MDH, 2018-05-17

ABB – Quality

Karl Williams, ABB Robotics Production Quality and OPEX Manager

Don’t look the other way.

Make quality happen.

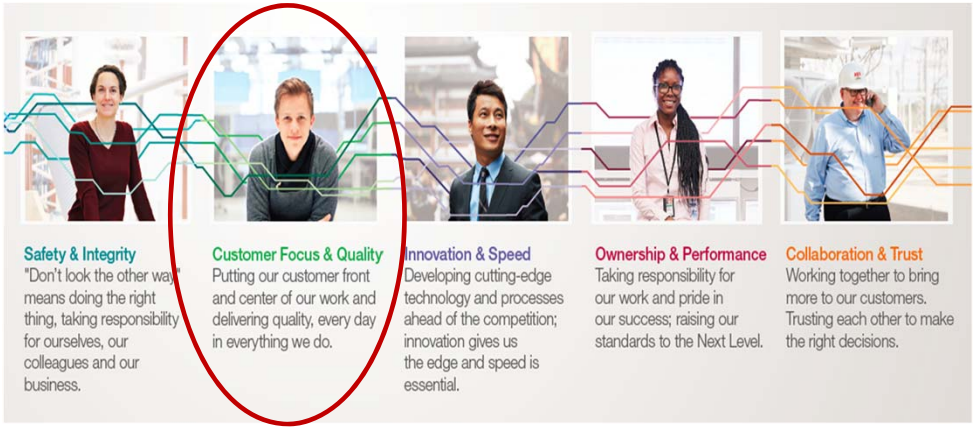
Contents

Clear customer focus & quality will power our growth

- The customer is the ultimate judge of our **quality**
- Quality improves when we fix what the **customer** tells us to fix
- Fixing what the **customers** ask us to fix, will delight them
- Delighted **customers** become fans
- Fans stay with “team” ABB, which **powers growth**

Our customers are the ultimate judges of quality, and delighting them powers growth

We have high aspirations for our Customer Focus & Quality value pair: perfection



To live up to this value pair, we must:

- Own and improve our external and internal Customers' Experience – everyone, individually and together, every time;
- Provide innovative, accurate, reliable and solutions, products and services that our Customers value;
- Meet all Customer needs completely and quickly in everything we do;
- When we fall short, demonstrate the courage to recognize our gaps and relentlessly chase perfection in our Customers' eyes.

Addressing our performance gap requires a cultural transformation throughout our value chain

Contents

Add perception of customer: Where is ABB?

Make quality happen: four stages to quality excellence

1 Ad-hoc fire-fighting
... doesn't save us losing customers due to process & product quality issues

2 Single, stable quality processes
... put the control culture in place and focus on product quality

3 Integrated quality system
... aligns cross-functionally on the customer focus and growth

4 Quality excellence
... makes us the company with the highest customer focus and quality in our industry by 2020

Voice of..	1 Ad-hoc fire-fighting	2 Single, stable quality processes	3 Integrated quality system	4 Quality excellence
Customer	– Overlapping systems, inconsistent use	– Consistent tracking, timely resolution	– Integrated tracking across Divisions and BUs	– One face to customer, one tracking method
Operations	– Limited transparency	– Basic metrics consistently applied by function	– Integrated metrics across value chain and lifecycle	– Harmonized performance metric systems in aligned cockpit as single source of truth
Employees	– Not consistently leveraged	– Opportunity to raise issues in system	– Cross-functional process to execute proposals	– Continuous improvement culture based on L6S

A continuous improvement and an engaged organization is the only way to grow. Together.

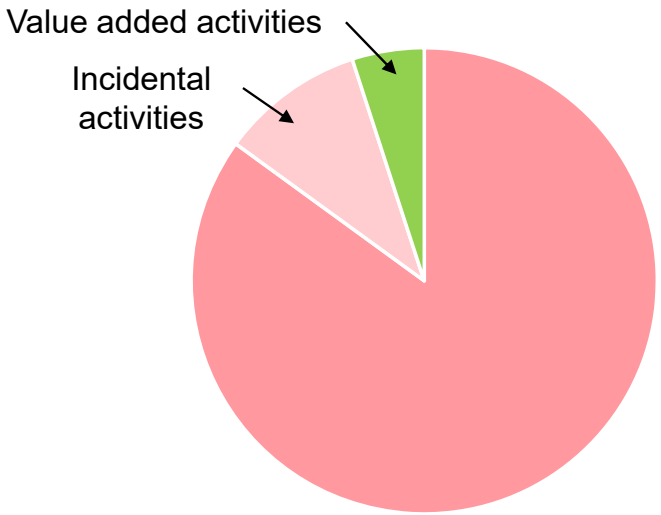
Where do you think we are on our Journey to Quality Excellence?

	Ad-hoc fire-fighting	Single, stable Quality processes	Integrated Quality System	Quality Excellence
Customer focus 	• Act when Customers complain • Fix symptoms • Provide what Customers are believed to expect	• Process outputs beginning to be measured against Customer Expectations • Pockets of addressing root causes	• Use many data sources to develop a complete Voice of the Customer understanding • Consistently, quickly spot issues & address adverse root causes	• Use the VOC understanding to address issues before the Customer voices concern • Viewed as truly one ABB by our Customers
Processes, technologies 	• Ad hoc work processes with inconsistent outcomes • Defined processes loosely managed and controlled • Metrics focused on the past • Data yields little insights	• Data used to manage processes • Core processes at local level have predictable results • Increasing use of standardized data and metrics	• Standardized processes, metrics and data collection across the organization • Core processes linked to form value chains • Local predictive dashboards to manage the organization	• Data driven processes managed by exception • Value chains managed, characterized and documented • Horizontally and vertically integrated predictive dashboards
People, Culture 	• Firefighting is the norm. Crisis management • Wide variation in organizational norms • Silos • People are managed, not developed	• Emergence of single culture • Resources aligned to produce results • Growing individual ownership • Cross functional decision being made	• Growing sense of trust and confidence • Process understanding across the organization • Growing confidence in individuals abilities • CI infrastructure merged into organization	• Barriers eliminated by redefining organizational interfaces • Collaboration and improvement is the cultural norm • Continuous improvement of organizational and individual capabilities

What is “Lean?”

All about improving speed by eliminating waste

Composition of a typical Business process



Key elements of a Lean program

- Truly know what the Customers value…and what they do not
- Identify the “Value Stream.” Understand the flow and interactions
- Have Customers pull from the process rather than push
- Aim for single piece flow…eliminate batches
- Pursue perfection. Continually improve

Non value-added activities also drive process variation. Besides improving speed, removing waste also supports Six Sigma goals

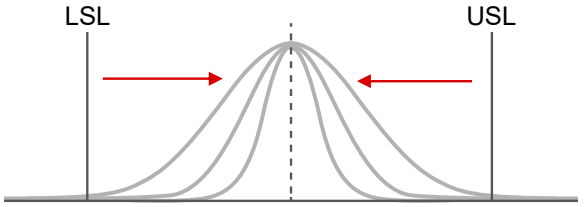
Lean Six Sigma is the combination of these two strong mutually reinforcing approaches

Lean

- Identify and eliminate waste to improve speed (and therefore efficiency)
- Hands-on focus
- High potential for bottom-line impact

"Striving for the perfect world"

"Produce & deliver only what the customer wants, in the shortest possible lead time"



Six Sigma

- Reduce variation in products and processes to improve stability & predictability
- Analytic focus
- Deep understanding of own processes

"Improving the imperfect reality"

"Detect problems, alert and stop"
"Eliminate the root cause of problems"

Lean Six Sigma will elevate our problem solving capability, building on our strong 4Q base

Contents

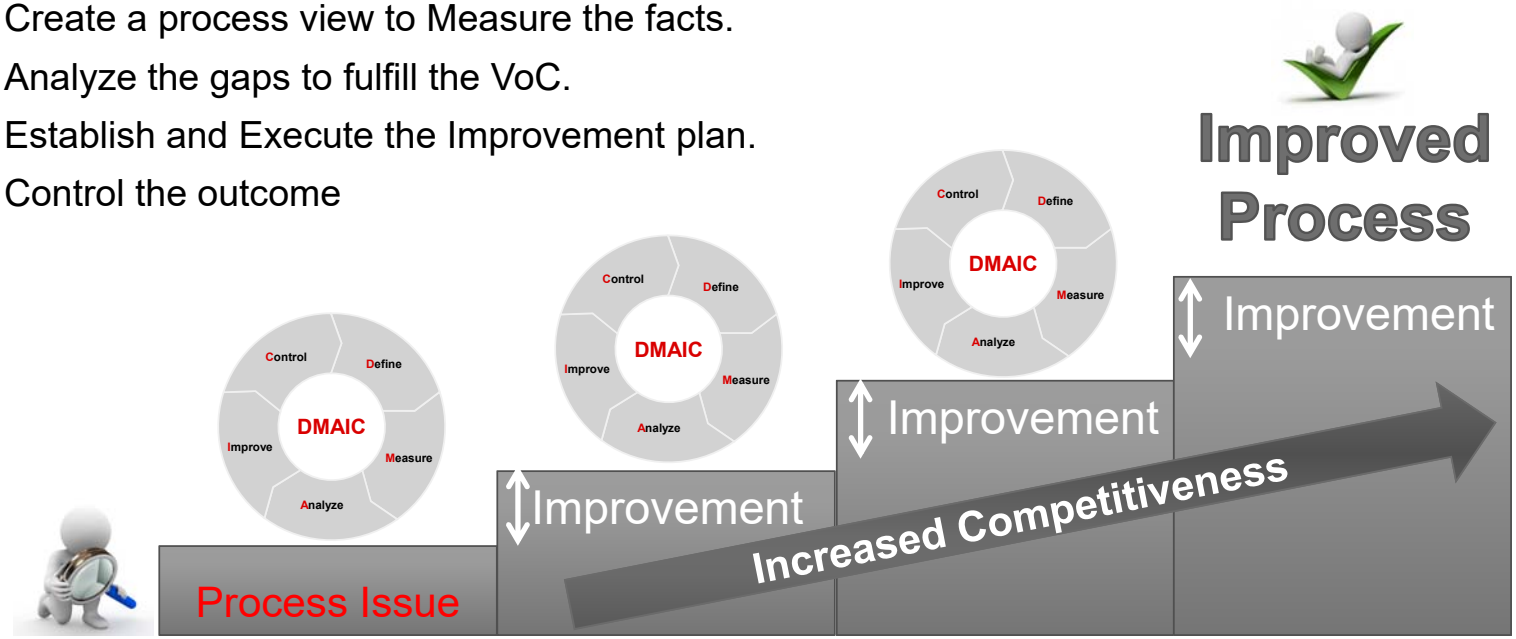
Make quality happen - Voice of the customer

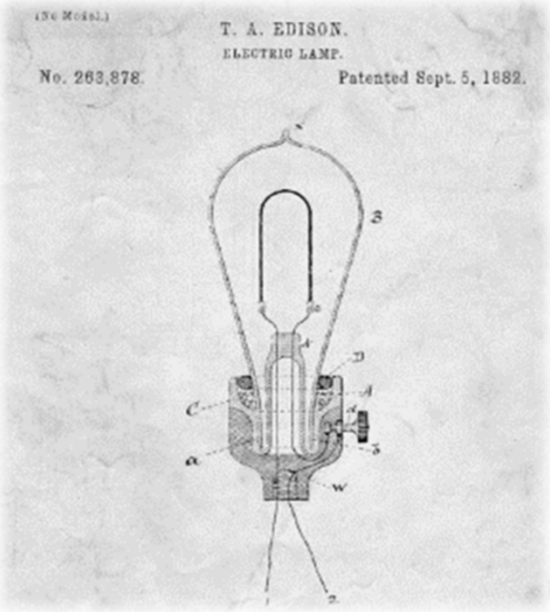
SOURCE: Source

Celebrating the red

Elements of Continuous Improvement:

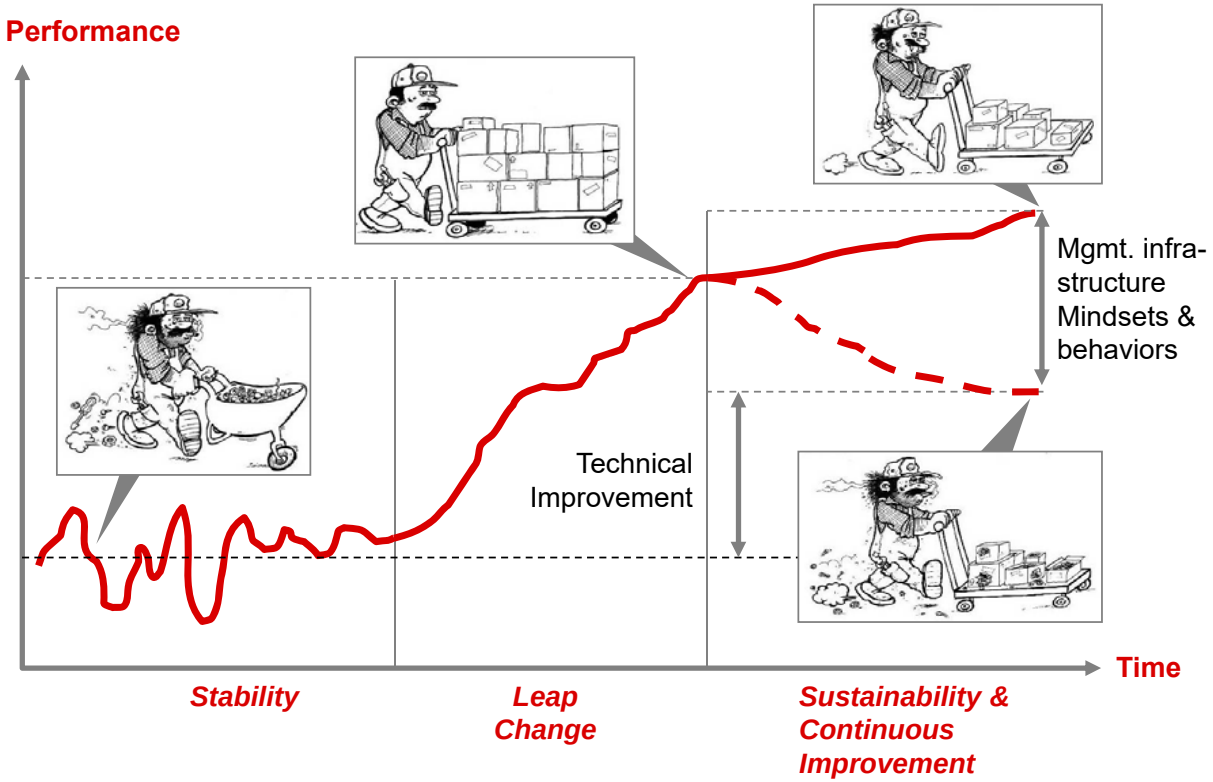
– **Highlight and Define the problems and opportunities**.
– Create a process view to Measure the facts.
– Analyze the gaps to fulfill the VoC.
– Establish and Execute the Improvement plan.
– Control the outcome





"I have not failed. I've just found 10,000 ways that won't work."
Thomas A. Edison

The key of every improvement is to sustain the change

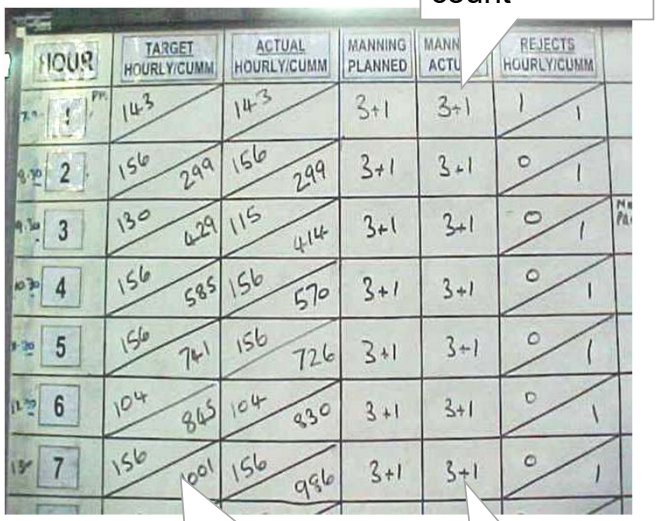


Typical pitfalls

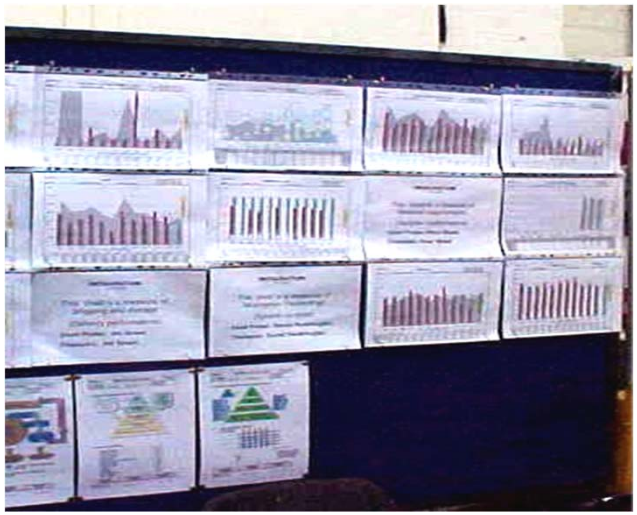
- **Targets do not cascade** in a meaningful way down to front line employees
- Leaders are **not role modelling,** and following their standard work
- **Continuous improvement is owned by the central team**, not the line leadership
- **Poor root cause problem solving** practices
- Focus solely on performance improvement (i.e., **not health** as well)
- **Performance dialogues are ineffective** at identifying problems

Visual management closely monitors performance and increases ownership – example from the shopfloor

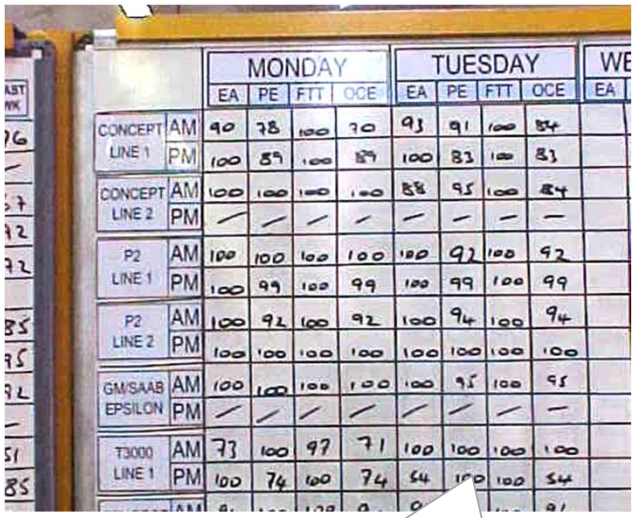
1 Cell boards



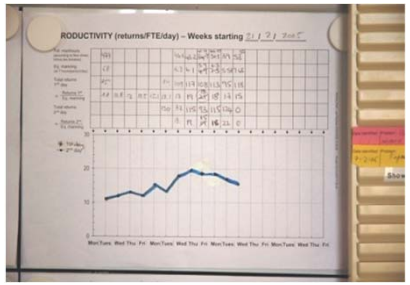
2 Business KPIs



3 Cell overall cell efficiency monitor

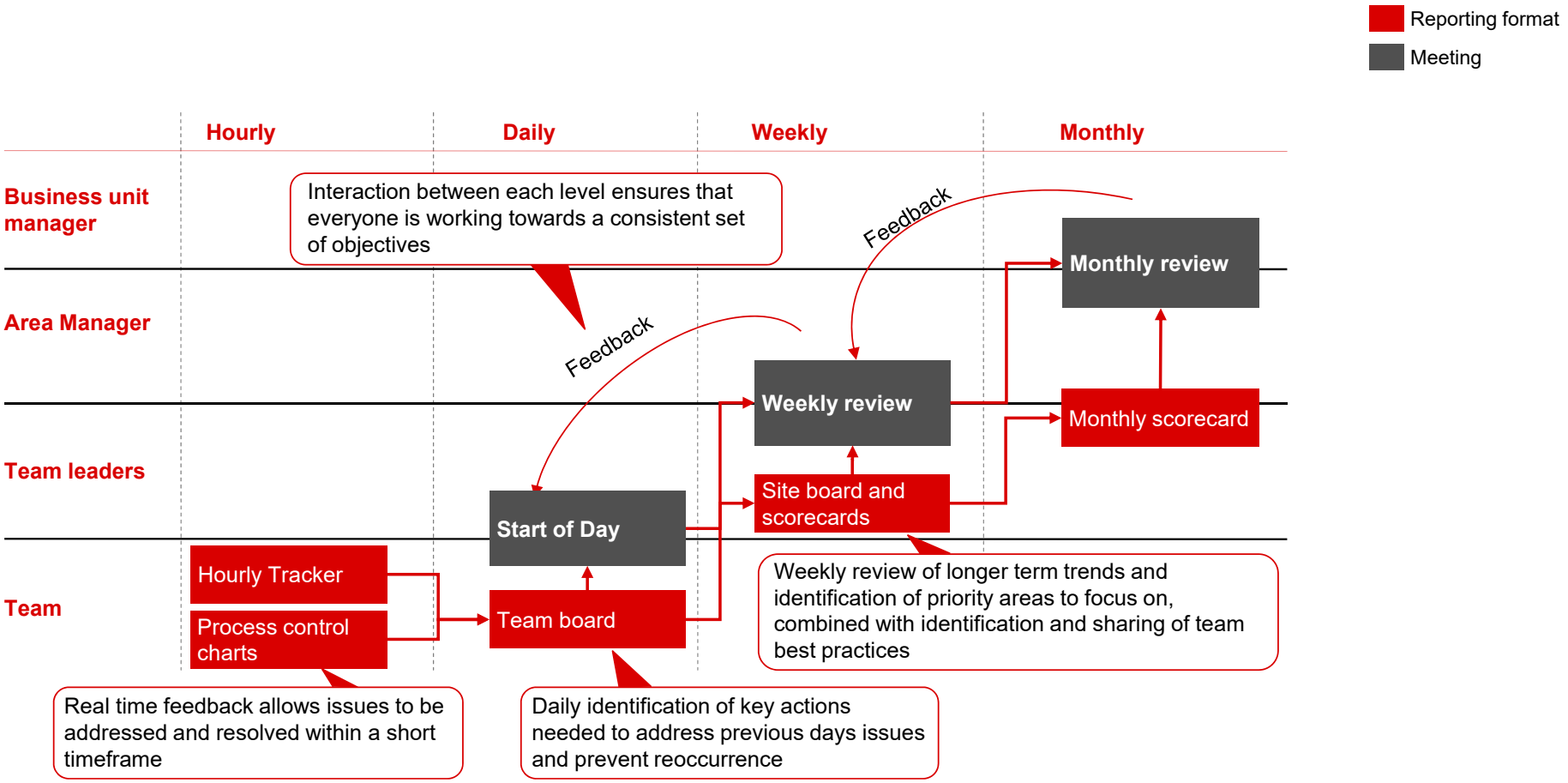


To hold a good meeting, the team leader has to ask the right questions to challenge underperformance



What is happening?	– What are the gaps to target? – Are any trends causing concern?
Why?	– What has happened to cause the performance gap? – Do we understand the true root causes? – Do we need to investigate further to really understand the problem?
What needs to be done?	– Do we need to take any short-term containment action? – What needs to be done to correct the problem and prevent this from happening again? – Will these actions completely resolve the problem or do we need to do any additional things to close the gap?
Who is going to do it?	– Who will take responsibility for completing the action? – Does the owner need support from any of the other team members?
When is it going to be done?	– Is it a priority action? – What is the deadline for completion? – When are the intermediate milestones?
How is progress to be tracked?	– Will it be solved immediately or is it necessary to use a T-card?

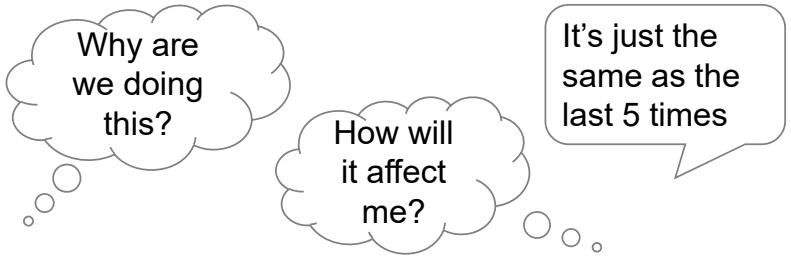
Performance management consists of a cascade of review meetings



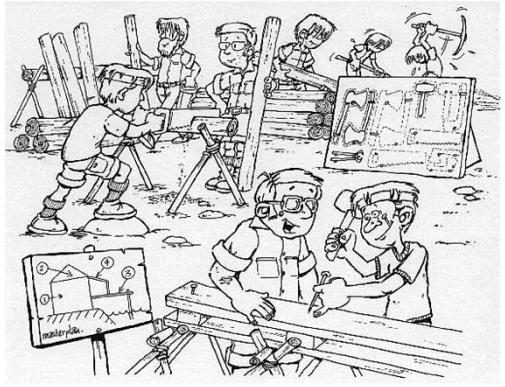
The Change Story – an engaging instrument creating understanding and engaging people at a personal level

Employees are told what to do, but lack understanding . . .

. . . causing confusion and cynicism



Develop a simple and compelling change story . . .



. . . which answers people's questions and excites them

- Ground the story and the need to change in past experience
- Formulate a clear, appealing vision of the future
- Explain a logical and emotionally persuasive path to get there

Contents

These elements are supported by Lean and Six Sigma tools

Lean 6 Sigma tools and methods covered today

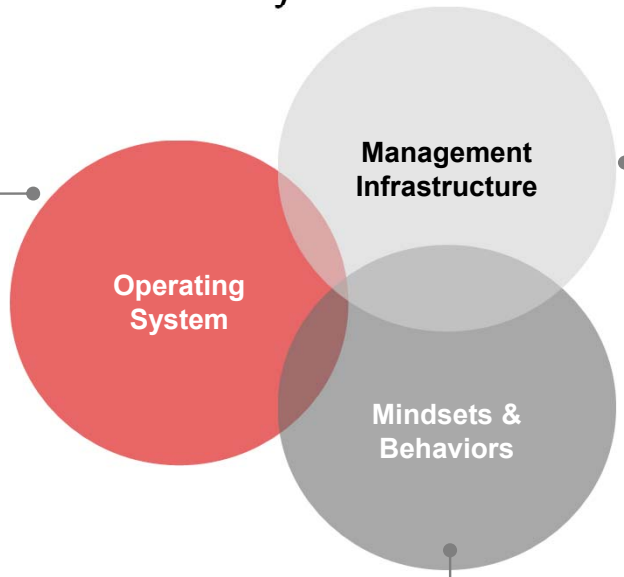
Operating system

Efficiency (“Lean”)

- Value Stream Mapping
- Waste
- Flow
- Takt
- Pull

Quality (“Six Sigma”)

- Prescriptive problem-solving process (DMAIC, Ishikawa, 5 Why)
- Statistical problem-solving tools (control charts)



Management infrastructure

- Performance management
- Lean leadership

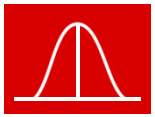
Mindset and behaviors

- Influence model
- Change story

Data – The Driving Force

Each level represents the typical percentage of data-driven decision making utilized in an average organization.

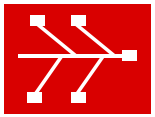
Highest level



Inferential statistics — **5%**

Basic statistical analysis — **15%**

Basic charts and graphs — **30%**



Quantitative brainstorming tools — **30%**

Qualitative brainstorming tools — **15%**

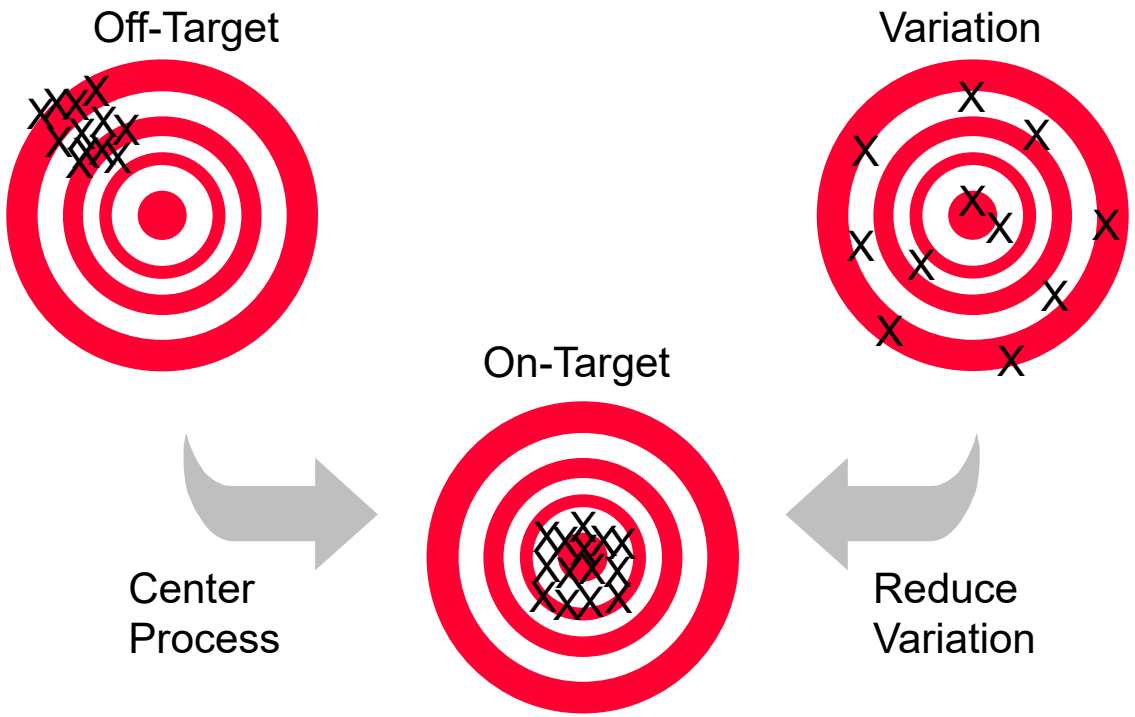
Intuition or gut feeling — **5%**

Lowest level

From idea to project

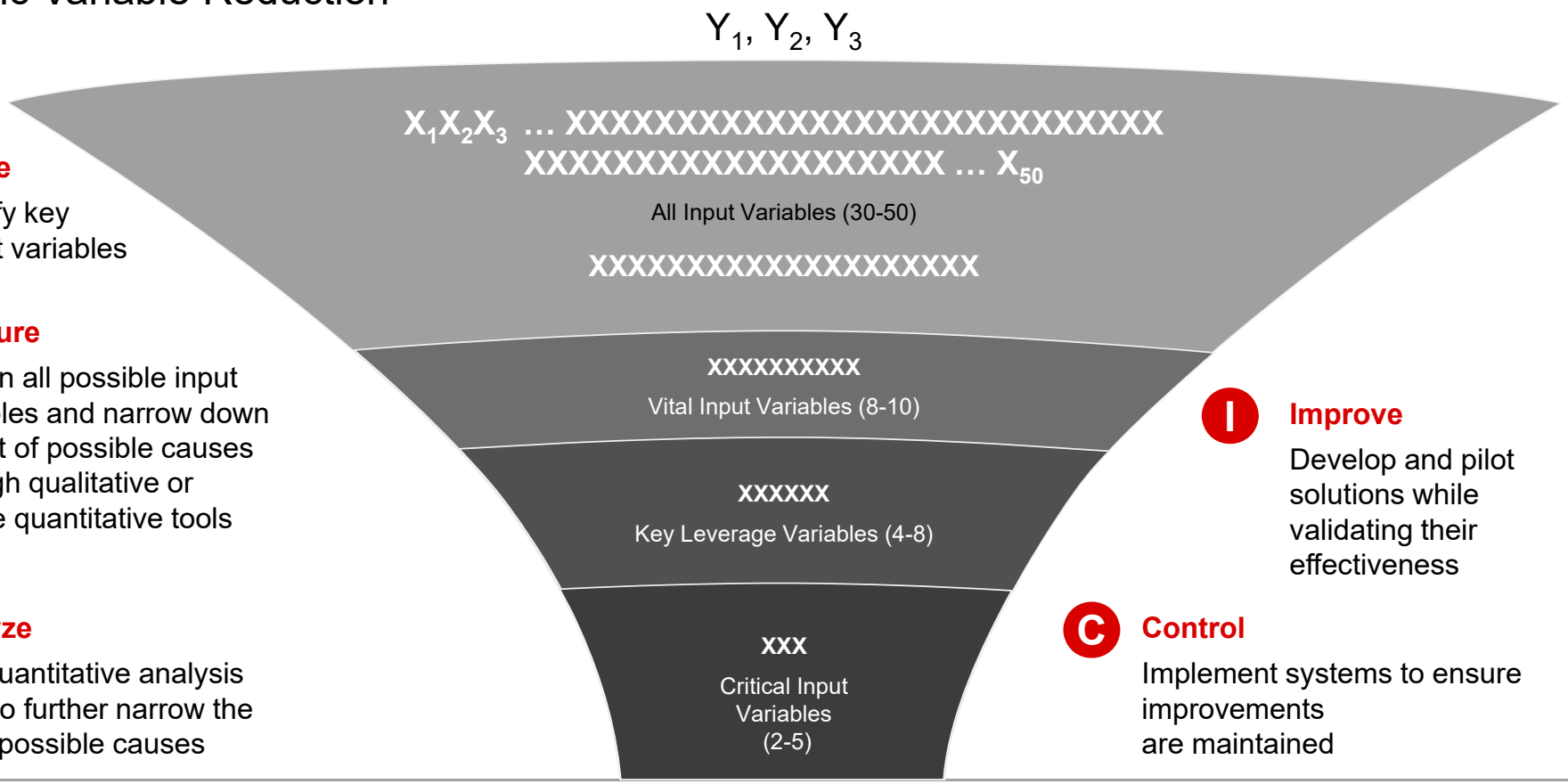
Idea identification

Lean Six Sigma methodology identifies processes that are off-target, and/or have a high degree of variation and corrects the process



From idea to project

Systematic Variable Reduction



D Define

Identify key output variables

M Measure

Pour in all possible input variables and narrow down the list of possible causes through qualitative or simple quantitative tools

A Analyze

Use quantitative analysis tools to further narrow the list of possible causes

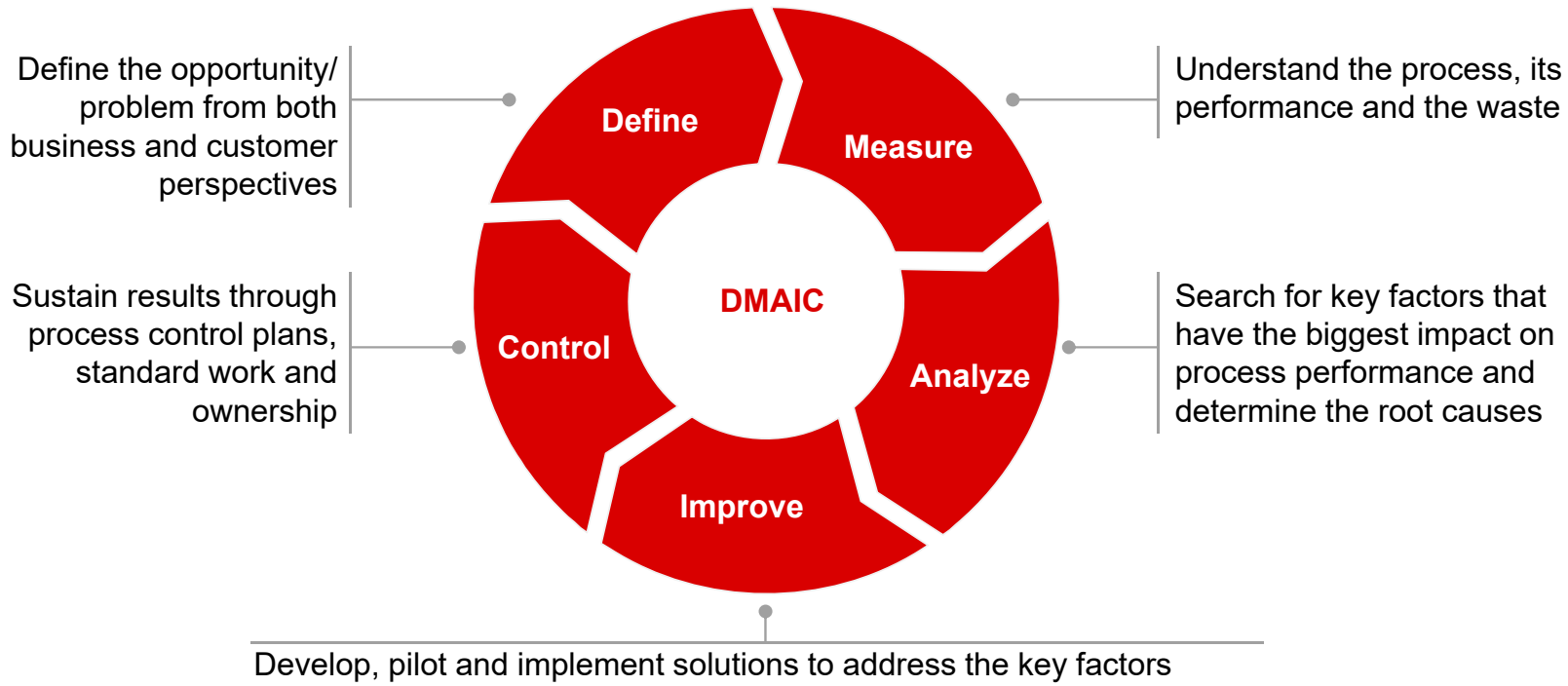
I Improve

Develop and pilot solutions while validating their effectiveness

C Control

Implement systems to ensure improvements are maintained

Lean Six Sigma projects follow the DMAIC process



In each phase different tools are applied to solve the problem in a structured way. In order to follow the right path the project team is supported by an experienced coach.

During DMAIC the best tools for a problem are selected based on coaching by an experienced Belt

Focus of today

Define	Measure	Analyze	Improve	Control
– **Problem definition** – SIPOC – VOC – CTQ Tree – Defined Metrics and Defects – Business case calculation	– Histogram – Pareto Chart/Run Chart – Scatter Plot – Process Map / **Value Stream Map Review** – Spaghetti diagrams – Overall Equipment Effectiveness – **Measurement System Analysis / GR&R** – **Process Capabilities Sigma levels** – Process Yield (e.g., FPY) – **FMEA**	– Cause and Effect/Fishbone Diagram – **5 Whys** – **Hypothesis** testing – Design Of Experiments – Regression analysis – Non Normal Data Analysis – Demand-leveling	– Idea Generation – Pilot Plan – **FMEA** – **Pull** / OPF – **Kanban** – Mistake proofing (e.g., Poka Yoke) – **SMED** – **5S**	– SOPs – Control Plans – **Control charts (e.g., Statistical Process Control)** – **Visual Management**

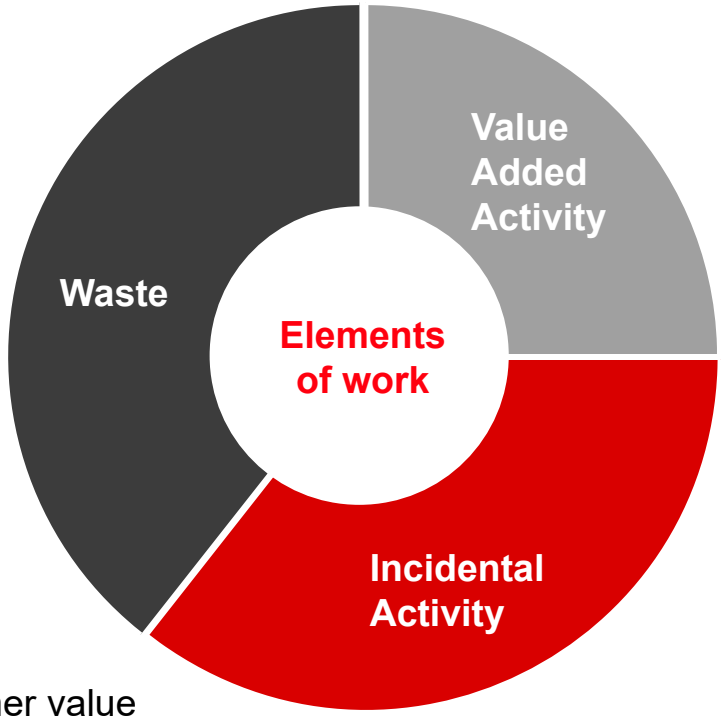
To be selected with the coach according to the problem to be solved

Waste is work which adds cost, but does not add value

Waste

– Work or use of resources that does not add any value to a product

– Waste is sometimes called “muda”, from the Japanese for waste



Value Added Activity

– Work that directly increases the value of the product in the eyes of the customer (e.g. Assembly of parts)

– What the customer is paying for

Incidental Activity

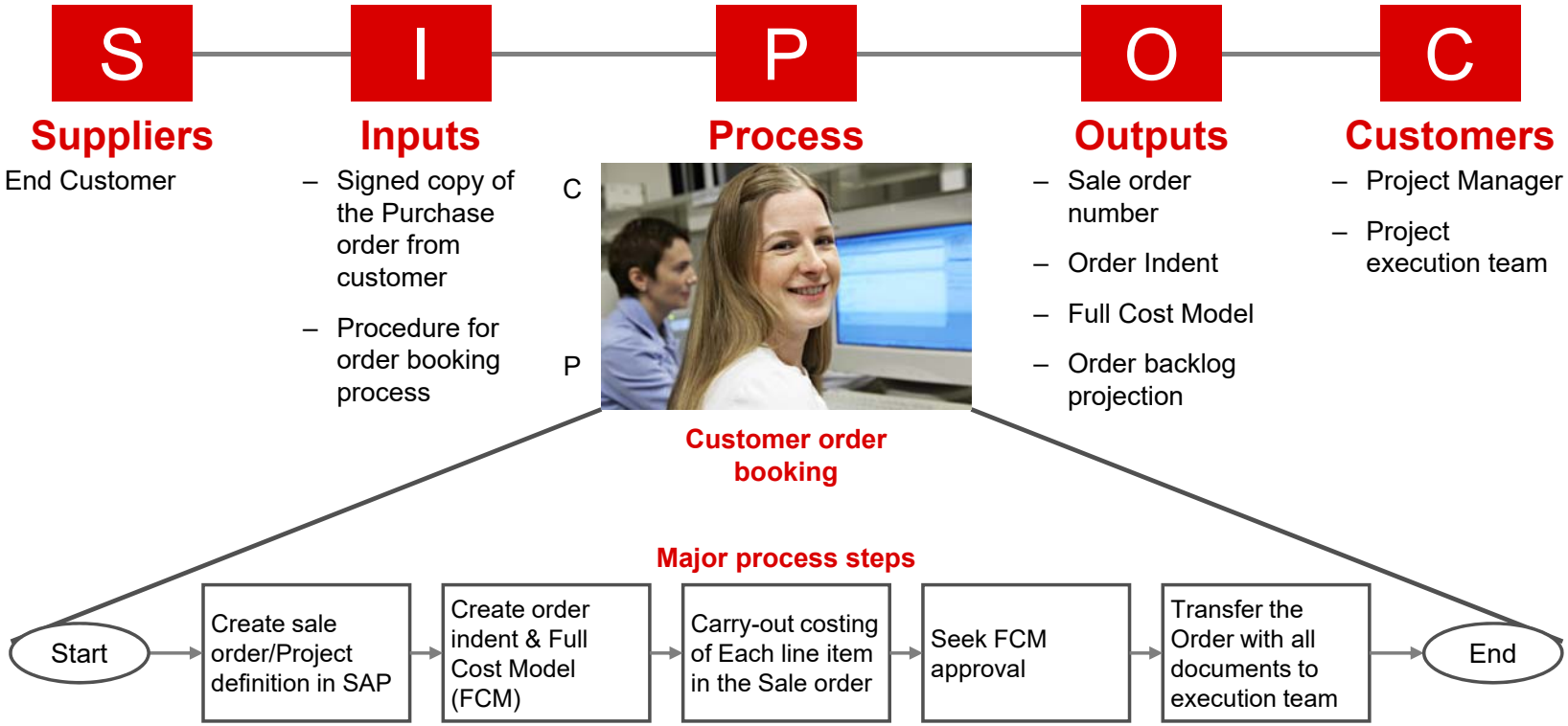
– Work that does not add customer value

– Is currently necessary to maintain operations (e.g. small movements to reach for material for assembly, transport, internal reporting)

Objective

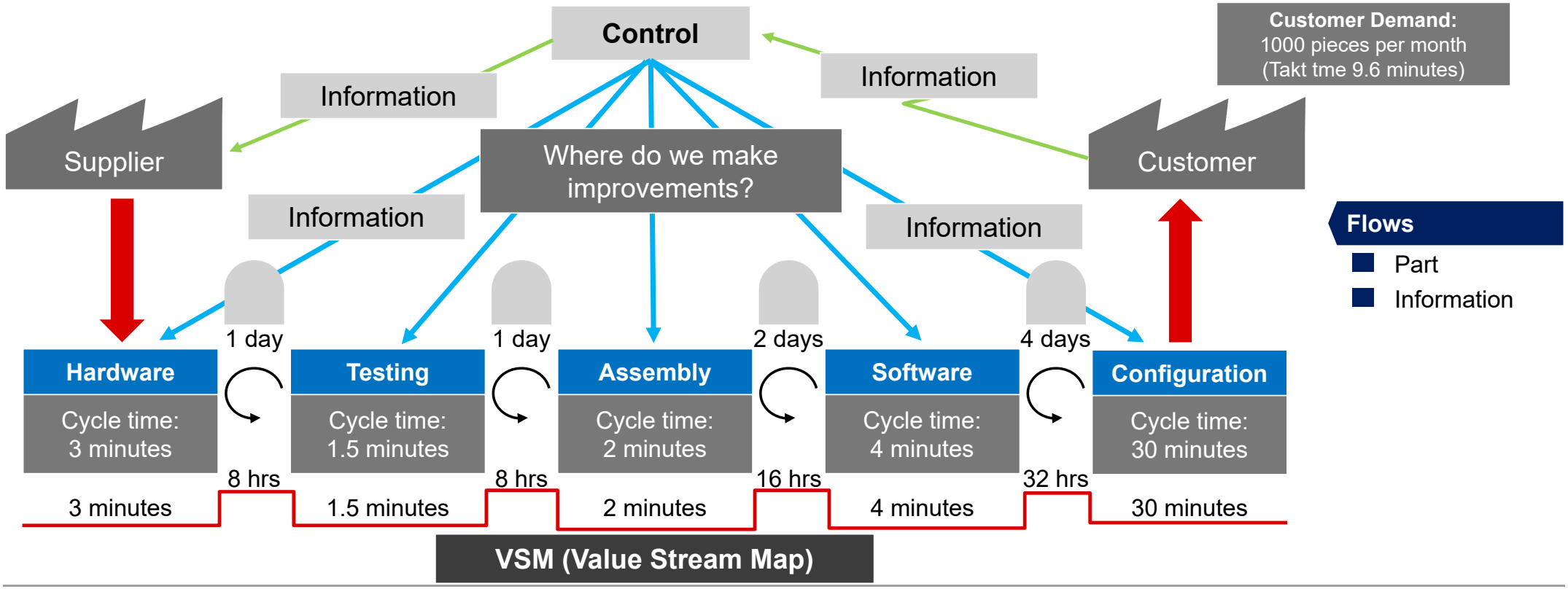
– The objective is to maximize the proportion of value added activity by eliminating waste and incidental activity

SIPOC


S
I
P
O
C
Suppliers
End Customer
Inputs
– Signed copy of the Purchase order from customer
– Procedure for order booking process
Process
C
P
Customer order booking
Outputs
– Sale order number
– Order Indent
– Full Cost Model
– Order backlog projection
Customers
– Project Manager
– Project execution team
Major process steps
Start
Create sale order/Project definition in SAP
Create order indent & Full Cost Model (FCM)
Carry-out costing of Each line item in the Sale order
Seek FCM approval
Transfer the Order with all documents to execution team
End

@Anika: animate

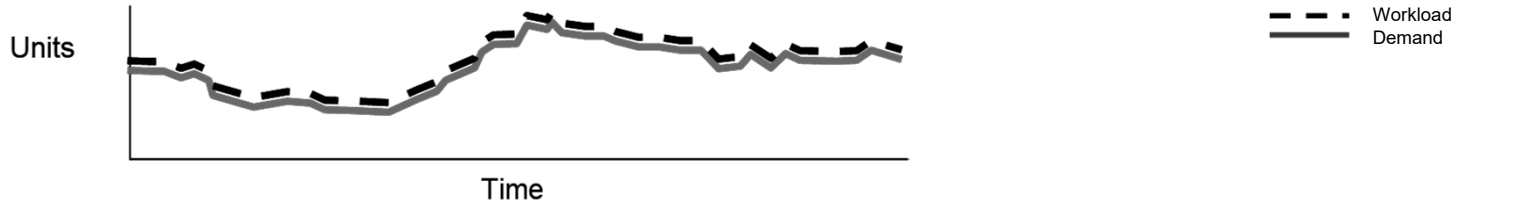
The value stream map



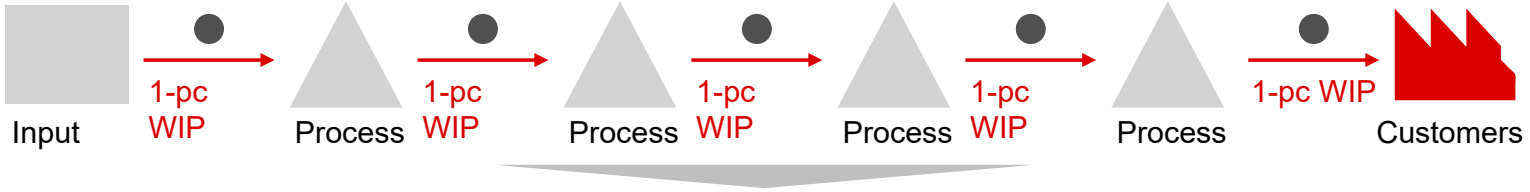
Lean system is customer focused

The characteristics of a Lean system

Workload following demand

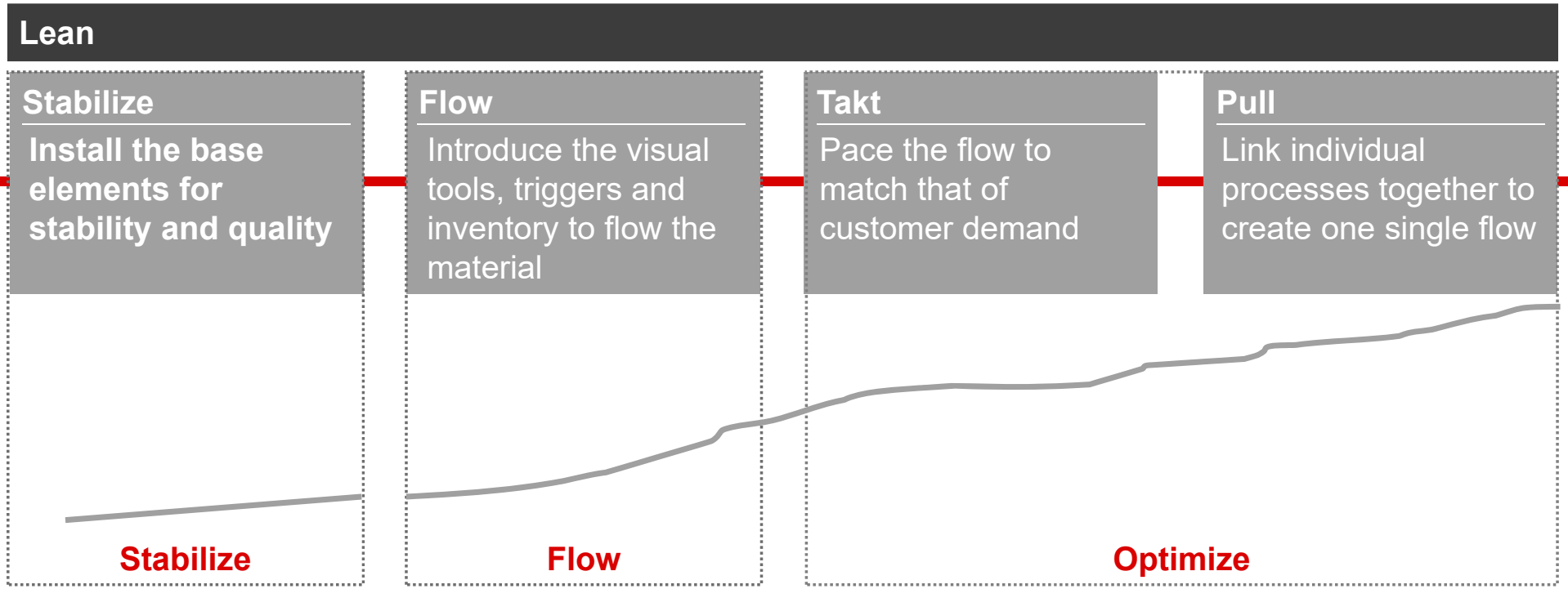


Processes are arranged in a manner that enables production to match the pattern of sales



- The workload matches the pattern of customer demand
- Focus on system efficiency, not individual utilization
- Immediate customer “pulls” from preceding process in the quantity needed, when needed from the supplier processes

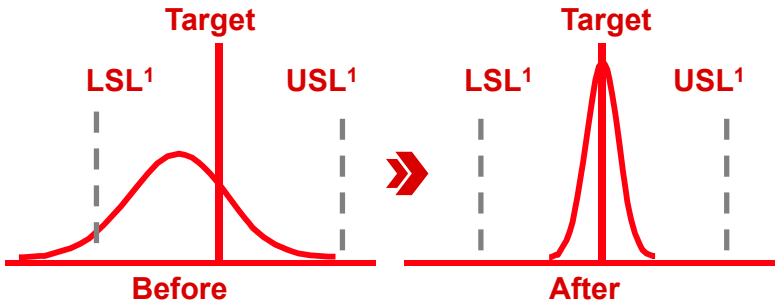
The first steps in applying Lean principles are Stabilise and Flow



Six Sigma – a methodology to continuous improvement and a metric

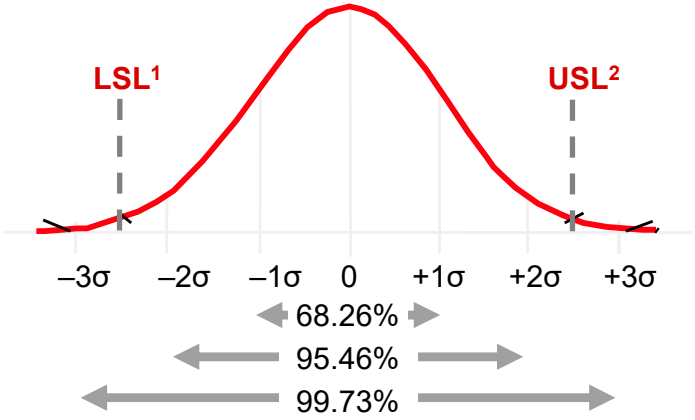
Six Sigma methodology

- The Six Sigma is a **structured and integrated approach to continuous business improvement** and shareholder value creation developed by Motorola in 1986
- Six Sigma aims for business and process improvements by
  - Measuring the process capability
  - Understanding the nature of process variability
  - Reducing process variability and
  - Centering process parameters towards customer expectations



Six Sigma as metric

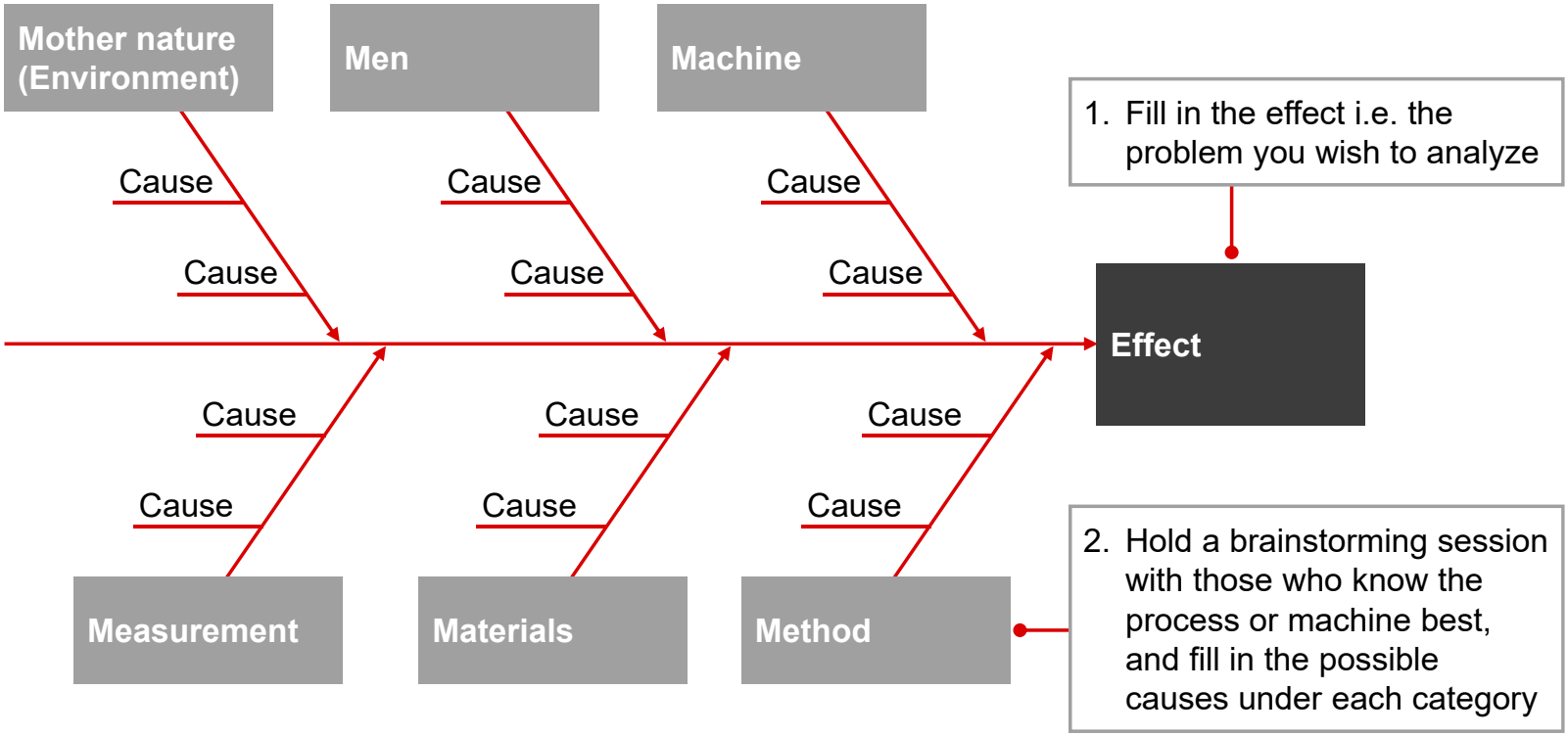
- The term “sigma" is used as a scale that expresses how well a process is performing in satisfying customer requirements
- Specifically the sigma level indicates the number of standard deviations (σ) of a process that fit between the process mean and the nearest specification limit
- A 6σ process generates 3.4 defects out of 1 million products produced (or services delivered)



The higher the sigma level, the better!

1 LSL: Lower Specification Limit, 2 USL: Upper Specification Limit

A simple tool for identifying possible causes is the fishbone or Ishikawa diagram



Asking 5 times why to identify the root cause of the problem

	Do use "5 Whys" to flow to a solution	Do not use "5 Whys" to build excuses
Problem	The parts are out of specs	The parts are out of specs
Why?	The wrong tool has been used	The right tool was not available
Why?	The standard tool has burned out	We don't have a second one
Why?	The temperature of the oil was too high	According to management, return on investment is too low to purchase another one
Why?	There is no temperature standard	Due to global competition, the product market price is too low

Focus

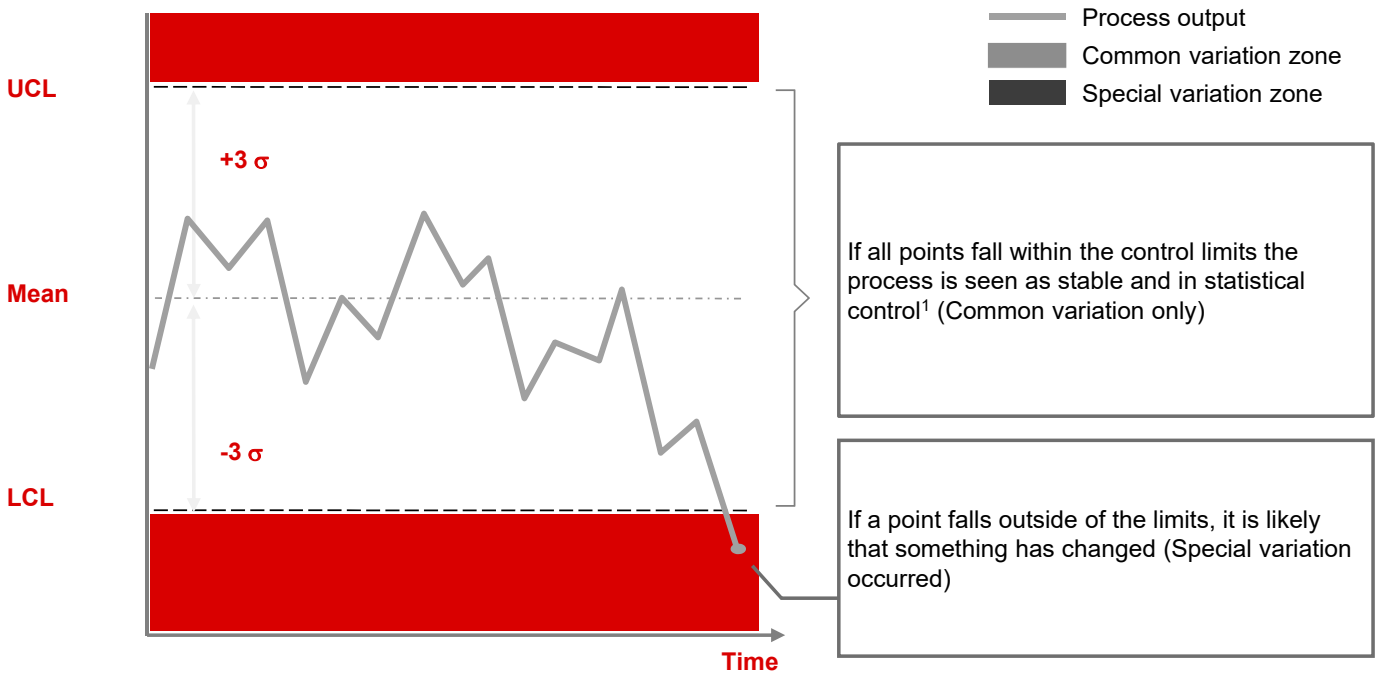
Cloudy

To differentiate between the common and special cause variation the concept of control charts and control limits was developed

Control limits…

- **What do they represent**
  - Control limits represent the range of the expected common variation in the process (you expect 99.73% of data points within the control limits)
  - **How are they defined**
  - **UCL (Upper control Limit):** Mean + 3·Standard deviation
  - **LCL (Lower control Limit):** Mean – 3·Standard deviation
  - **How are they used**
- During the Measure phase:
- To determine the stability of the process
- To identify whether variation in the process is due to special causes
- During the Control phase:
- To ensure that gains made during a project are sustained
- To act as an early warning system when changes are made to a process

…Usage in a control chart



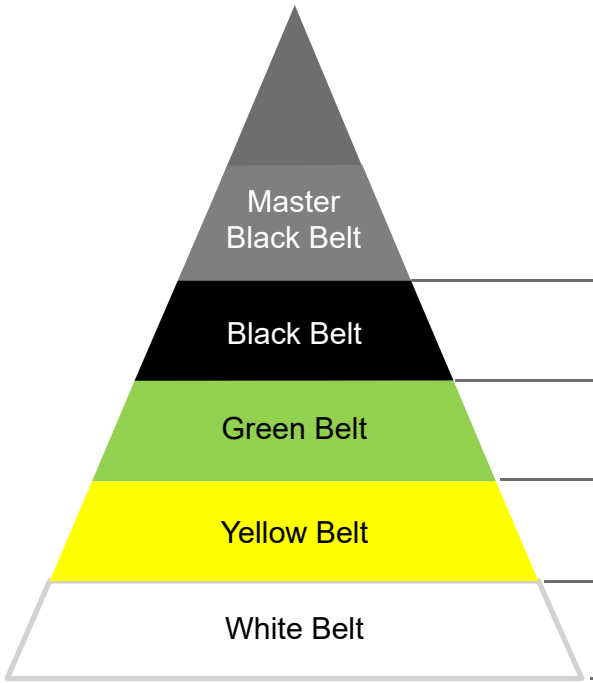
1 Unless other specific patterns appear (e.g. 9 points in a row below center line)

Lean and Six Sigma complement each other

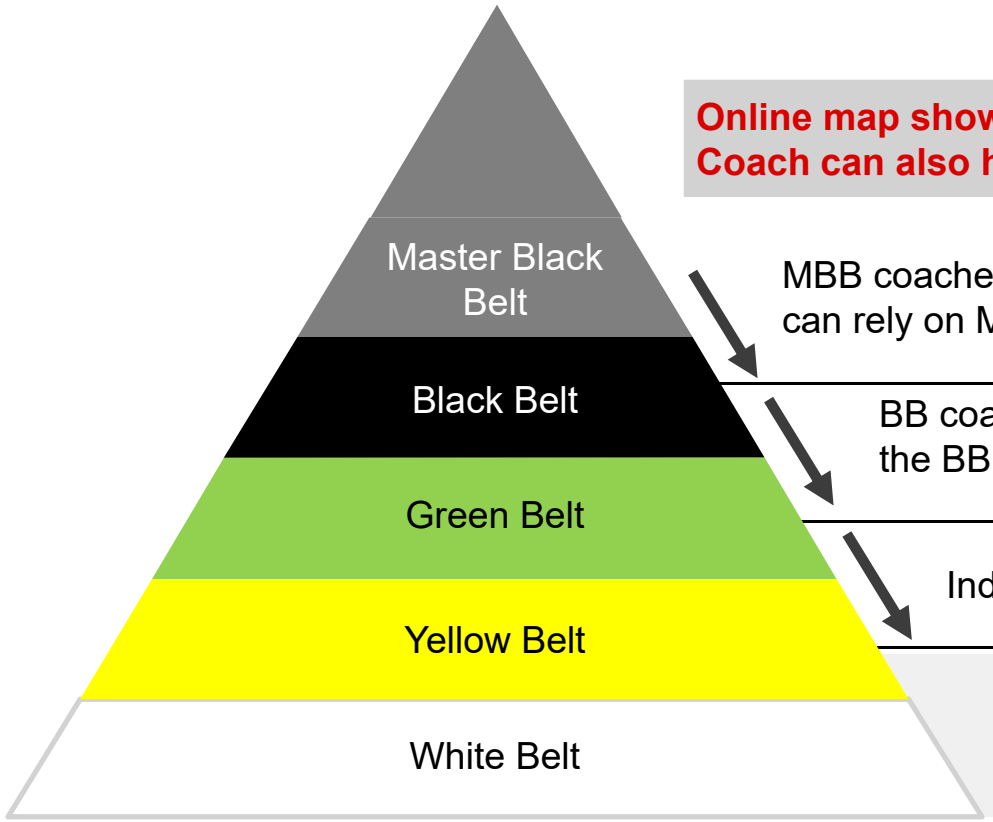
Lean	Six Sigma
Efficiency	Stability
Speed	Consistency
Waste elimination	Problem/variability elimination
“Striving for the perfect world”	“Improving the imperfect reality”
“Produce and deliver (only) what the customer wants, in the shortest possible lead time”	“Detect problems, alert and stop” “Eliminate the root cause of problems”

Contents

Lean Six Sigma organization consists of different belt levels

Lean Six Sigma pyramid	Roles in the organization	Dedication
		
Master Black Belt	Experts who can drive cross-business-unit projects as sparring partners to business managers and develop Lean Six Sigma (L6S) at ABB	Full time
Black Belt	Motors of the organization who deliver high-impact projects while supporting management in building a capable organization	Full time
Green Belt	Change agent who execute projects themselves and provide critical support to black belts and master black belt both on their projects and in building the L6S culture	20%
Yellow Belt	Multipliers who are capable of identifying and executing projects and steering them into the organization	10%
White Belt	Ambassadors who draw on fundamental knowledge of L6S to provide a starting point for further development and awareness of quality	None

❷ An essential part of the implementation is project coaching



Online map shows available coaches, which can be approached by candidate.[1] Coach can also have a higher level if the designated belt is not available.

MBB coaches up to 5 BBs during their certification projects. Afterwards each BB can rely on MBB for on-demand coaching for difficult tasks

BB coaches GB on certification project. Coaching is part of certification of the BB. Afterwards, GB can rely on BB for on-demand coaching

Individual coaching for YB is available on demand by local GB

Dial-in coaching session on general topics is available weekly

1 Recommendations for matching are stated in governance

MDH, 2018-05-17

ABB Robotics – Quality

Karl Williams, ABB Robotics Production Quality and OPEX Manager

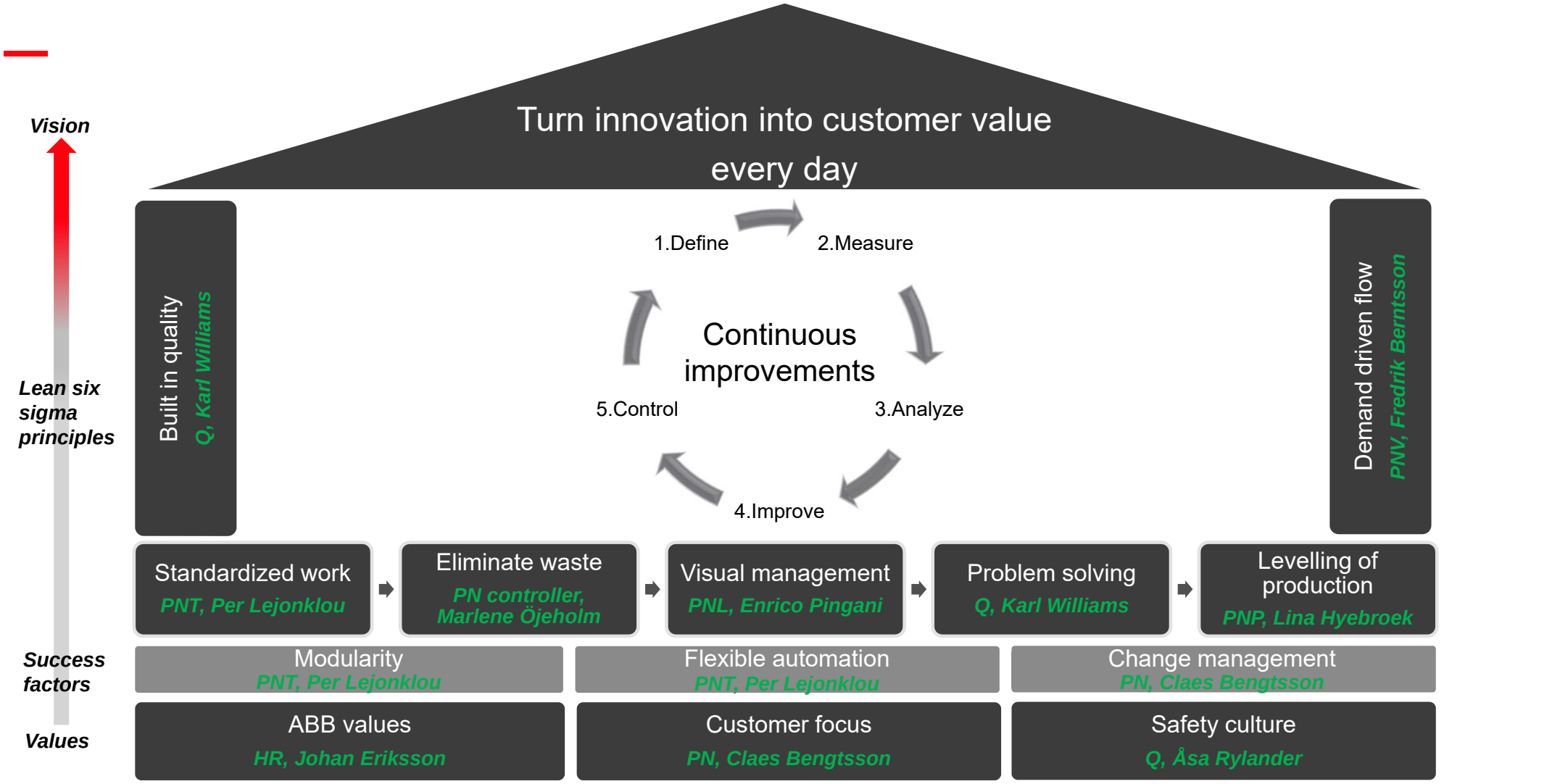
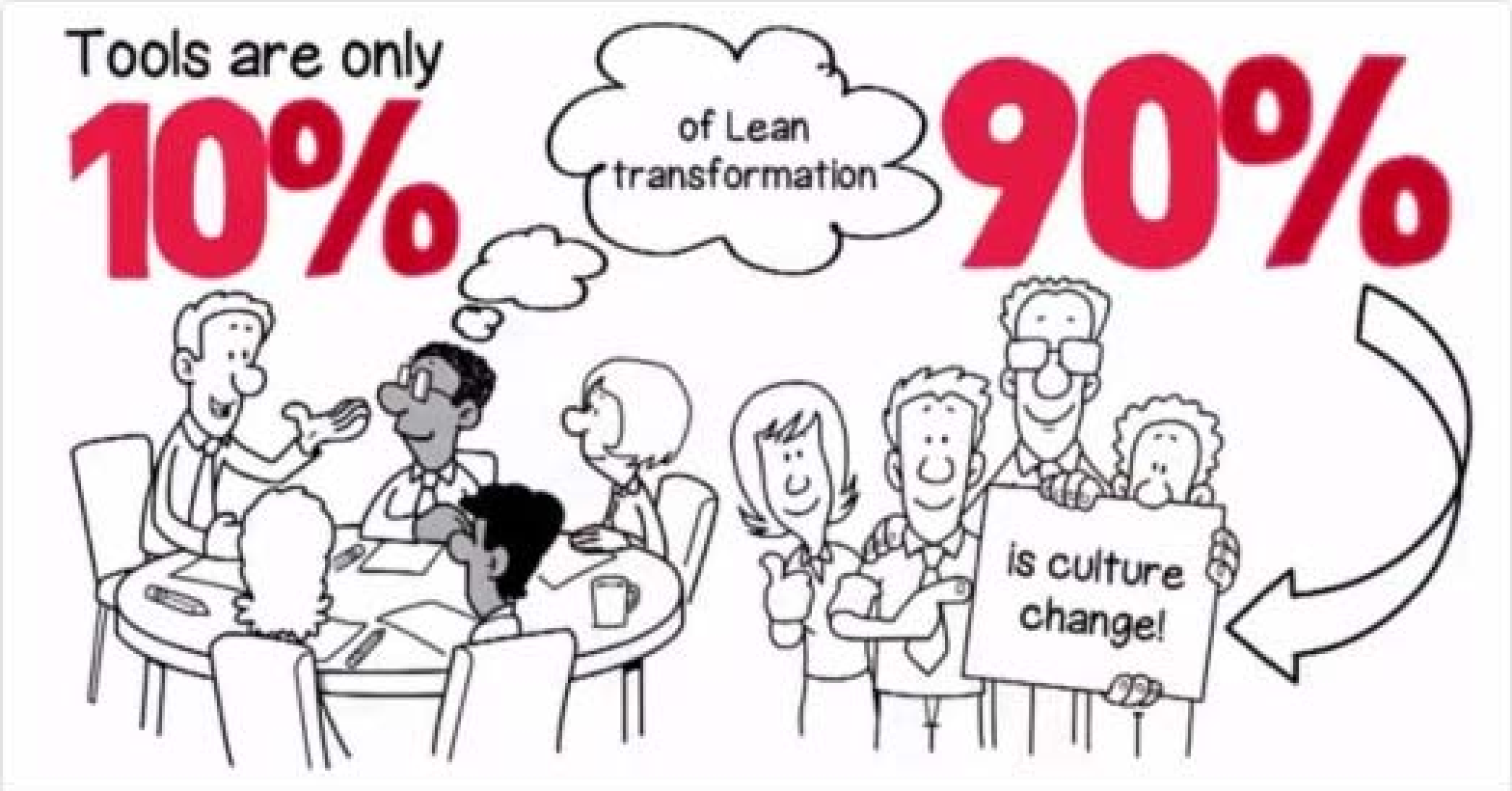


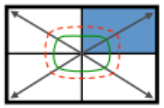
ABB Robotics Production System – Principle owners

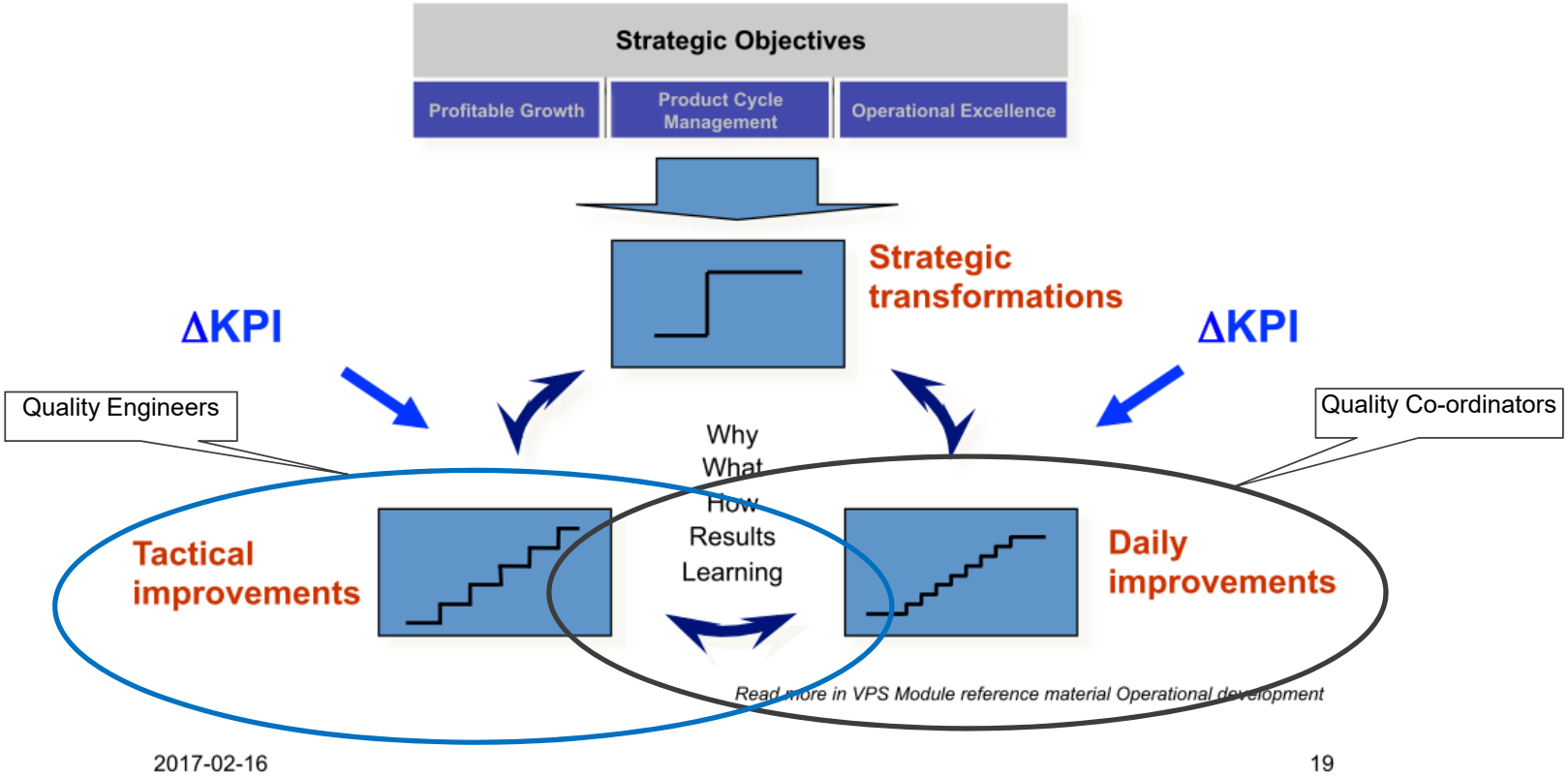


Why Lean is Wrongly Deployed - ASK FABRIZIO - LeanVlog

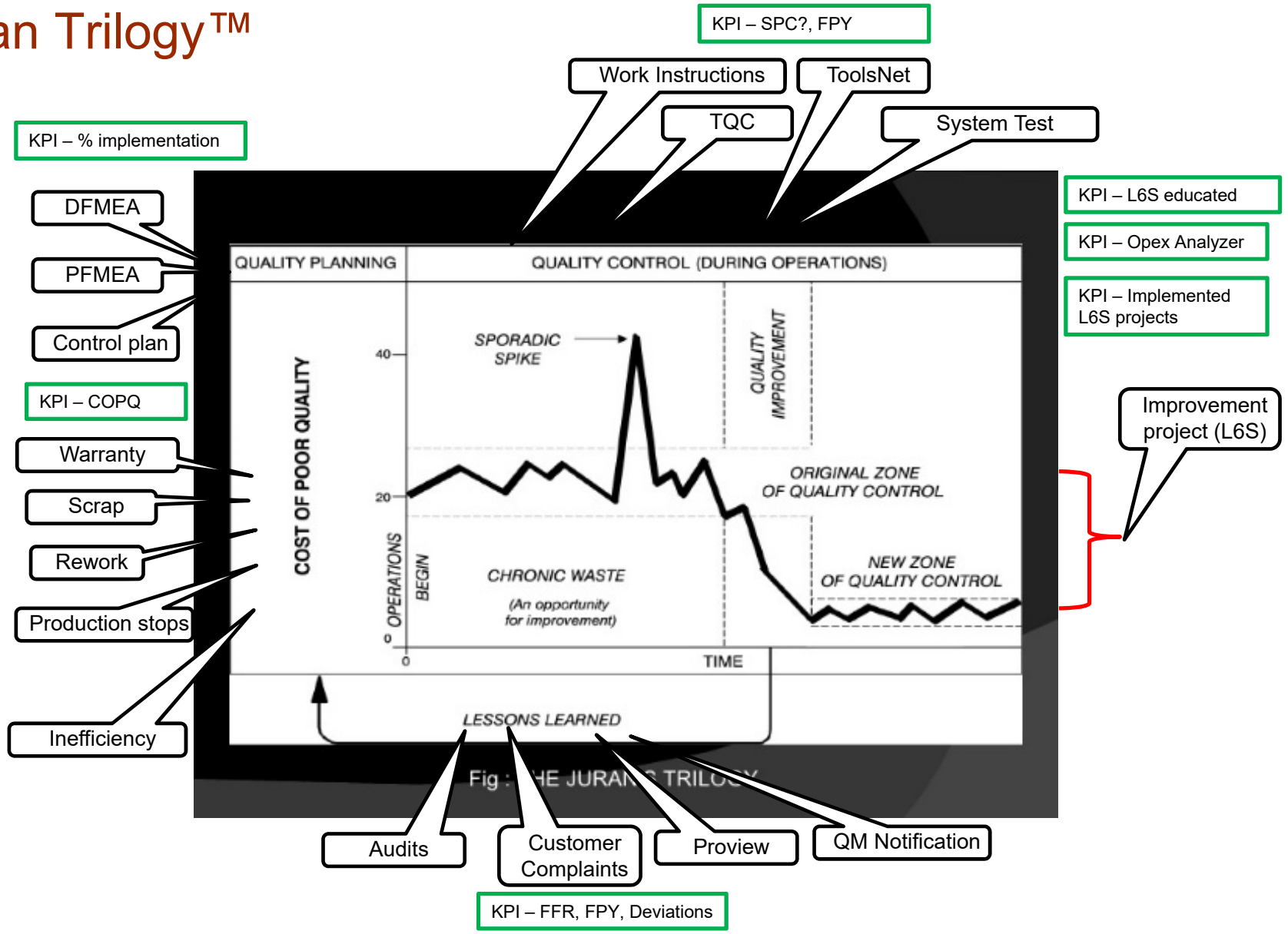
leanvlog.com

To build an effective change infrastructure – Implementing a process for policy deployment and improvement work

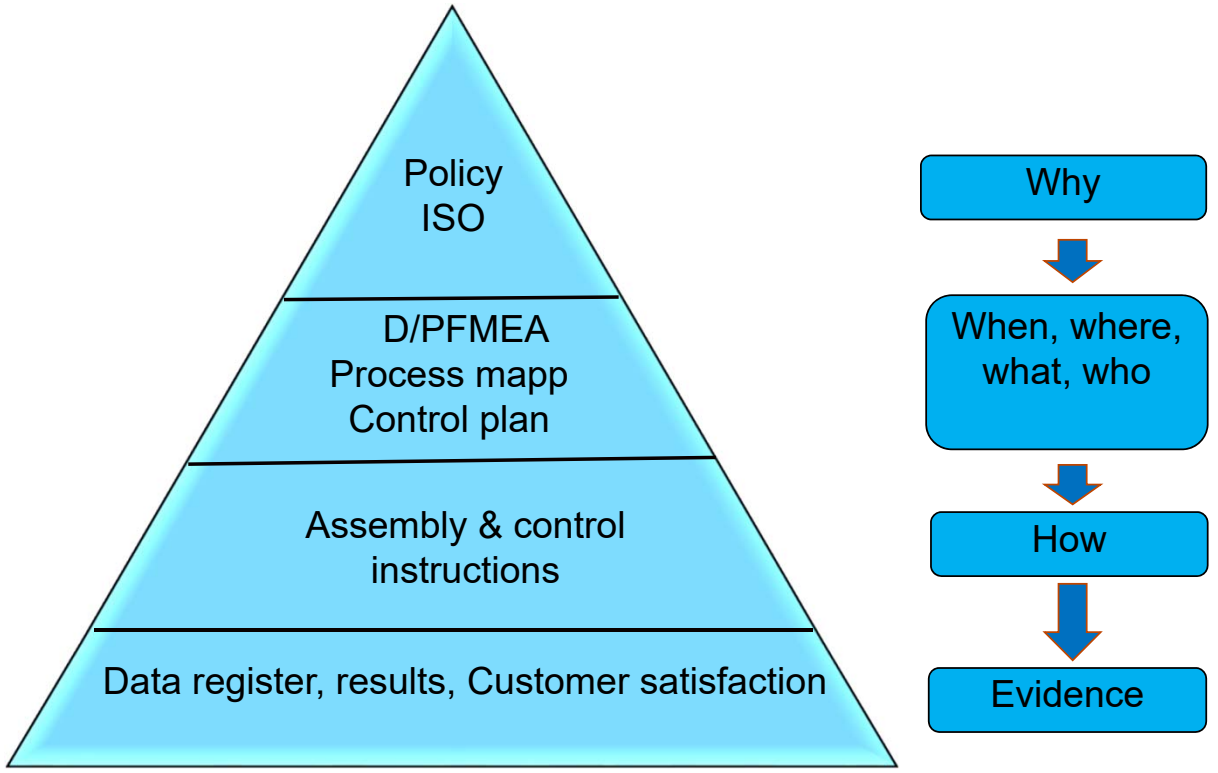




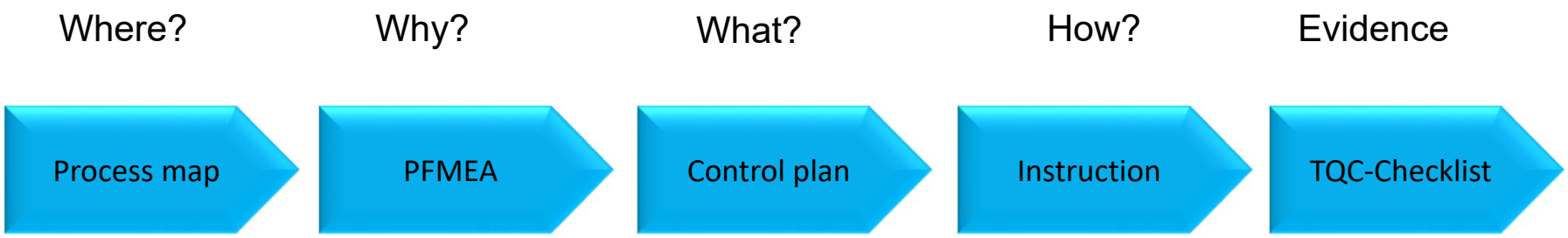
The Juran Trilogy™



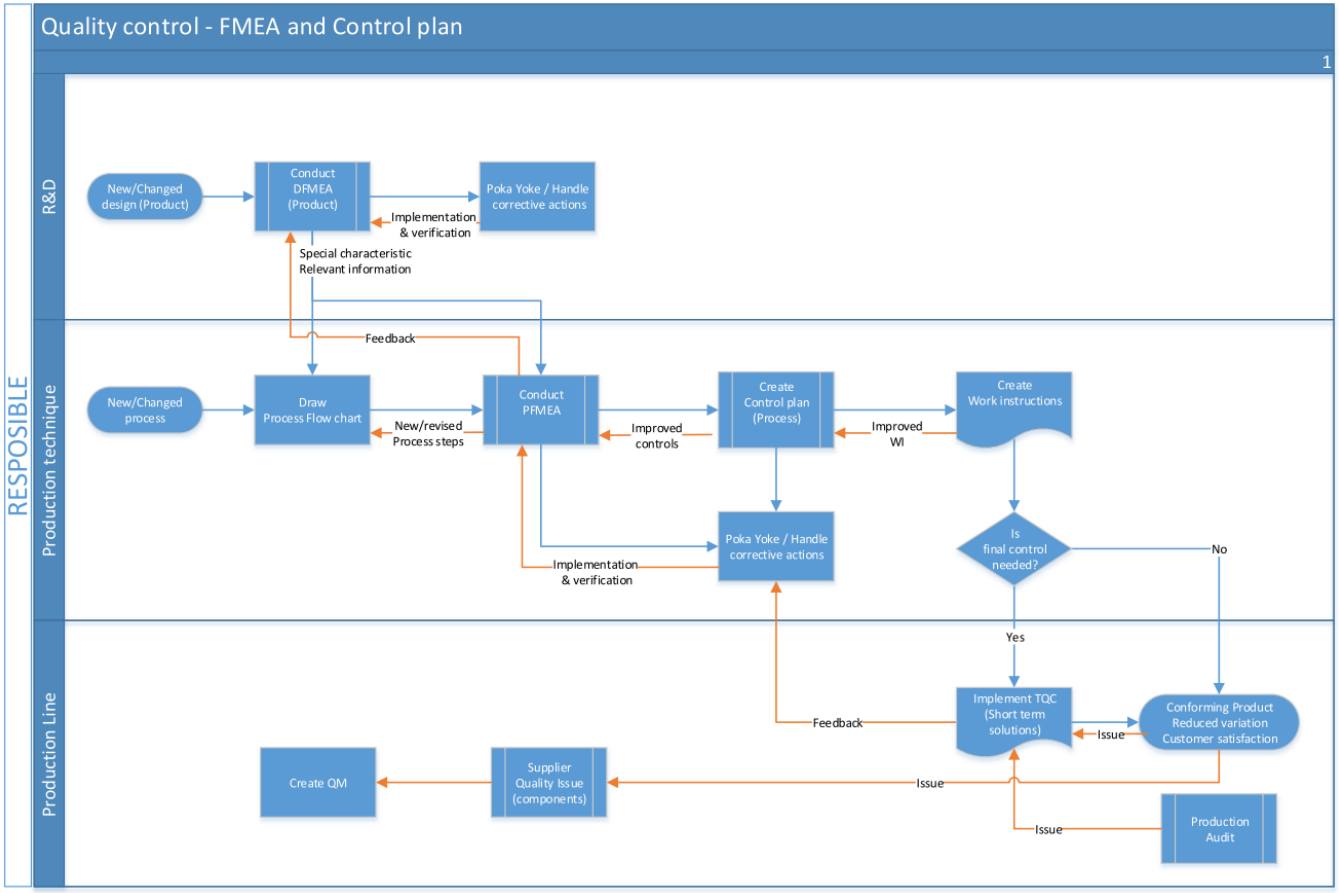
Quality Control



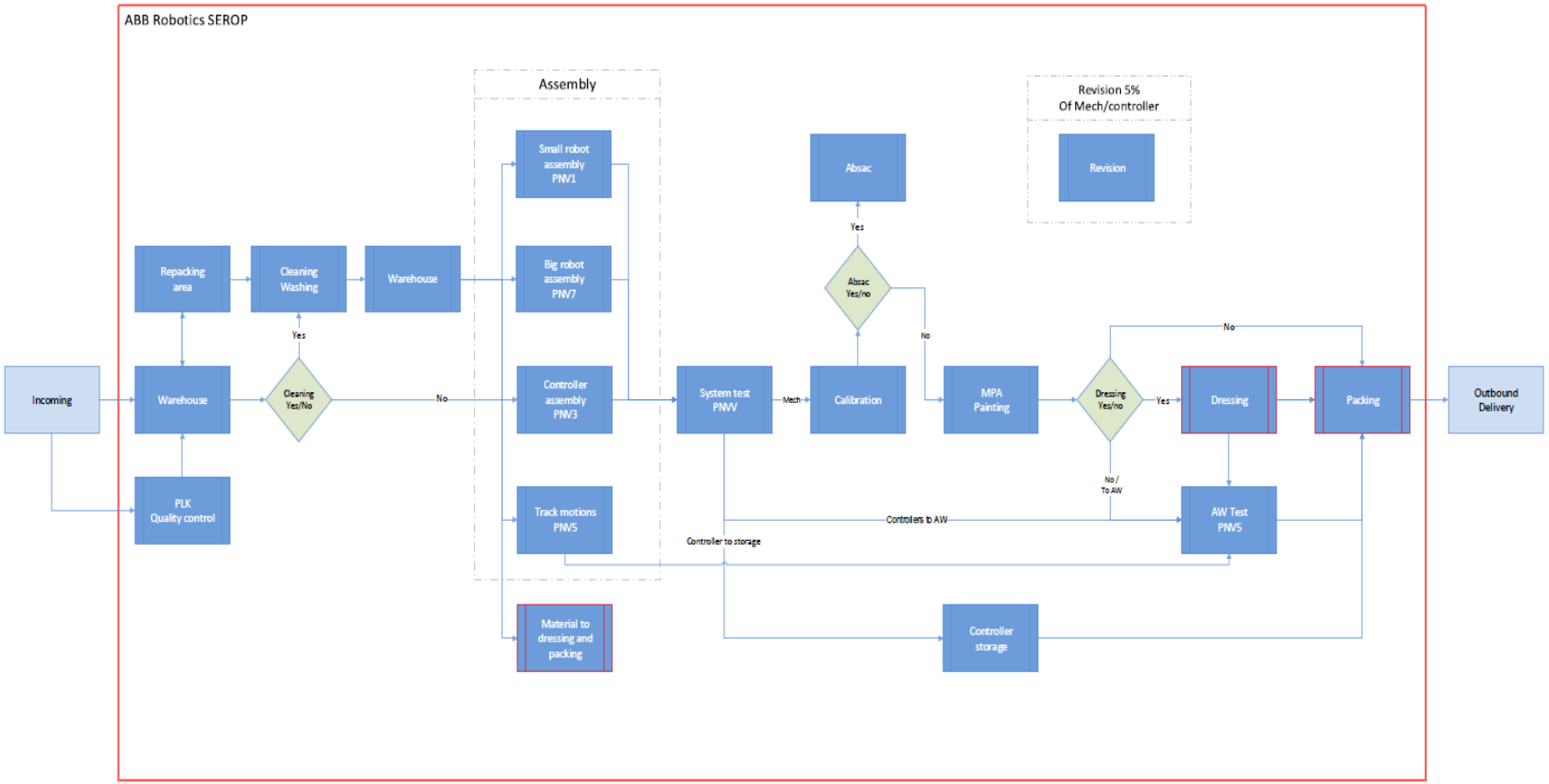
Quality Control Process



Input and Output (Process: DFMEA-PFMEA-CP-TQC)



P chart - Processkarta



PFMEA - *exempel*

Issuer, telephone			Date	Follow-up date/week	Remark					Customer			Articlenumber				
Anna Palmgren, 021-344411			2012-01-30														
Affected departments and/or supplier			Participant							Projectname, projectnumber			Name				
			P Johansson, M Olsson, K Engström, A Bovin, K Hart, A Palmgren							NGAR produktion Axel 1							
			Characteristics of failure				Rating				Action - Status				Rating			
No	Activity or component	Function (uppgift)	Failure mode (felsätt)	Causes of failure (felorsak)	Effects of failure (feleffekt)	Current controls	Occ	Sev	Det	RPN	Recommended action	Responsible	Priority	Actions taken	Occ	Sev	Det	RPN
4	axel 1	O-ring växel -fot	o-ringen kläms och eventuellt hamnar delvis inne i växeln	o-ringen hamnar ur läge. Förmodligen p.g.a. att stativet inte riktigt passar på växeln eftersom det inte hänger riktigt rakt.	läckage om o-ringen hamnar utanför och ännu värre om o-ringen hamnar inne i växeln.	täthetsprov	6	8	8	384	Fett pa o-ring, bra styrning av växel i fixturen. När atlas dragere installerats kan dragningen övervakas med momentvinkel=> indikation på att o-ring klämts			Fett på o-ring, bra styrning av växel i fixturen. Olika dim på o-ring testat. Atlasdragare införd. Loctite införd på förbandet.	2	8	8	128
5	Axel 1	O-ring centrumrör	O-ringen kläms	O-ringen ur läge	Läckage		2	8	8	128				test under prototypbygge	2	8	4	64
6	Centrumrör ax 1		Hanteringsskador	skadad tätningsyta	Läckage		3	8	8	192	Transportskydd, täthetsprovning	A Palmgren		Rören skyddas med plastnät under transport.	1	8	8	64
	Plaströr	Kablage skydd	Glömmer montera plaströret	Montör	Slitage kablage		3	5	4	60	TQC, avsyning	K Engström		Infört i avsyning	3	5	4	60

Control Plan

Control Plan															
Control Plan No	3HAC057763-001		Customer				Date (originated)	2016-02-22	Date (revision)						
Part Number / Revision	1		Customer Contact				Customer Eng. Approval								
Part Name / Description	IRB6700		Plan Prepared By	Ken Huynh			Customer Quality Approval								
Part / Process No	Process Name / Operation	Tool/Jig	Characteristic No	Characteristic Product	Characteristic Process	Characteristic Class	Methods Product / Process /	Methods Evaluation	Methods Sample		Methods Control method	Reaction Plan	Instruction	Comments	
Assembly axis 4															
1	Assembly axis 4														
1.1	Tightness test of gearbox 3-4			No leakage			Correct pressure according to tightness instruction 3HAC 12086-1.	Green/Red lights	100%	continuously	Automatic with Test equipment	If test fail check the connections and seals with leak spray. Adjust and recheck		If the source of the leak cannot be found, the object must be sent out for repair.	
1.2	Oil filling axis 3-4				Filling with correct oil amount		Correct oil amount acc. to specification for the axis	Check that scanned volume and Receipt are the same	100%	continuously	Check Receipt	Adjust to right volume manually		Filling instruction 3HAC12086-3	
1.3	Grease amount				Filling with correct grease		Correct grease amount acc. to specification	Check that scanned volume and Receipt are the same	100%	continuously	Check Receipt	Adjust to right volume manually			
1.4	Dial indicator	Press tool			Adjusting the friction		Correct friction interval indication 18-30.	Visual inspection	100%	continuously	Dial indicator	Adjust and recheck	3HAC043954-006 LL / HL 3HAC048394-006 PL		

«It has become evident that quality competitiveness for the years ahead requires a new basic approach. Merely adding new methods or tools to the traditional approach is not enough. The new basic approach is centered around the concept of enlarging the strategic business plan to include quality goals. The processes for meeting these quality goals then parallel the process long used for meeting tradition goals such as for sales, product development and profit»

– Juran on Leadership for Quality 1989, page 12

May 21, 2018

Will Rogers, who died in a 1935 plane crash in Alaska with bush pilot, Wiley Post, was one of the greatest political/country/cowboy sages ever known.)

Some of his sayings:

1. Never slap a man who's chewing tobacco.
2. Never kick a cow chip on a hot day.
3. There are two theories to arguing with a woman. Neither works.
4. Never miss a good chance to shut up.
5. Always drink upstream from the herd.
6. If you find yourself in a hole, stop digging.
7. The quickest way to double your money is to fold it and put it back into your pocket.
8. There are three kinds of men:
   The ones that learn by reading.
   The few who learn by observation.
   The rest of them have to pee on the electric fence and find out for themselves.
9. Good judgment comes from experience, and a lot of that comes from bad judgment.
10. If you're riding' ahead of the herd, take a look back every now and then to make sure it’s still there.
11. Lettin' the cat outta the bag is a whole lot easier'n than puttin' it back in.
12. After eating an entire bull, a mountain lion felt so good he started roaring. He kept it up until a hunter came along and shot him.
    The moral: When you're full of bull, keep your mouth shut.