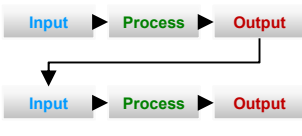


Define

**Relevance of Topic:** 36%

**Suitable for:** Six Sigma

**Own contribution:** 80%



- Voice of Customer & Business
- Requirements and Deviations
- Severity of Problems of Outputs

Project-Charter	
Business Relevance	Problem
Scope/ Objectives	Experts Belt-Team Management

- Input
- Requirements and deviations
- negative Influences on Problems

- Process-Steps > Activities
- Input, Output, Methods & Resources
- negative Influences on Problems

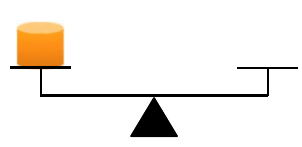
		Problems (Y)			
		Y1	Y2	Y3	Yn
Input (Xi)	Xi1		3		
	Xi2				1
	Xin			4	
Process-Steps (Xp)	Xp1	2			
	Xp2			5	
	Xpn		7		

Problems (Y)	Operationalisation		Graphical Display	
	Y1	Y2	Y3	Yn
Input (Xi)	Xi1			
	Xi2			
	Xin			
Process-Steps (Xp)	Xp1			
	Xp2			
	Xpn			

**Risk: 14%**

There is a/ no Difference in: the degree of: (Y) ... between: Levels of (x)

**Test: ANOVA**



12

9 3

6

011011102200801  
110114051978101  
101501195801001  
010100101010101  
001110100110011

**Application & Support:**

- Red: Management (Sponsor, Accountable)
- Yellow: Belt (Black-Belt/ Green-Belt)
- Green: Experts

**Identify Project**

- collect project topics
- evaluate topics
- prioritize topics
- select project

**Define Project**

- process and output
- problem
- effect
- solution ideas (if present)

**SIPOC (Supplier-Input-Process-Output-Customer)**

- structure process into the main process steps
- assign inputs and (intermediate) outputs
- assign supplier and customer

**VoC/ VoB > CCR/ CBR > CtQ**

- interview customer/ manager
- derive requirements for outputs and evaluate their deviations
- derive problems Y of the output and their severity

**Project-Charter**

- focus on critical problems Y
- specify their business relevance
- define scope and objectives
- build a team

**Input-Analysis**

- identify necessary inputs
- specify the requirements
- specify negative influences xi of inputs on the output/ problems Y

**Process-Mapping & -Analysis**

- map process steps into activities
- assign inputs and outputs
- specify methods & resources
- specify neg. influences xm/ xr

**Cause & Effect-Matrix (C&E)**

- evaluate impact strength of the negative influences of inputs xi, methods xr and resources xr on the outputs/ problems Y

**Data-Collection-Plan**

- operationalize influences xi, xm, xr and problems Y as measurands
- determine scale level
- determine conditions and procedure of measurement

**Hypotheses**

- automatically generated with:
  - type of hypothesis (Difference/ Relationship)
  - relevance of hypothesis (Risk)
  - appropriate statistical tests

**Measurement-System-Analysis**

- check repeatability, reproducibility, stability and linearity of the measurement system
- Gage R&R

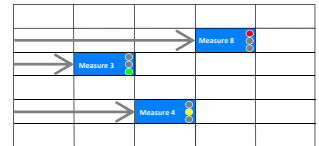
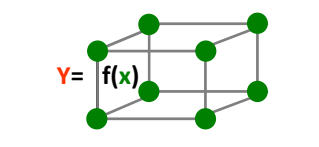
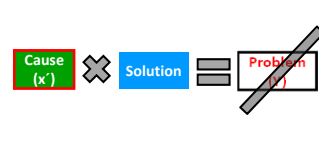
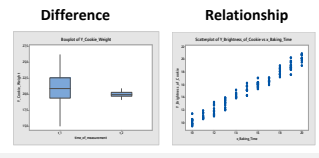
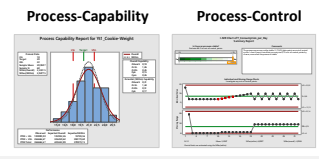
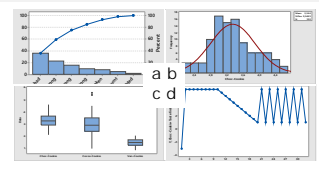
**Collect Data**

- collect existing data
- measure actual data
- according to Data-Collection-Plan

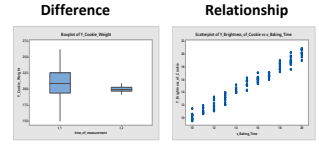
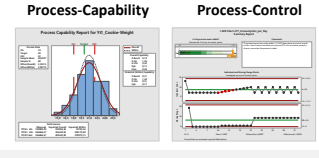
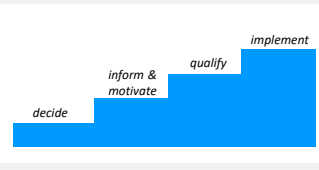
**Focus:**

- Y Problem
- X Influence/ Cause
- Z Effect
- S Solution
- P Project Management

Analyse



Measure	Yield	Defects	Cost	Time
Measure 1				
Measure 2				
Measure 3				
Measure 4				
Measure 5				



Plan Process Monitoring and Out of Control Measures	Document Project and present Results	Define Standards for the new Process
Start Continuous Improvement (CIP)	Continue checking Target Achievement	Continue checking Process Capability

**Tools:**

- sigmaGuide®
- Minitab®

**Graphical Data Evaluation**

- a) Pareto-Chart
- b) Histogram
- c) Boxplot
- d) Time Series Plot

**Process-Capability/ -Control**

- Yield%/ DPU/ DPMO
- Z.Bench (Sigma Level)/ cp/ cpk ...
- I-MR/ xbar-R/ xbar-S/ P-/ U-Chart as baseline of the process

**Test Hypothesis**

- Difference-Hypothesis:  $Y_a \neq Y_b$
- Relationship-Hypothesis:  $Y \neq f(x)$

**Root-Cause-Analysis**

- identify root-causes x' of the negative influences x on the problems Y

**Solution-Ideas**

- develop solutions to eliminate, circumvent or adjust parameter of the root-causes x'
- prioritize solutions

**Design of Experiments (DoE)**

- adjust significant/ relevant parameters x to optimize Y

**Action-List**

- specify solutions as measures (Who?/ What?/ until When?)

**FMEA (Failure Mode and Effects Analysis)**

- minimize risks of measures

**Implementation**

- decide on measures
- inform and motivate
- qualify (if necessary)
- implement measures

**Process-Capability/ -Control**

- Yield%/ DPU/ DPMO
- Z.Bench (Sigma Level)/ cp/ cpk ...
- I-MR/ xbar-R/ xbar-S/ P-/ U-Chart for the improved process

**Test Hypothesis**

- Difference-Hypothesis:  $Y_a \neq Y_b$
- Relationship-Hypothesis:  $Y \neq f(x)$

**Sustainability, Documentation**

- Process-Management-Plan
- Project-Story-Book

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Improve

Control

Measure

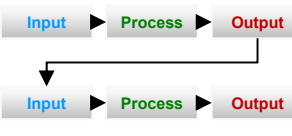
**Application & Support:**

- Red: Management (Sponsor, Accountable)
- Yellow: Belt (Black-Belt/ Green-Belt)
- Green: Experts

**Relevanz des Themas:** 36%

**Tauglichkeit für:** Six Sigma

**eigener Beitrag:** 80%



**Voice of Customer & Business**

**Anforderungen und Abweichungen**

**Schwere der Probleme des Outputs**

Project-Charter	
Business-Relevanz	Problem
Scope/ Ziele	Experten Belt-Team Management

**Input**

**Anforderungen und Abweichungen**

**negative Einflüsse auf Probleme**

**Prozess-Schritte > Aktivitäten**

**Input, Output, Methoden & Ressourcen**

**negative Einflüsse auf Probleme**

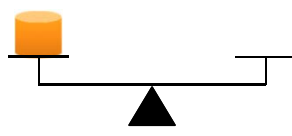
Input (Xi)	Xi1	Problems (Y)			
		Y1	Y2	Y3	Yn
			3		
				4	1
Process-Steps (Xp)	Xp1	2			
	Xp2			5	
	Xpn		7		

Problems (Y)	Operationalisation		Graphical Display	
	Y1	Y2	Y3	Yn
Y1				
Y2				
Y3				
Yn				
Input (Xi)	Xi1	Xi2	Xi3	Xi4
Xi1				
Xi2				
Xi3				
Xi4				
Process-Steps (Xp)	Xp1	Xp2	Xp3	Xpn
Xp1				
Xp2				
Xp3				
Xpn				

**Risiko: 14%**

Es gibt (k)einen Unterschied in: Ausmaß von (Y) ... zwischen: Stufen von (x)

**Test: ANOVA**



12 011011102200801

9 110114051978101

3 101501195801001

010100101010101

6 001110100110011

**Ausführung & Support:**

- Management (Sponsor, Accountable)
- Belt (Black-Belt/ Green-Belt)
- Experten

**Projekt identifizieren**

- Themen einsammeln
- Themen bewerten
- Themen priorisieren
- Projekte auswählen

**Projekt definieren**

- Prozess und Output
- Problem
- Wirkung
- Lösungs-Ideen (falls vorhanden)

**SIPOC (Supplier-Input-Process-Output-Customer)**

- Prozess in die wichtigen Prozess-Schritte gliedern
- Inputs und (Zwischen-) Outputs zuordnen, ebenso wie Lieferanten und Kunden

**VoC/ VoB > CCR/ CBR > CtQ**

- Kunden/ Manager befragen
- Anforderungen an Outputs und deren Abweichungen ableiten
- Abweichungen bewerten und Schwere der Probleme Y ableiten

**Project-Charter**

- kritische Probleme Y fokussieren
- Business-Relevanz ableiten
- Scope und Ziele definieren
- Team zusammenstellen

**Input-Analyse**

- notwendige Inputs identifizieren
- Anforderungen an Inputs konkretisieren
- negative Einflüsse xi auf Probleme der Outputs Y ableiten

**Prozess-Mapping & -Analyse**

- Prozess-Schritte in Aktivitäten gliedern
- Inputs & Outputs, Methoden & Ressourcen zuordnen
- Neg. Einflüsse xm/ xr ableiten

**Cause & Effect-Matrix (C&E)**

- Stärke der negativen Einflüsse der Inputs xi, Methoden xm und Ressourcen xr auf die Probleme des Outputs Y bewerten

**Daten-Erhebungs-Plan**

- Einflüsse x und Probleme Y als Messgrößen operationalisieren
- Bedingungen und Prozedur der Messung konkretisieren

**Hypothesen**

- automatisch erzeugt mit:
  - Typ der Hypothese (Unterschied/ Zusammenhang)
  - Relevanz der Hypothese (Risiko)
  - angemessener statistischer Test

**Mess-System-Analyse**

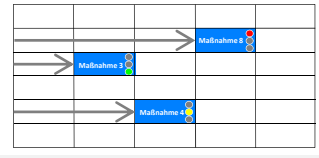
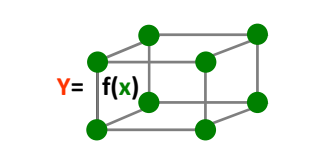
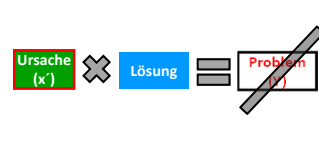
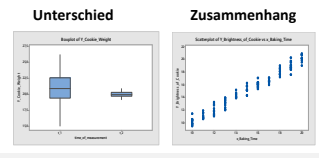
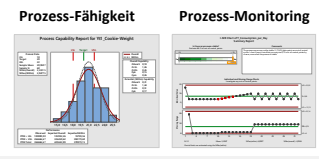
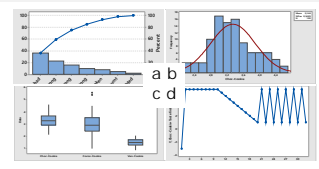
- Wiederholbarkeit und Reproduzierbarkeit, Stabilität & Linearität des Mess-Systems prüfen
- Gage R&R

**Daten erheben**

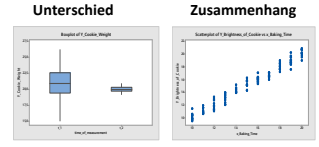
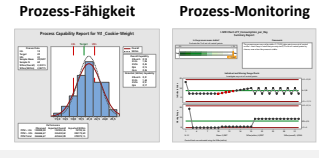
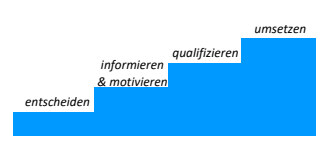
- vorhandene Daten abrufen
- aktuelle Daten messen
- Gemäß Daten-Erhebungs-Plan

**Fokus:**

- Problem
- Einfluss/ Ursache
- Effekt
- Lösung
- Projekt Management



Problem	Ursache	Maßnahme	Ergebnis
		Maßnahme 8	
		Maßnahme 5	
		Maßnahme 4	



**Plan für das Prozess-Monitoring und Notfall-Maßnahmen erstellen**

**Story-Book zum Projekt abschließen und Ergebnisse präsentieren**

**Definiere Standards für den neuen Prozess**

**Beginne mit dem kontinuierlichen Verbesserungs-Prozess (KVP)**

**Setze die Überprüfung der Zielerreichung fort**

**Setze die Überprüfung der Prozessfähigkeit fort**

**Tools:**

- sigmaGuide©
- Minitab©

**Daten graphisch analysieren**

- a) Pareto-Diagramm
- b) Histogramm
- c) Boxplot
- d) Zeitreihen-Diagramm

**Prozess-Fähigkeit/-Monitoring**

- Yield%/ DPU/ DPMO
- Z.Bench (Sigma Level)/ cp/ cpk ...
- I-MR/ xbar-R/ xbar-S/ P-/ U-Chart als Baseline des Prozesses

**Hypothesen-Tests**

- Unterschieds-Hypothese:  $Y_a \neq Y_b$
- Zusammenhangs-Hypothese:  $Y \neq f(x)$

**Ursache-Wirkungs-Analyse**

- Basis-Ursachen x' der negativen Einflüsse x auf die Probleme Y identifizieren

**Lösungs-Ideen**

- Lösungs-Ideen entwickeln, mit denen die Basis-Ursachen x' eliminiert, umgangen oder optimal justiert werden können
- Lösungsideen priorisieren

**Design of Experiments (DoE)**

- justiere signifikante/ relevante Parameter x zur Optimierung von Y

**Maßnahmen-Liste**

- Lösungen in konkrete Maßnahmen überführen (Wer?/ Was?/ bis Wann?)

**FMEA (Failure Mode and Effects Analysis)**

- Risiken der Maßnahmen minimieren

**Umsetzung**

- entscheide über Maßnahmen
- informiere & motiviere
- qualifiziere (wenn notwendig)
- setze Maßnahmen um

**Prozess-Fähigkeit/-Monitoring**

- Yield%/ DPU/ DPMO
- Z.Bench (Sigma Level)/ cp/ cpk ...
- I-MR/ xbar-R/ xbar-S/ P-/ U-Chart zur verbesserten Prozess-Leistung

**Hypothesen-Tests**

- Unterschieds-Hypothese:  $Y_a \neq Y_b$
- Zusammenhangs-Hypothese:  $Y \neq f(x)$

**Nachhaltigkeit & Dokumentation**

- Process-Management-Plan
- Project-Story-Book

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