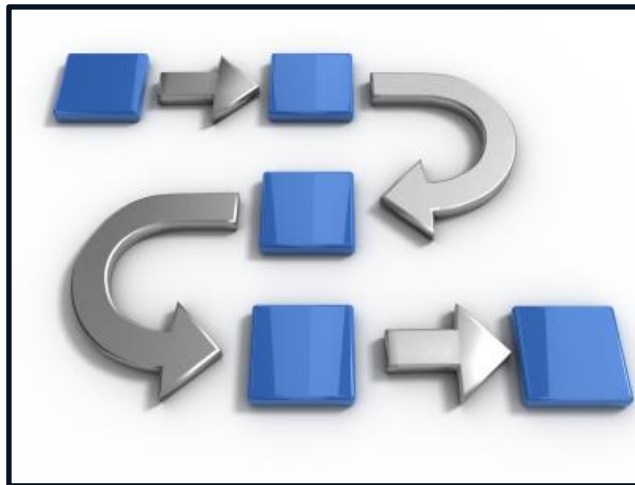
- The Challenge for Leadership is a key consideration for Quality Management
  - (1) Keeping the promise to your customers
  - (2) Hiring and retaining reliable people and
  - (3) Developing a QM culture
- Quality Management is Systems Thinking
  - An approach to problem solving, that considers and evaluates “facts and events” as parts of an overall system.
  - Avoids the failures created by reacting to specific parts, outcomes or events in isolation.
  - Considers specific strategies and tactics to overcome known limitations.
- Quality Management can also have significant staff impacts
  - QM trained and adoptive people are Engaged
    - Learn the facts and take action to create reliable solutions within scope and resources
  - QM People are Productive
    - Utilize the right processes and tools with improved outcomes
- QM culture and discipline supports System Engineering practices

# Complete QM is People, Processes and Tools



## Work Culture

Team of Engaged, Well-Trained High-Performers



## Policy / Procedure

Artfully Designed and Deployed Work Standards



## Technology

Fully-Utilized Tools and Efficiencies

Resilience solutions can be helped by QM!

***If Resilience focuses on providing required capability when facing adversity, including disruptive events, then what is a suitable approach to determining those possible events, reactions and outcomes?***

***Strong Resilience solutions can be helped by adopting a Quality Management Culture!***

*The INCOSE Systems Engineering Quality Management (SEQM) working group was formed and dedicated to supporting other INCOSE working groups to understand and implement QM concepts into the efforts of other INCOSE working groups.*



Thank you!

# Questions and Discussion