



Yalın Altı Sigma

Metot ve araçları

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2023

Kalite Yönetim Stratejisi

Süreç iyileştirme girişimleri (kuşak programları)

Kalite seviyesi - 1 milyonda 4 hata

Yöneticiler

- ✓ Üst
- ✓ Orta
- ✓ Saha

Uzmanlar

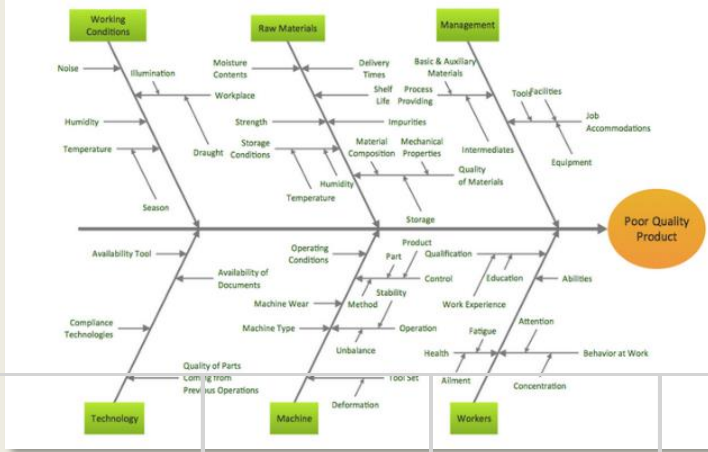
- ✓ Kalite
- ✓ Planlama
- ✓ İK
- ✓ Mühendislik
- ✓ İmalat
- ✓ ...



Üst Yönetim

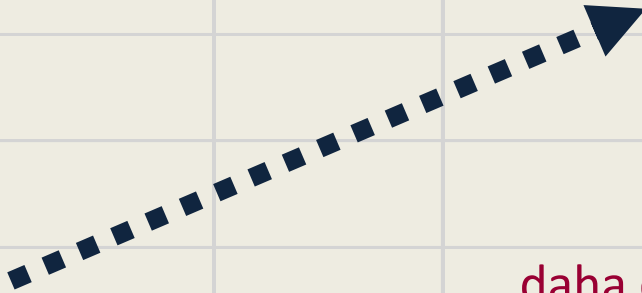
Altı Sigma metot ve araçları

Bilgi, sağduyu, deneyim



A

B



Daha iyi .. ?

.. daha kısa zamanda

.. daha kaliteli

.. daha düşük maliyetle

SOMUT, ÖLÇÜLEBİLİR İYİLEŞME

$$f(x) \Rightarrow Y$$

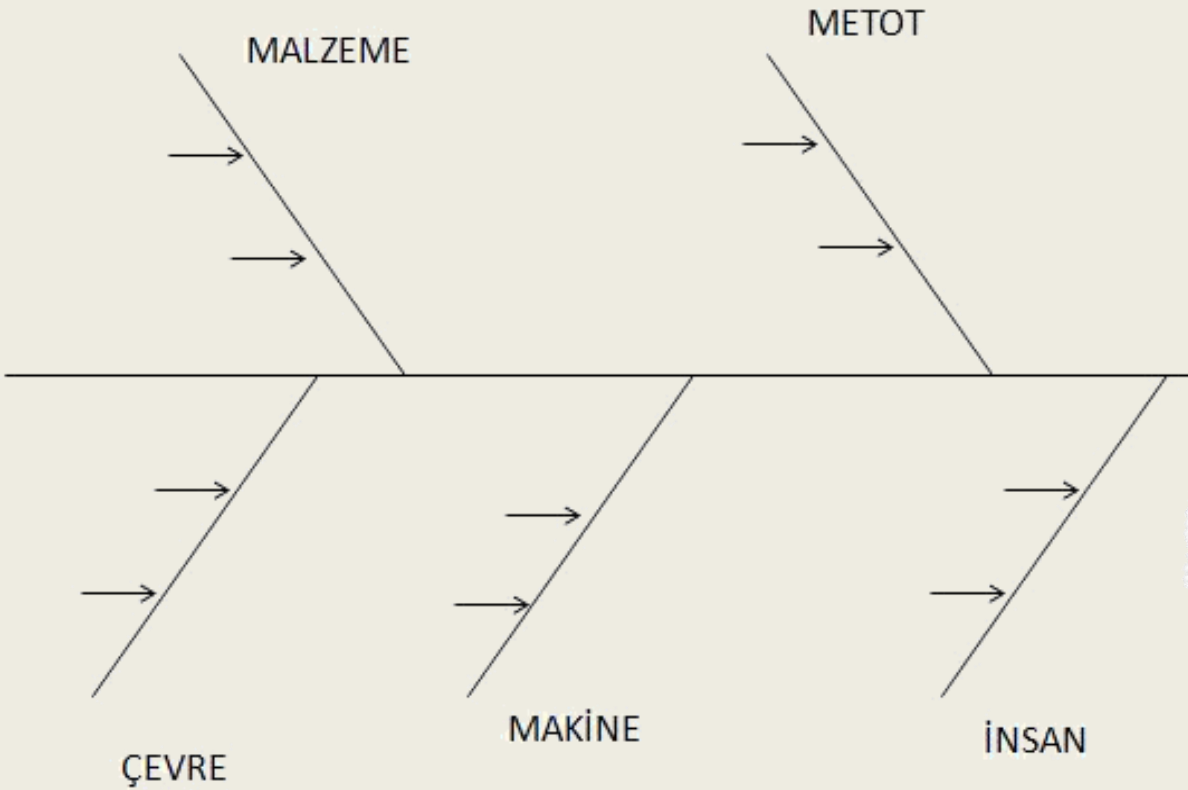
Sebepler

Sonuç

Yediklerimiz
Genetik
Uyku
Spor
Stress
....



Sağlık



$$f(x) \Rightarrow y$$

PARA

Kar / Zarar
Satışlar
Pazar Payı
Maliyetler
Ödemeler

.....

.....

....



ZAMAN

Terminler
Çevrim
Bakım süresi

.....

.....

.....

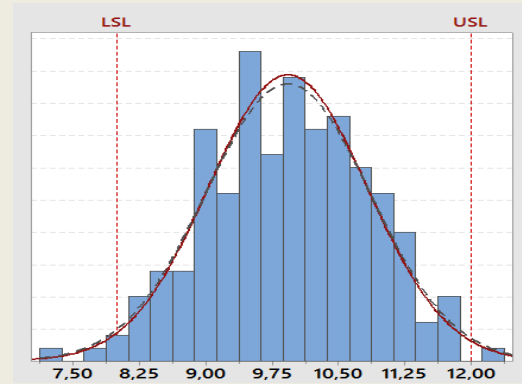
KALİTE

İmaj
Ürün desteği
Müşteri/çalışan memnuniyeti

.....

Max

**Kârlılık, Üretim, Verimlilik, Kalite,
Pazar payı, Müşteri memnuniyeti, Yetkinlik, Süreklilik**

Optimize

**Maliyet, Değişkenlik, Çevrim süreleri, Hatalar, Kayıplar,
Şikayetler, Devamsızlık, İş kazaları...**

Min

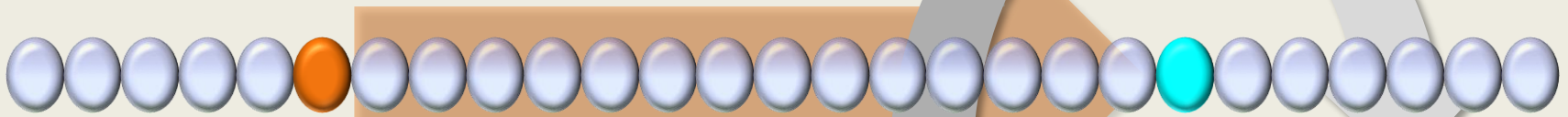
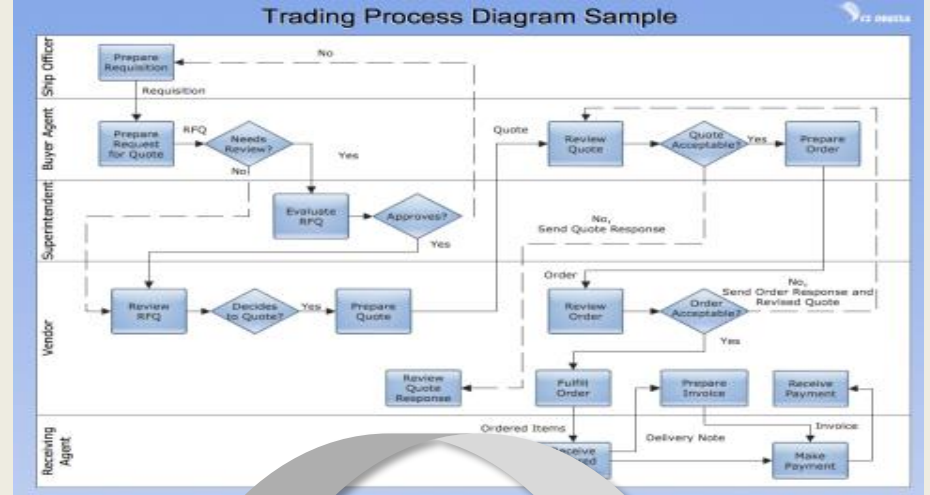
Hedefi ve sonucu olan ...

Kaynak kullanan

- İnsan
- Mekan
- Makine
- Malzeme
- Enerji

...

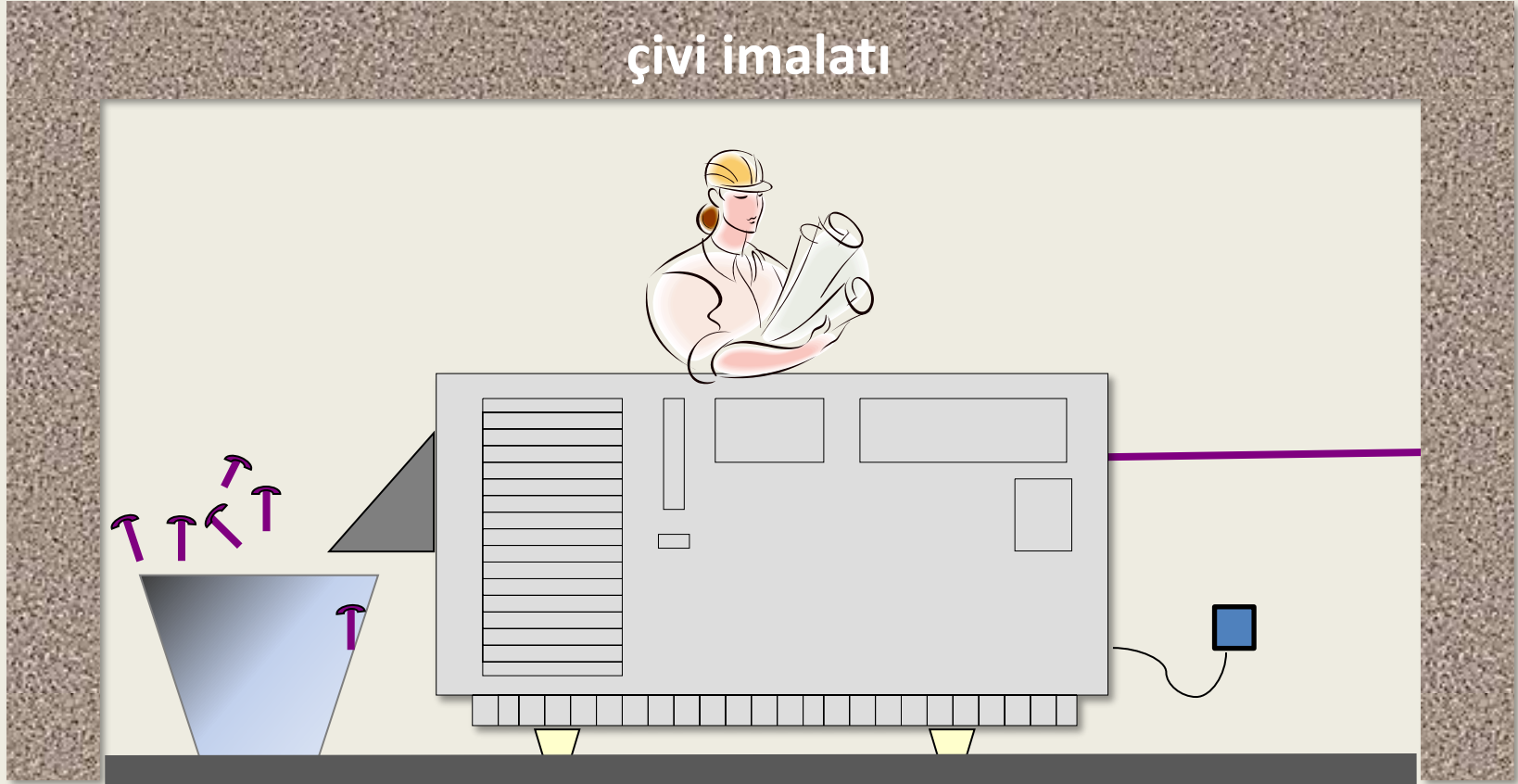
Zamana yayılmış, ilgili faaliyetler



proje

Fark ... tekrar

proses



Çiviler = f (İnsan, Makine , Tesis, Malzeme, Metot, Enerji ...)

Y

x1

x2

x3

x4

x5

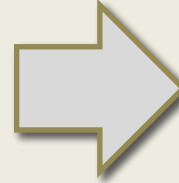
x6



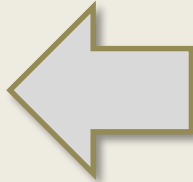
Maliyet

Süre

Test sonuçları

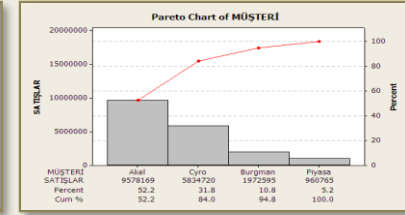
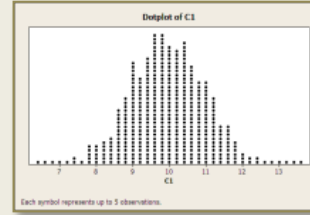


Motor Çevrim



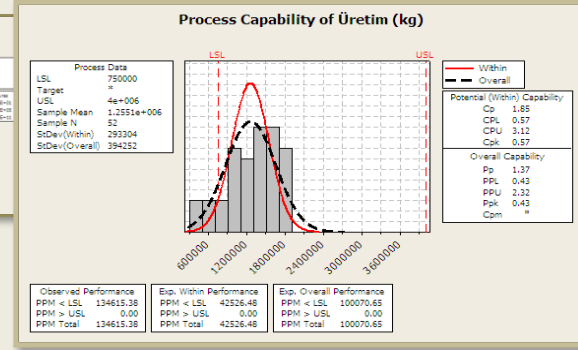
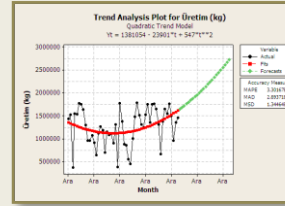
**GRUPLAMA
AYRIŞTIRMA**

Histogram
Pie – Pareto
Box , Interval Contour ..



İZLEME

Time Series
Trend, Tahmin

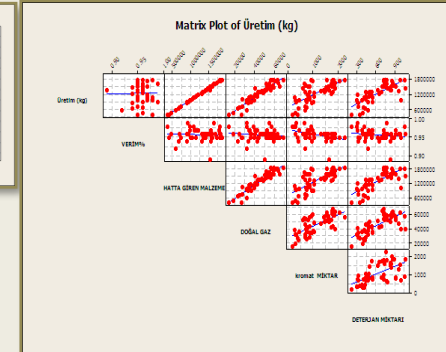
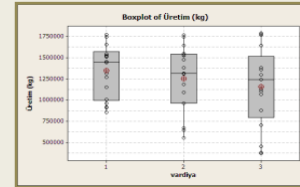


ÖLÇME

Gage R & R (MSA)
Yeterlilik
Kontrol vs Teknoloji Matrix

KIYASLAMA

Hipotez testleri
ANOVA

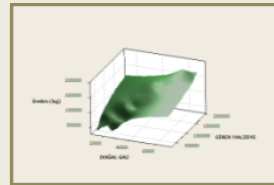


İLİŞKİLENDİRME

Basit & Çoklu Regresyon

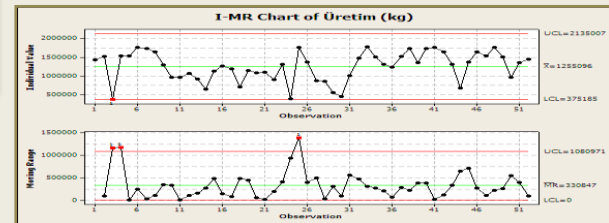
DENEME

Deney Tasarımları



KONTROL

İstatistiksel Proses Kontrol



$$Y = f(x)$$



TÖÇİK

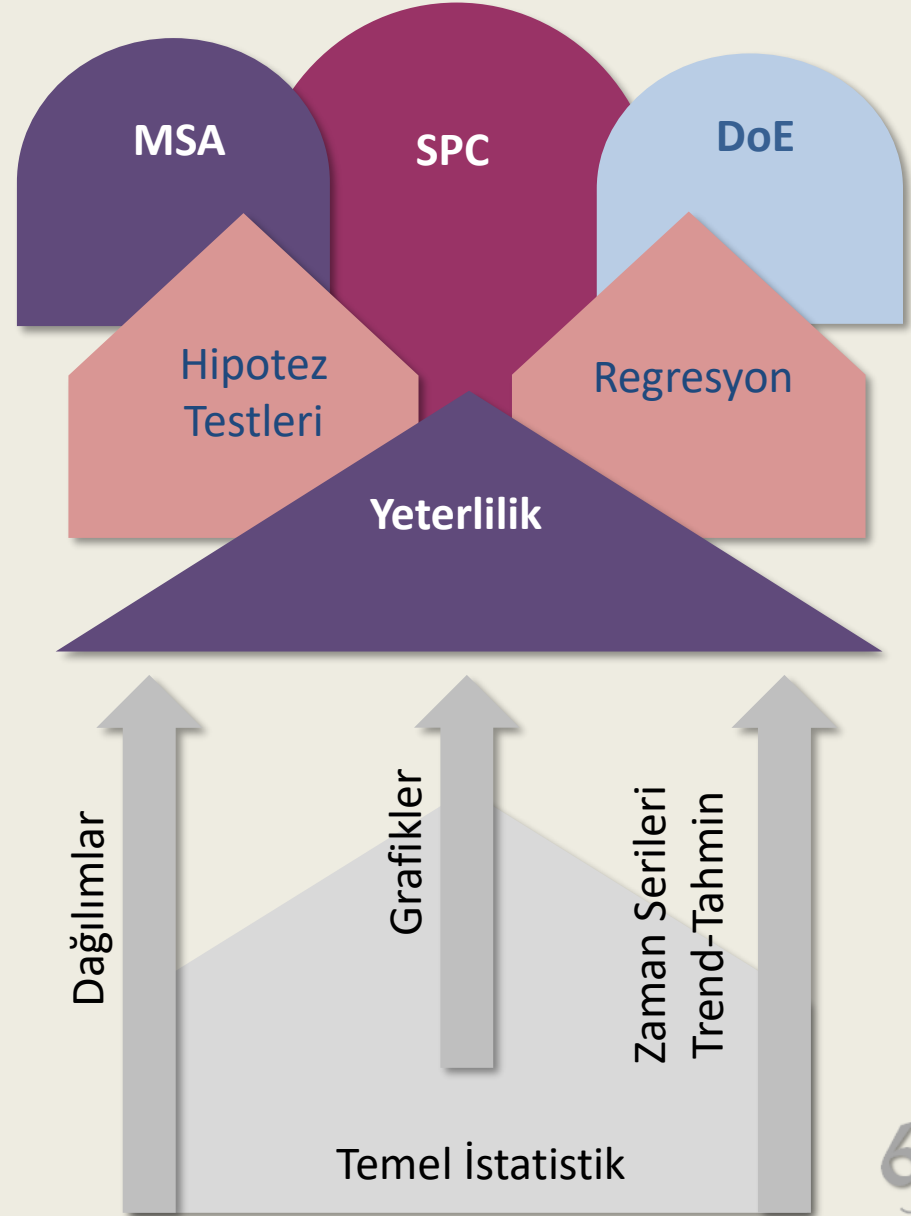
Gerçek, basit, önemli, verisi bol bir süreç bul

Mevcut sürecin performansını ve potansiyelini ölç

Sonuca etki edebilecek ana ve kritik faktörleri belirle

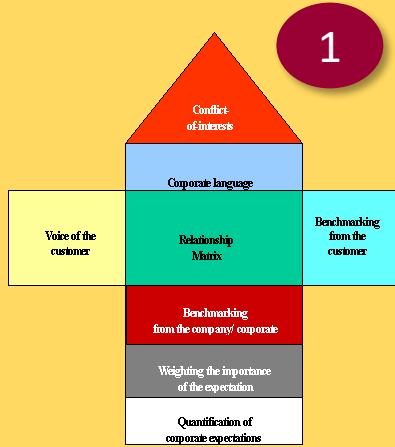
Değişkenliği azalt, min-max-opt

İyileşmenin kalıcı olmasını sağla

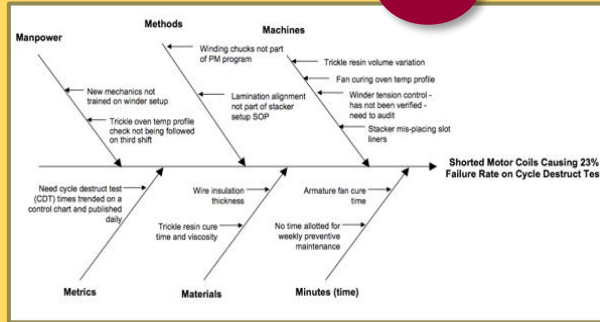


hafta	Gün oturum	1. saat	ara	2. saat
1	1	Altı sigma tanıtım		Metot ve araçlar
1	2	Müşterinin sesi		Kalite Fonksiyonu Yayılımı (QFD)
2	3	Tanımsal istatistik		Grafikler
2	4	Balık kılıçığı (Ishikawa)		Proje belirleme
3	5	Trend - tahmin modelleri		Mevsimsellik
3	6	Olasılık		Dağılımlar
4	7	Yeterlilik (Z)		Yeterlilik Cp Pp
4	8	Kontrol-Teknoloji matrisi		Proses haritalama
5	9	Bireysel danışmanlık		Bireysel danışmanlık
5	10	Sunumlar I		Sunumlar II
6	11	Hipotez testleri I		Hipotez testleri II
6	12	Hipotez testleri III		Optimizasyon
7	13	Regresyon I		Regresyon II
7	14	Regresyon III		Optimizasyon
8	15	Deney tasarımları I		Deney tasarımları II
8	16	Tepki yüzeyi analizi		Optimizasyon
9	17	Kontrol şemaları I		Kontrol şemaları II
9	18	Ölçüm sistemleri (MSA) I		Ölçüm sistemleri (MSA) II
10	19	sunumlar		sunumlar
10	20	sınav		yol haritası / kapanış
11	21	Bireysel Danışmanlık		Bireysel Danışmanlık
11	22	Bireysel Danışmanlık		Bireysel Danışmanlık
		Konu anlatımı		Kuşak adayı
		Ortak çalışma		Bireysel danışmanlık
		örnek vaka, konu tekrarı, soru cevap, paylaşım		

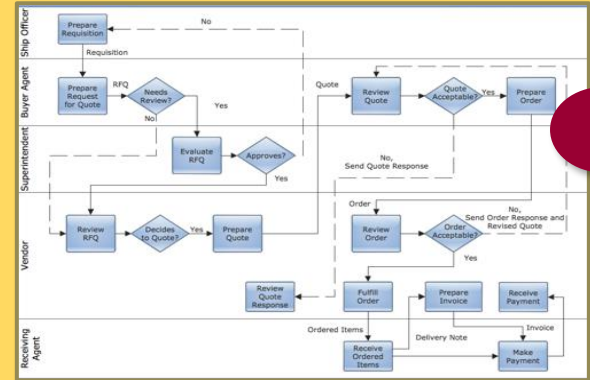
hafta	Gün	sabah (9-12)	ara	ö.sonra (13-16)
1	1	Altı sigma tanıtım		Kalite Fonksiyonu Yayılımı (QFD)
1	2	Tanımsal istatistik		Balık kılıçığı (Ishikawa)
2	3	Grafikler		Zaman serileri
2	4	Mevsimsellik		Proje belirleme
3	5	Olasılık, dağılımlar		Yeterlilik (Z)
3	6	Yeterlilik (Cp Pp)		Kontrol-Teknoloji matrisi
4	7	Hipotez testleri		Regresyon
4	8	Çoklu modeller		Optimizasyon
5	9	Deney tasarımları-1		Deney
5	10	Deney tasarımları-2		Sunumlar-1
6	11	Kontrol şemaları		Ölçüm sistemi
6	12	Sunumlar-2		Sınav / Yol haritası
		Bireysel Danışmanlık		Bireysel Danışmanlık
		Bireysel Danışmanlık		Bireysel Danışmanlık



1



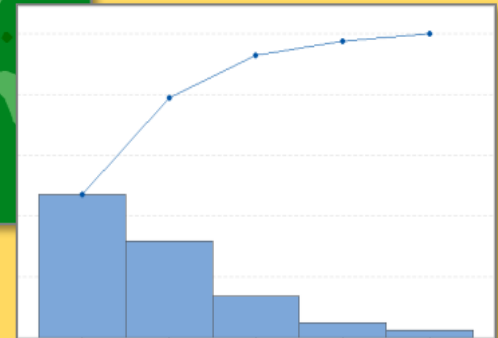
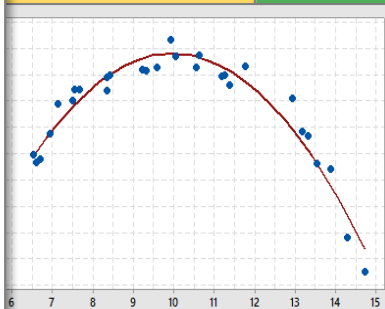
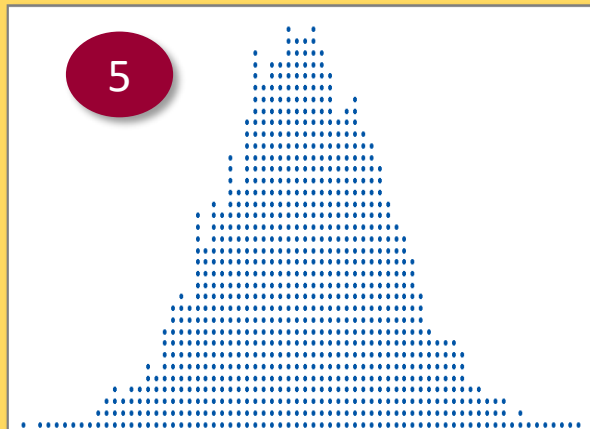
2



3

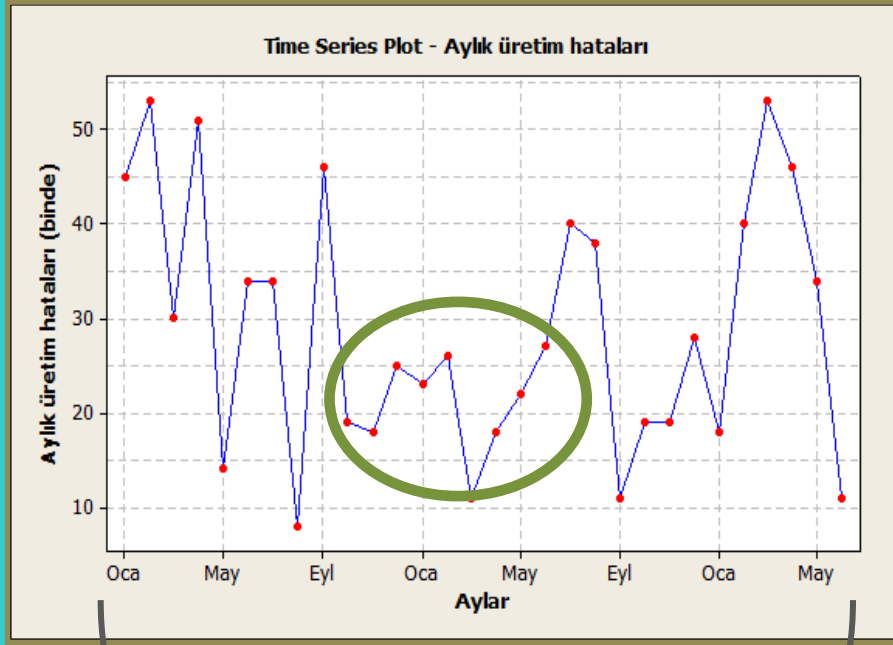
↓	C1-T	C2-T	C3	C4	C5	C6	C7	C8	C9	C10	C11-T	C12-T	C13	C14	C15	C16
	Damage	Defects	Counts	Faults	Shift	Weight	Rejects	Sampled	Blemish		Flaws	Period		Paint	Thicken	Sample
1	Scratch	Missing Screws	274	-0,22435	1	905	20	98	2		Scratch	Day		120	124	51
2	Scratch	Missing Clips	59	0,29532	1	930	18	104	4		Scratch	Day		123	121	35
3	Bend	Defective Housi	19	0,35517	1	905	14	97	1		Peel	Day		121	121	21
4	Chip	Leaky Gasket	43	-0,25060	1	905	16	99	1		Peel	Day		118	124	32
5	Dent	Scrap	4	0,04660	1	905	13	97	4		Smudge	Day		120	117	48
6	Scratch	Unconnected Wir	8	-0,01963	2	885	29	102	5		Scratch	Day		111	117	19
7	Chip	Missing Studs	6	0,12111	2	890	21	104	2		Other	Day		127	103	12
8	Scratch	Incomplete Part	10	-0,72188	2	930	14	101	1		Other	Evening		122	135	31

4

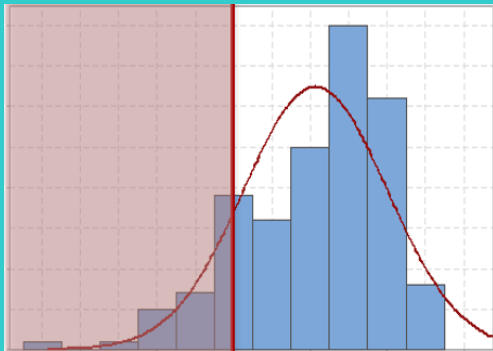


HataAdedi

24
28
17
24
15
33
103
37
121
19
120
12
48
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28
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37
150
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7
25



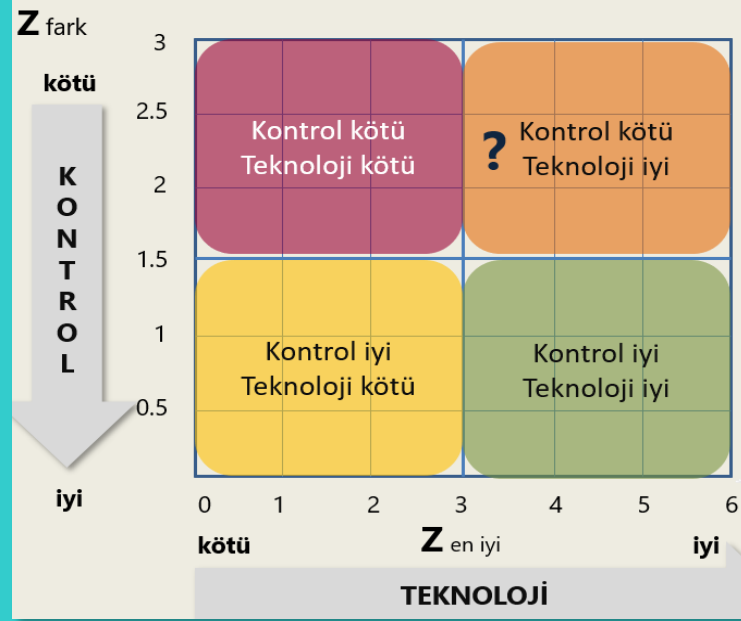
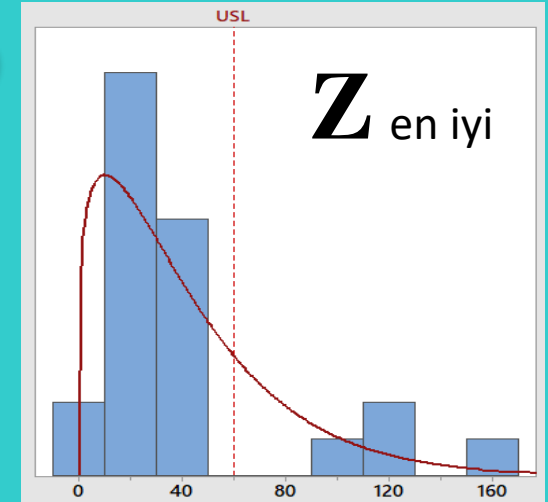
1 **Z** tüm **Z** fark



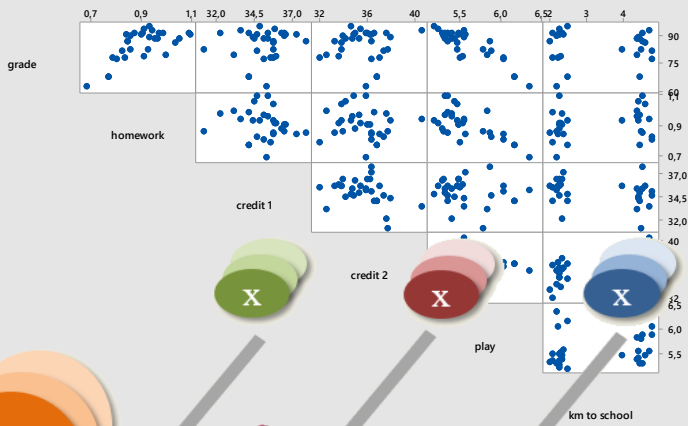
3

4

2



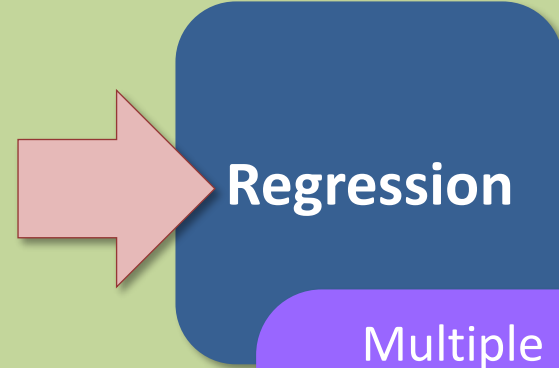
Matrix Plot of grade; homework; credit 1; credit 2; play; km to school



$Y = f(x)$

Y

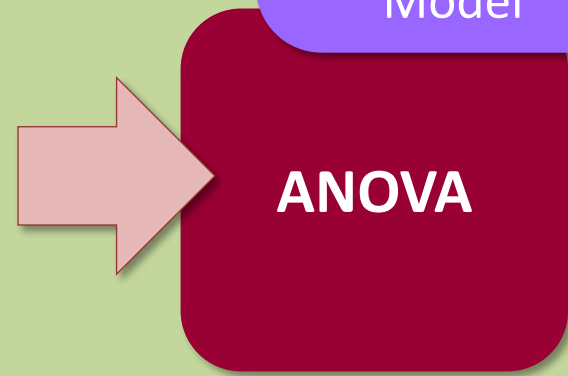
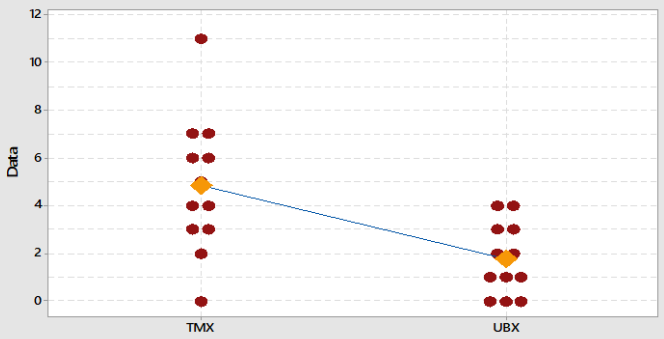
X X X



Multiple Regression & General Linear Model

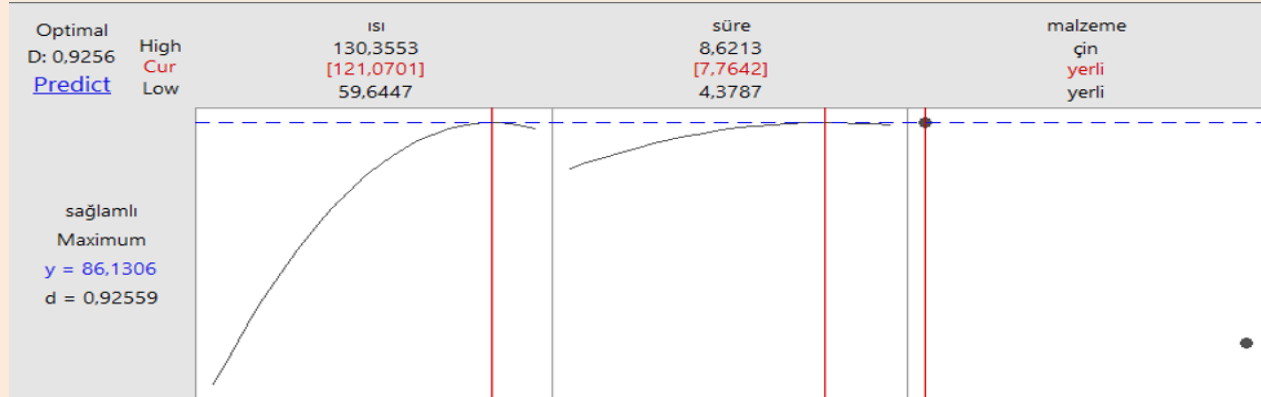
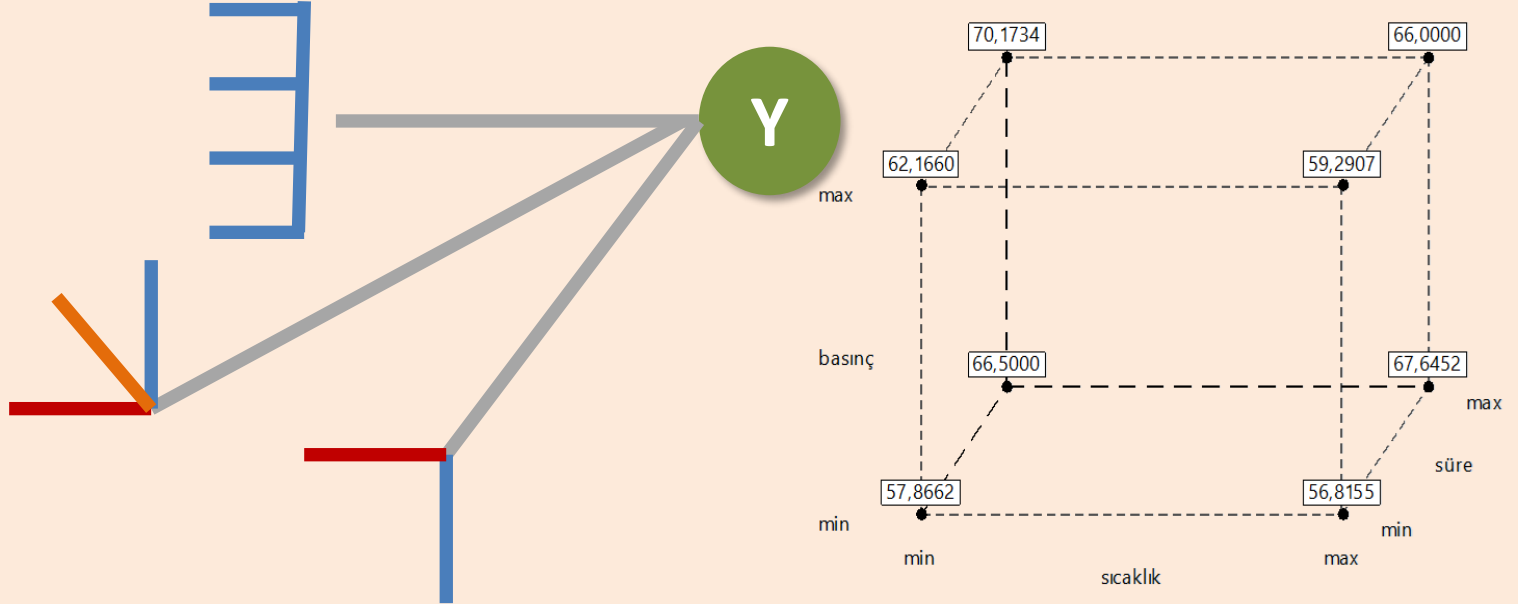
Response optimizer

Individual Value Plot of TMX; UBX



- Faktöryel
- Tepki Yüzeyi
- Karışım
- Taguchi

DENEY TASARIMLARI



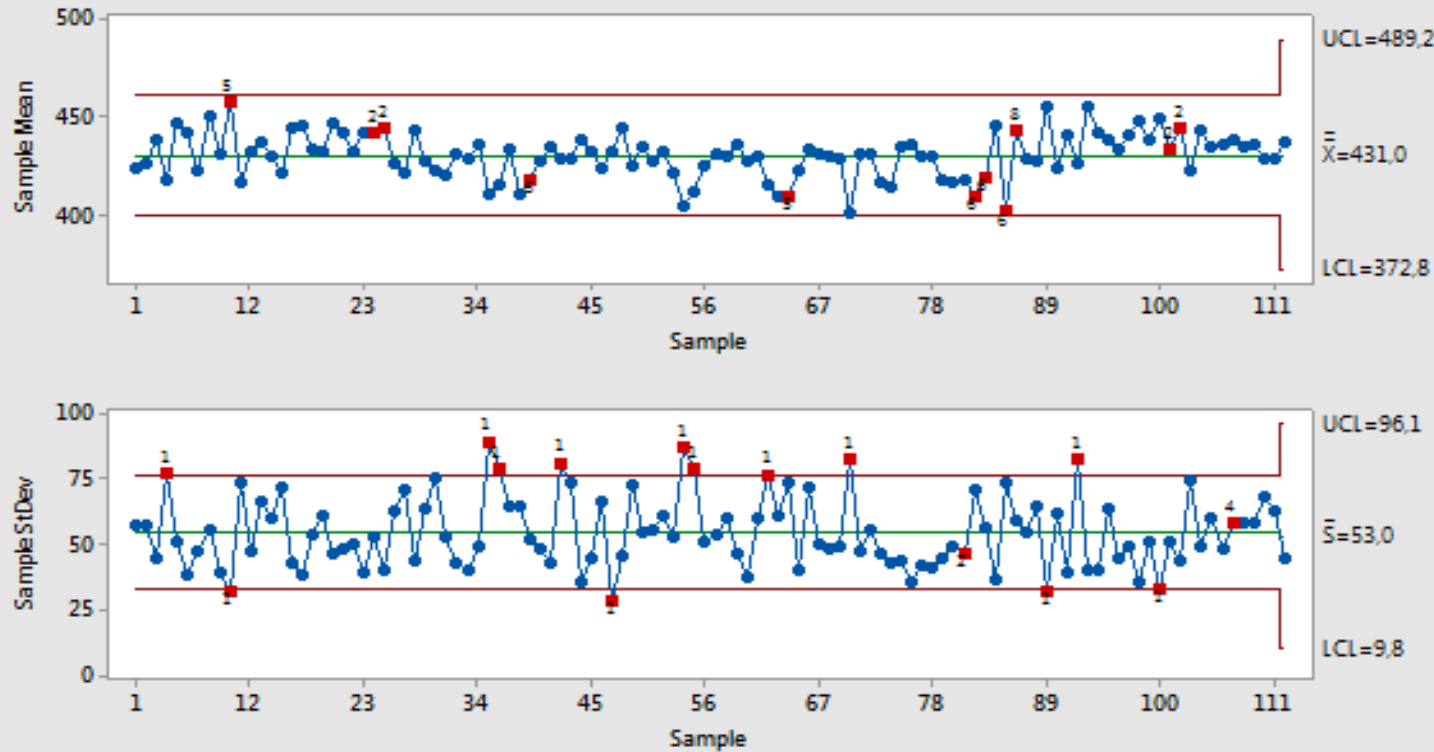
Hata Türleri Etki Analizi FMEA

Sistem	İşlev varlığı	Hata türleri	Olası nedenler	Olası etkiler	Şiddet	Olasılık	Algılama araçları	Mevcut risk koruma önlemleri	Notlar

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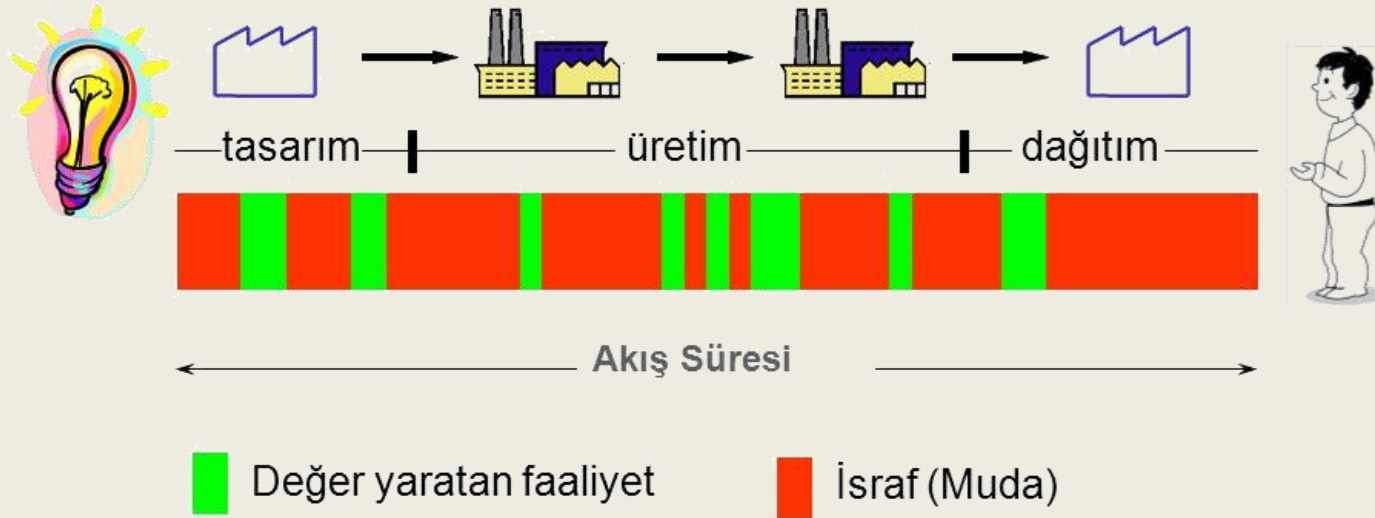
FMEA

İstatistiksel Proses Kontrol



Tests performed with unequal sample sizes

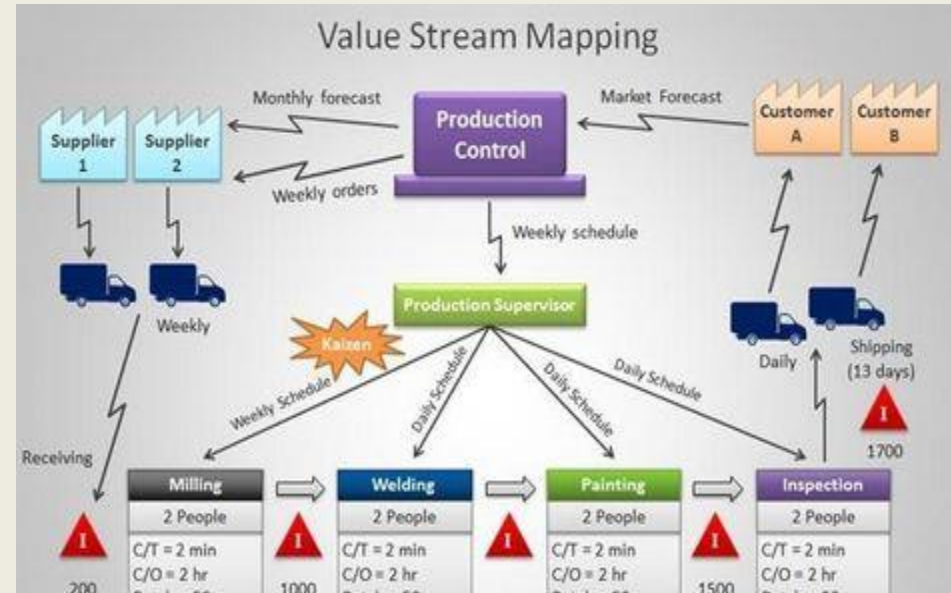
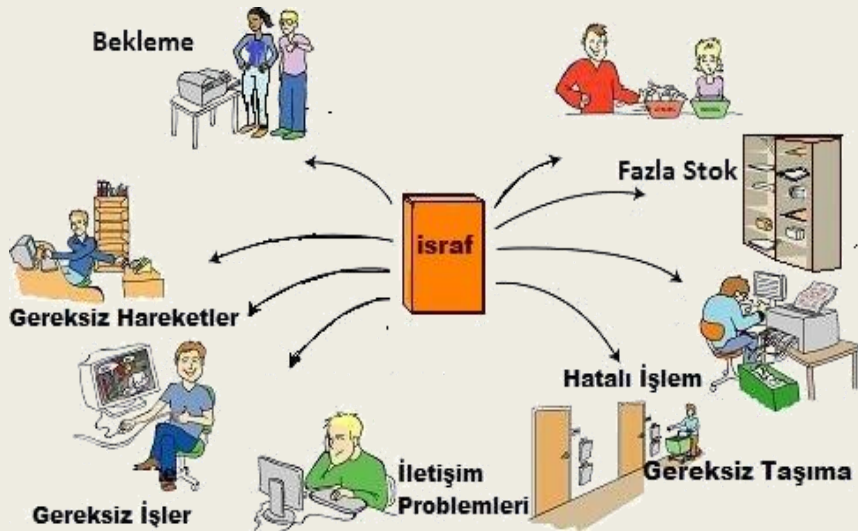
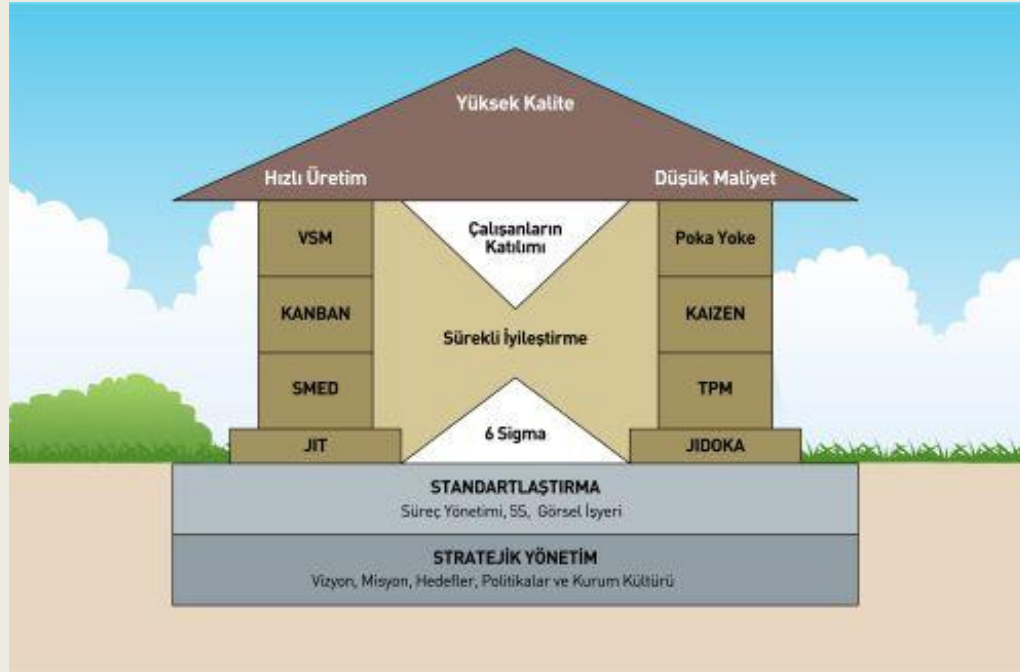
YALIN DÜŞÜNCE



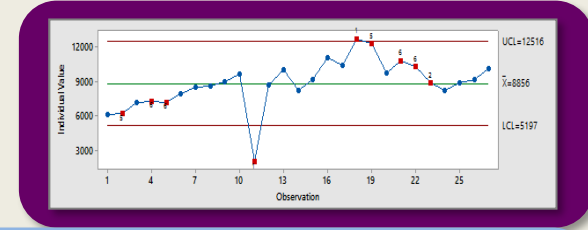
Değer, müşterinin para vereceği şeydir ..



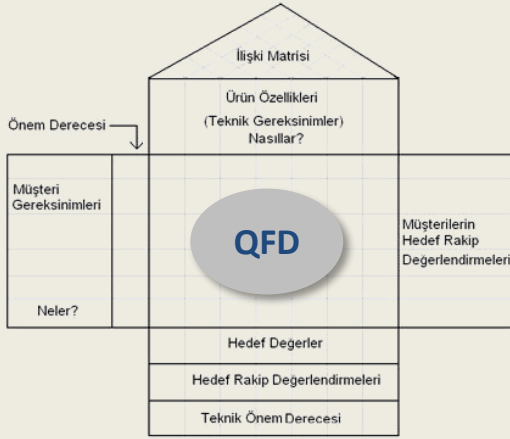
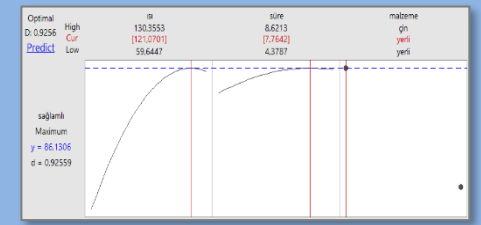
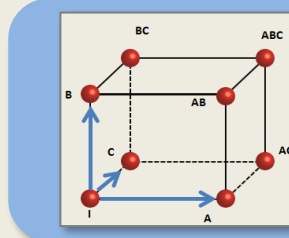




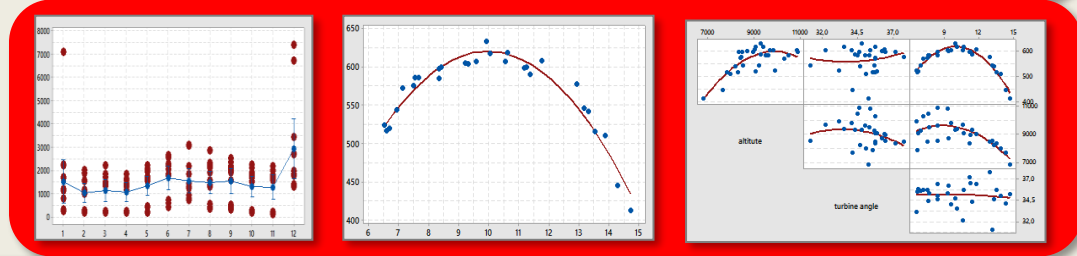
Kontrol



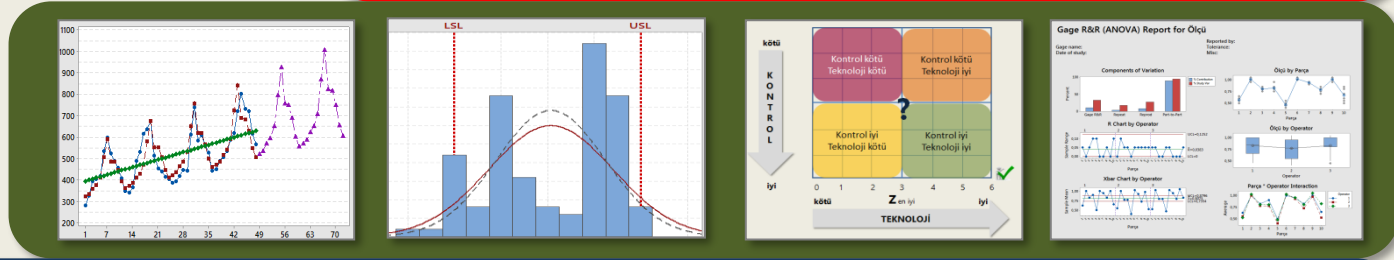
İyileştirme



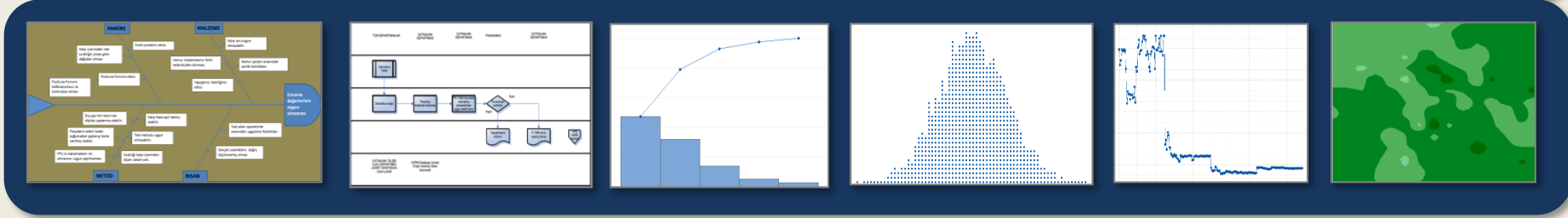
Analiz

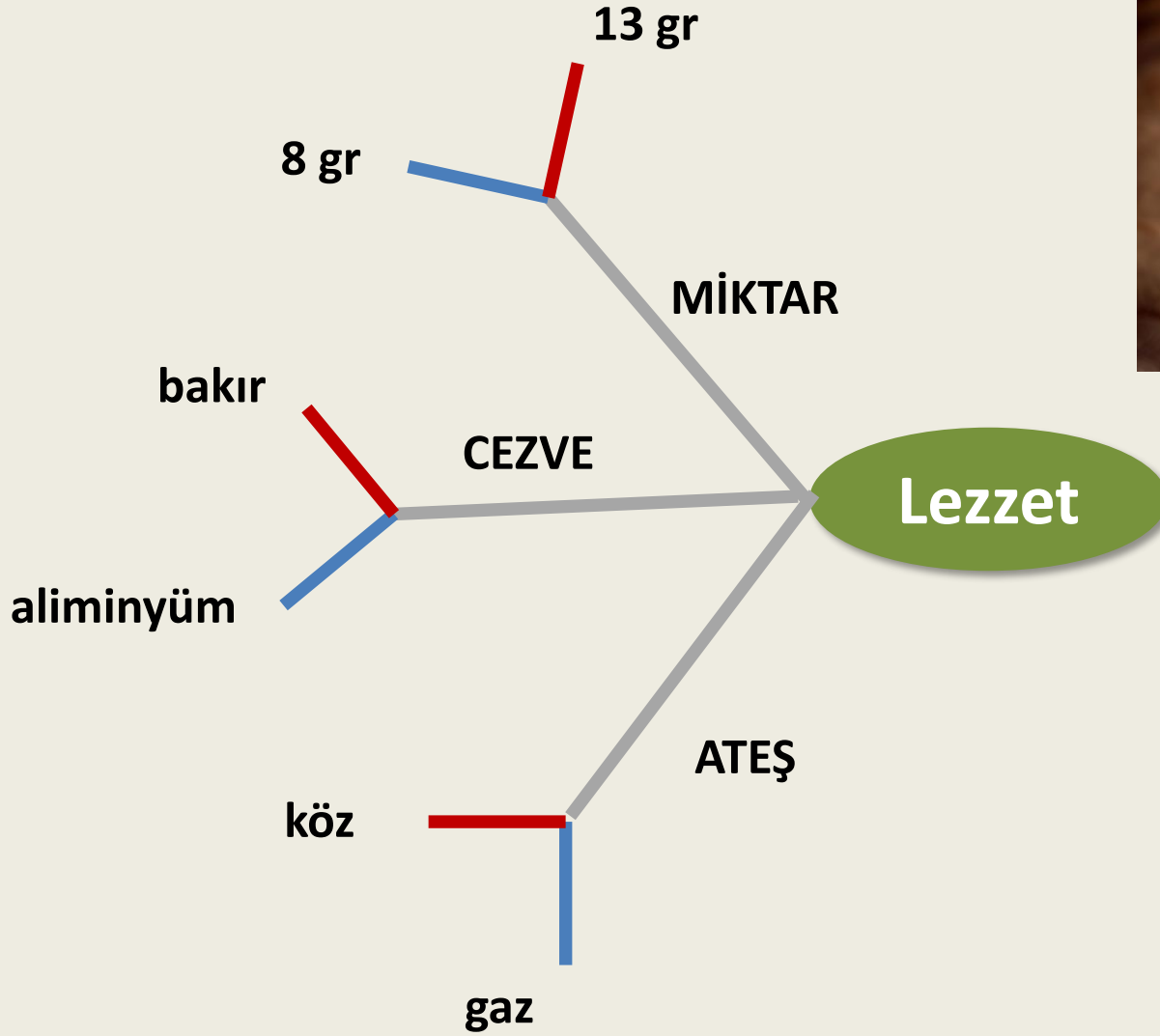


Ölçme



Tanımlama





Letafet Kahvecigil
Degustatör