

PRICING DENGAN MEMPERTIMBANGKAN RISIKO *ONLINE CHANNEL* DALAM *DUAL-CHANNEL SUPPLY CHAIN*

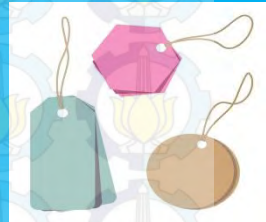
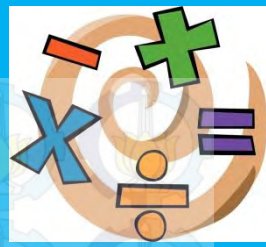
Putri Nida Nurmaram

Erwin Widodo

Imam Baihaqi

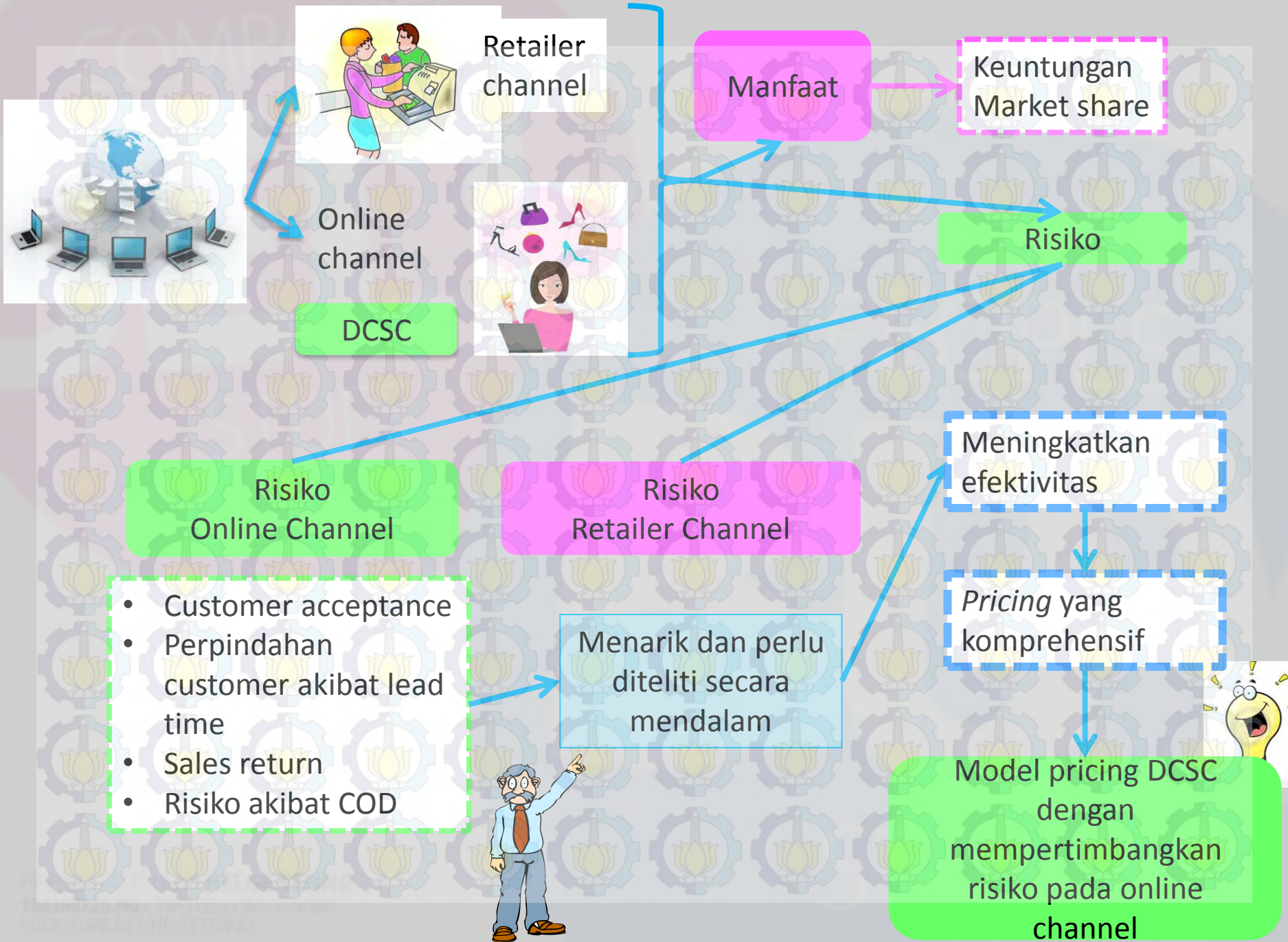


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Outline

- Latar belakang
- Rumusan masalah
- Metodologi
- Permodelan
- Percobaan Numerik
- Diskusi
- Referensi



Rumusan Masalah

1



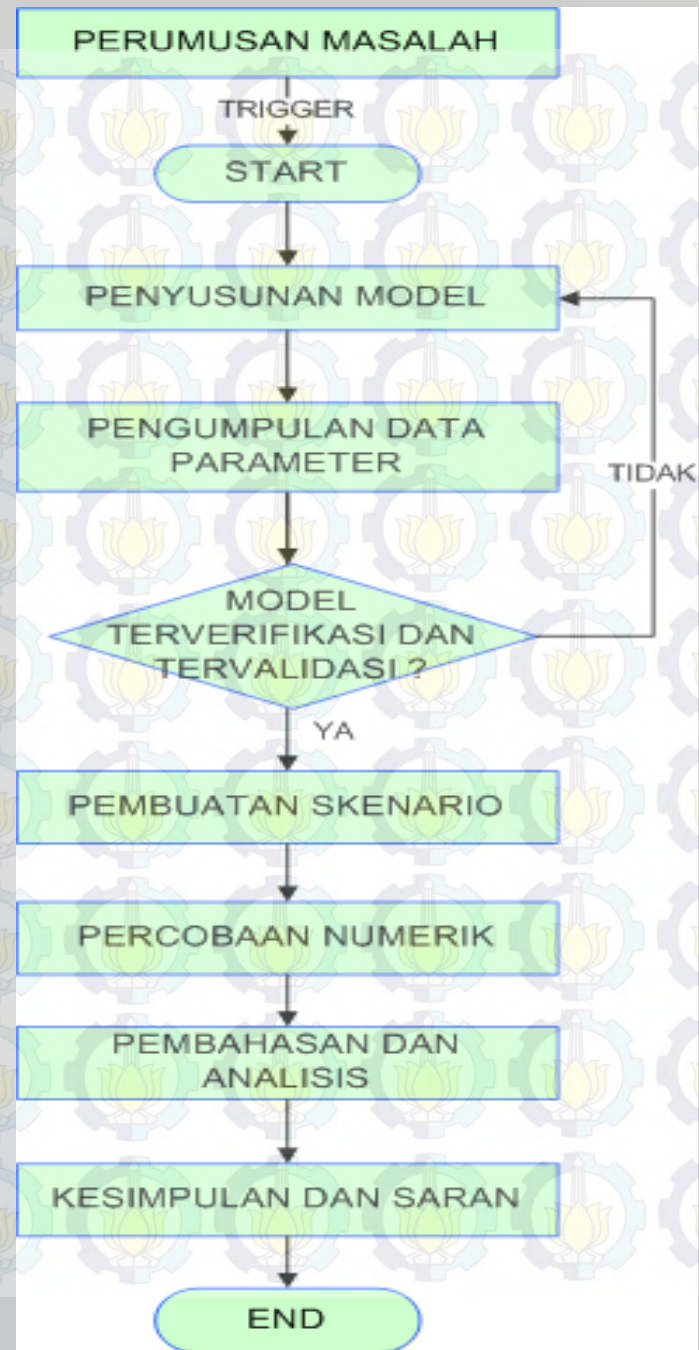
Bagaimana menentukan harga jual produk optimal untuk *warehouse*, *retailer* dan *online channel* pada DCSC dengan pertimbangan risiko pada *online channel*.

Menentukan kapan DCSC dengan pertimbangan risiko pada *online channel* diperlukan atau tidak, berdasar sudut pandang *manufacturer*, *retailer* dan *online channel* selaku individu maupun DCSC secara keseluruhan.

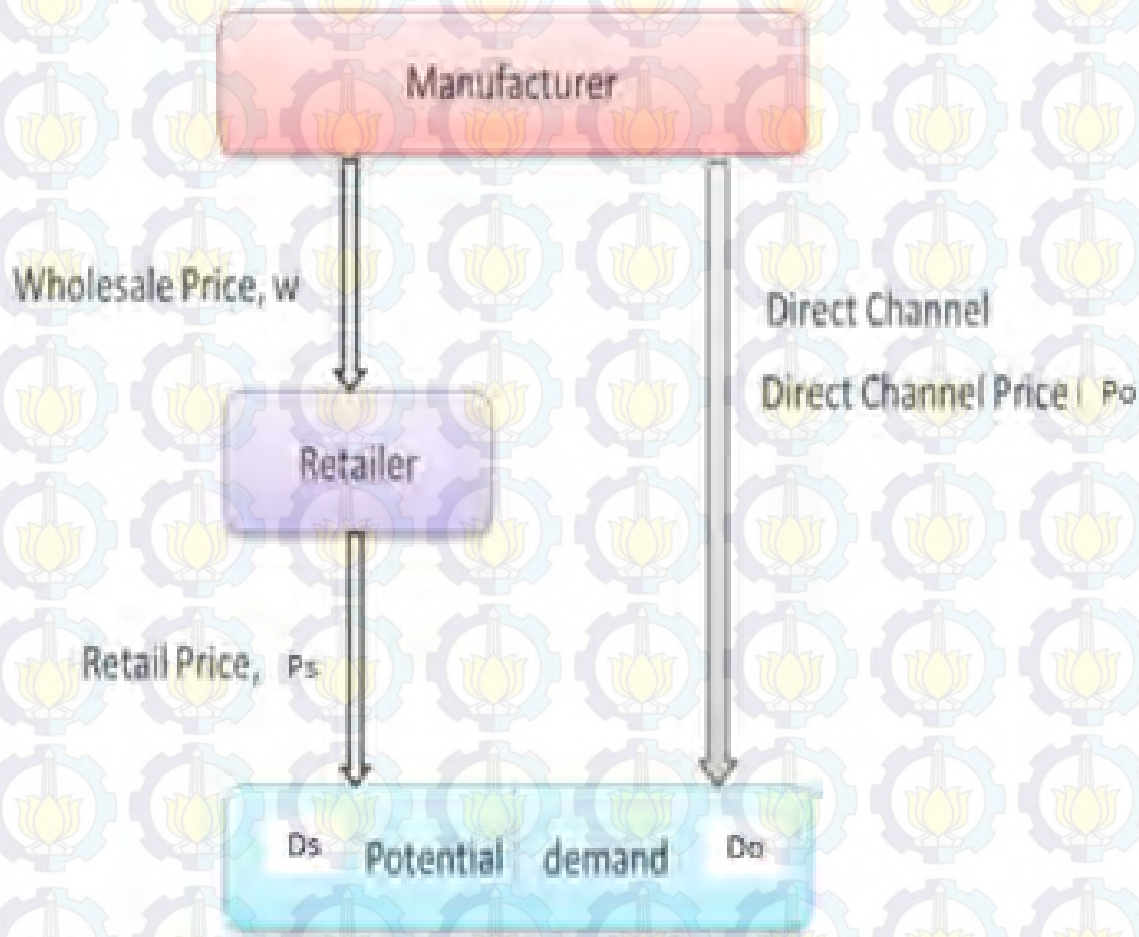
2



Metodologi Penelitian



Sistem yang Diamati



Gambar 1. Sistem DCSC

Asumsi



Customer acceptance, Sales return, COD, Lead time yang terjadi hanya pada *online channel*.



Warehouse langsung menerima barang dari *manufacturer* dan berasosiasi dengan *online channel* untuk mengirimkan produk langsung kepada *customer*.

Setiap *sales return* yang terjadi ditangani melalui mekanisme substitusi produk oleh *online channel*.

Tidak ada *defect* pada *sales return*, sehingga produk yang dikembalikan akan disimpan kembali di *warehouse*.

Barang yang ditolak customer pada saat COD akan dikembalikan ke *warehouse* dan dijual di *second market*.



Pengembangan Model

Model

DCSC tanpa risiko

DCSC dengan risiko

Susunan

Fungsi Permintaan

Fungsi Tujuan: maksimasi
keuntungan

Fungsi Pembatas

Notation

α	= Lead time sensitivity to online channel
β	= Lead time sensitivity to retailer channel
π_c	= System profit
π_m	= Manufacturer profit
π_s	= Retailer profit
π_o	= Online profit
λ	= Probability of COD success
μ	= COD percentage
d_s^{max}	= Retailer maximum demand
b	= Price elasticity
c_c	= Collecting cost per transaction
C_c	= Total collecting cost
c_h	= Handling cost per transaction
C_h	= Total handling cost
c_u	= Production cost per unit

Parameters

Decision Variables

l = Lead time

P_o = Online price

P_s = Retail price

ρ = Customer acceptance

vo = Salvage value per unit

Vo = Total salvage value

w = Wholesale price

Model DCSC tanpa Mempertimbangkan Risiko (Widodo et al., 2011)

Fungsi permintaan Retailer channel

$$D_s = a_s^{max} - \left(\frac{P_s - P_o}{1 - \rho} \right)$$

Permintaan max - Rasio customer saving dan pengorbanan

Fungsi permintaan Online channel

$$D_o = \frac{\rho P_s - P_o}{\rho(1 - \rho)}$$

Menyesuaikan perspektif online

Fungsi tujuan : Maksimasi keuntungan

Keuntungan Retailer channel

$$\pi_s = (P_s - w) D_s$$

Keuntungan Online channel

$$\pi_m = (w - c_u) D_s + (P_o - c_u) D_o$$

Fungsi pembatas

- Harga jual produk pada tiap *channel* harus lebih besar atau sama dengan biaya produk per unit.
- *Wholesale price* tidak boleh lebih tinggi dari *online price*.
- Kuantitas permintaan tidak boleh bernilai negatif.
- Jumlah permintaan retail dan direct channel tidak melebihi jumlah permintaan maksimum.
- Harga jual tertinggi untuk tiap *channel*.



Model DCSC dengan Mempertimbangkan Risiko pada *Online channel*

Fungsi permintaan Retailer channel

$$D_s = d_s^{max} - b \frac{P_s - P_0}{1 - \rho} + \beta l$$

Permintaan
maksimum

Rasio customer
saving dan
pengorbanan

Perpindahan
customer

Model DCSC dengan Mempertimbangkan Risiko pada Online channel

Fungsi permintaan Online channel

$$D_o = A + B + C$$

Penjualan tanpa return:

- Transfer
- COD sukses

COD gagal

Penjualan dengan return:

- Transfer
- COD sukses

$$A = (1 - r) \left[(1 - \mu) \left(b \frac{\rho(P_s - P_o)}{\rho(1-\rho)} - \alpha l \right) + (\lambda \mu) \left(b \frac{\rho(P_s - P_o)}{\rho(1-\rho)} - \alpha l \right) \right]$$

$$B = (r) \left[(1 - \mu) \left(b \frac{\rho(P_s - P_o)}{\rho(1-\rho)} - \alpha l \right) + (\lambda \mu) \left(b \frac{\rho(P_s - P_o)}{\rho(1-\rho)} - \alpha l \right) \right]$$

$$C = ((1 - \lambda)\mu) \left(b \frac{\rho(P_s - P_o)}{\rho(1-\rho)} - \alpha l \right)$$

Fungsi tujuan : Maksimasi keuntungan

Keuntungan Retailer channel

$$\pi_s = (P_s - w)D_s$$

Keuntungan Online channel

$$\pi_m = (w - c_u)D_s + (P_o - c_u)D_o - R_o + S_o - C_h - L_o - C_c + V_o$$

1. Keuntungan warehouse

2. Keuntungan online

3. Sales return

4. Keuntungan substitusi

5. Handling cost

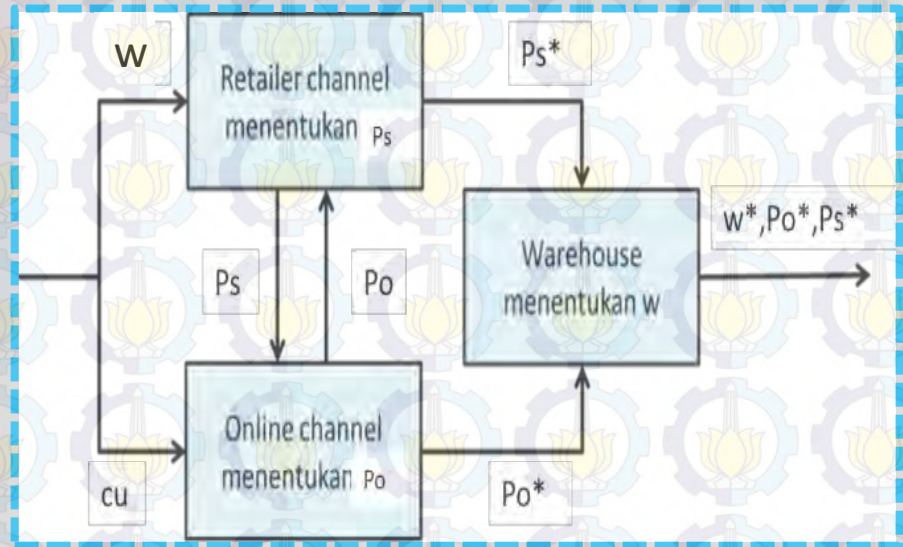
6. Cancel payment

7. Collective cost

8. Salvage value

Percobaan Numerik

Optimization Scheme



Set Parameter

Tanpa Risiko	ρ	d_3^{MAX}	b	cu			
	0.30	1800	1	200			
Dengan Risiko	ρ	d_3^{MAX}	b	cu	l	α	β
	0.30	1800	1	200	3	2.45	1.96
	μ	λ	r	cc	ch	vo	
	0.075	0.95	0.12	5	10	160	

Numerical Experiment

Verification

```
File Edit Text Go Cell Tools Debug Parallel Desktop Window Help
Current Folder: C:\Users\cahyo\Documents\MATLAB
Shortcuts (H) How to Add (A) What's New
Editor - E:\TANPARISIKO\tanparisikol.m
Stack Base - f_x
function [f] = tanparisikol(T)
% 1 2 3 4 5 6 7 8 9
P = [0.3;1800;1;200];
%Objective function
f = (-1)*((T(2)-T(3)).*(P(2)-((P(3)*(T(2)-T(1)))/(1-P(1)))))...%profit retailer
+ ((T(3)-P(4)).*(P(2)-((P(3)*(T(2)-T(1)))/(1-P(1)))))...%profit manufacturer jual ke retailer
+ ((T(1)-P(4)).*(P(3)*P(1)*(T(2)-T(1))/(P(1)*(1-P(1)))))...%profit online
end
```

```
Command Window
<stopping_criteria_details>
Active inequalities (to within options.TolCon = 1e-006):
lower upper ineqlin ineqnonlin
1 2 8
pTot =
220.0000 400.0000 220.0001
pTotval =
-3.1371e+005
exitflag =
1
output =
iterations: 2
funcCount: 8
ineqlengths: 1
stepsize: 0
algorithm: 'medium-scale: SQP, Quasi-Newton, line-search'
firstorderopt: 2.2737e-013
constrviolation: 0
message: [1x788 char]
```

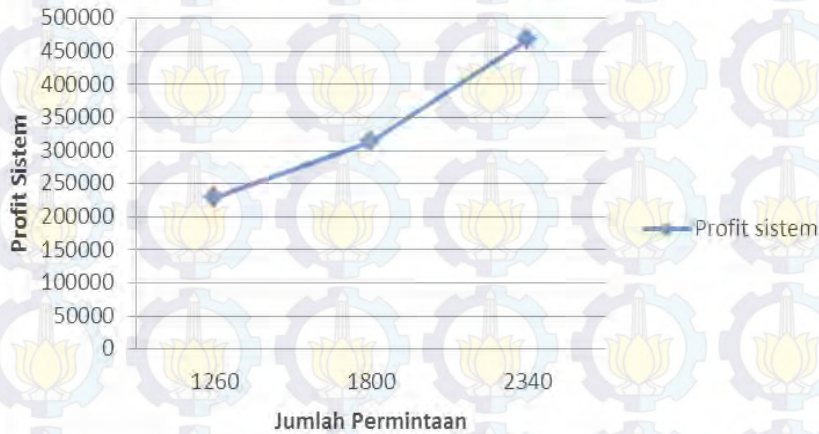
```
File Edit Text Go Cell Tools Debug Desktop Window Help
Stack Base - f_x
function [f] = dengarisiko(D)
% 1 2 3 4 5 6 7 8 9 10 11 12 13;
P = [0.3 1800 1 2.45 1.96 0.075 0.95 0.12 200 5 10 160 3];
%Objective function
f = (-1)*(((D(2)-D(3)).*(P(2)-((P(3)*(D(2)-D(1)))/(1-P(1)))+P(5)*P(13)))))...%profit retailer
+ ((D(3)-P(9)).*(P(2)-((P(3)*(D(2)-D(1)))/(1-P(1)))+P(5)*P(13)))))...%profit manufacturer jual ke retailer
+ ((D(1)-P(9)).*(1-P(6)).*(P(3)*P(1)*(D(2)-D(1))/(P(1)*(1-P(1))))-P(4)*P(13)))...%lao return no cod
+ ((1-P(8))*P(7)*P(6)*((P(3)*P(1)*(D(2)-D(1))/(P(4)*(1-P(1))))-P(4)*P(13)))...%lao return no cod sukses
+ (P(8)*(1-P(6))*((P(3)*P(1)*(D(2)-D(1))/(P(1)*(1-P(1))))-P(4)*P(13)))...%return no cod
+ (P(8)*P(7)*P(6)*((P(3)*P(1)*(D(2)-D(1))/(P(4)*(1-P(1))))-P(4)*P(13)))...%return cod sukses
+ ((1-P(7))*P(6)*((P(3)*P(1)*(D(2)-D(1))/(P(1)*(1-P(1))))-P(4)*P(13)))...%cod gagal
+ (D(3))*((P(5)*(1-P(6))*((P(3)*P(1)*(D(2)-D(1))/(P(1)*(1-P(1))))-P(4)*P(13)))...
+ (P(8)*P(7)*P(6)*((P(3)*P(1)*(D(2)-D(1))/(P(1)*(1-P(1))))-P(4)*P(13)))...%laoes return
+ ((D(1)-P(9)).*(P(8)*(1-P(6))*((P(3)*P(1)*(D(2)-D(1))/(P(1)*(1-P(1))))-P(4)*P(13)))...
+ (P(8)*P(7)*P(6)*((P(3)*P(1)*(D(2)-D(1))/(P(1)*(1-P(1))))-P(4)*P(13)))...%laostratol
- (P(1))*((P(8)*(1-P(6))*((P(3)*P(1)*(D(2)-D(1))/(P(1)*(1-P(1))))-P(4)*P(13)))...
+ (P(8)*P(7)*P(6)*((P(3)*P(1)*(D(2)-D(1))/(P(1)*(1-P(1))))-P(4)*P(13)))...%banding cost
- (P(10))*((1-P(8))*P(7)*P(6)*((P(3)*P(1)*(D(2)-D(1))/(P(1)*(1-P(1))))-P(4)*P(13)))...
+ (P(8)*P(7)*P(6)*((P(3)*P(1)*(D(2)-D(1))/(P(3)*(1-P(1))))-P(4)*P(13)))...
+ ((1-P(7))*P(6)*((P(3)*P(1)*(D(2)-D(1))/(P(1)*(1-P(1))))-P(4)*P(13)))...%collective cost
+ (D(1))*((1-P(7))*P(6)*((P(3)*P(1)*(D(2)-D(1))/(P(1)*(1-P(1))))-P(4)*P(13)))...%cancel payment
+ (P(12))*((1-P(8))*(1-P(6))*((P(3)*P(1)*(D(2)-D(1))/(P(1)*(1-P(1))))-P(4)*P(13)))...
+ (P(8)*P(7)*P(6)*((P(3)*P(1)*(D(2)-D(1))/(P(1)*(1-P(1))))-P(4)*P(13)))...
+ ((1-P(7))*P(6)*((P(3)*P(1)*(D(2)-D(1))/(P(1)*(1-P(1))))-P(4)*P(13)))...%jual ke gudang
end
```

```
Command Window
New to MATLAB? Watch this Video, see Demos, or read Getting Started.
Active inequalities (to within options.TolCon = 1e-006):
lower upper ineqlin ineqnonlin
2 13
pTot =
268.9860 400.0000 220.0001
pTotval =
-3.3258e+005
exitflag =
5
output =
iterations: 3
funcCount: 12
ineqlengths: 1
stepsize: 1.7756e-005
algorithm: [1x44 char]
firstorderopt: 1.7756e-005
constrviolation: 2.8422e-014
message: [1x777 char]
```

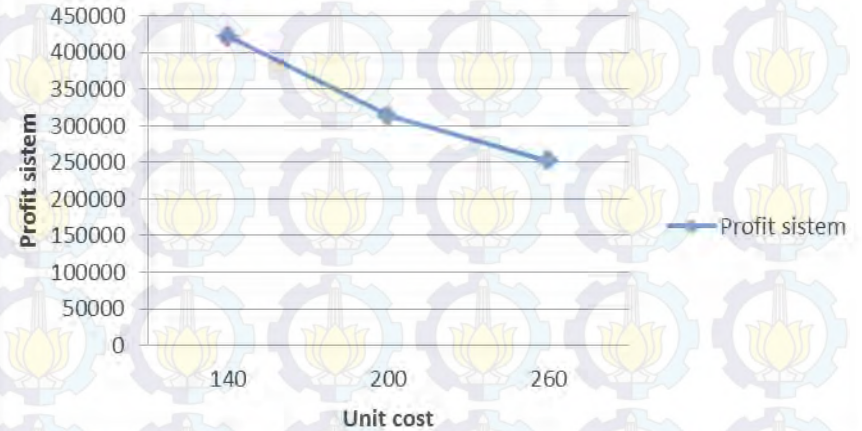

Numerical Experiment

Validation

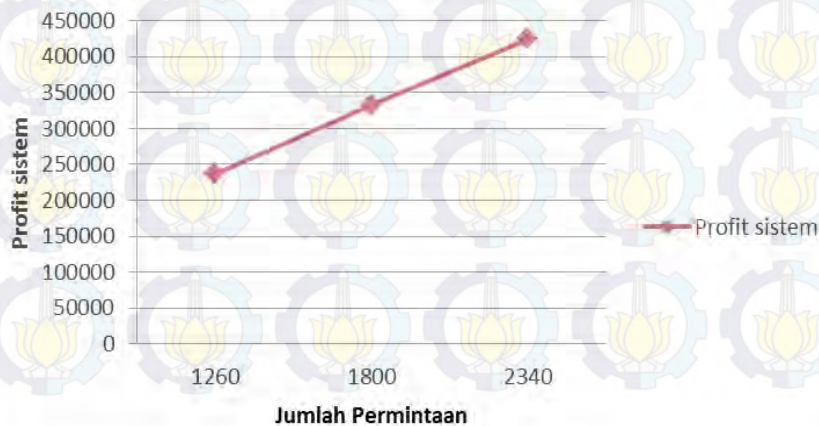
Profit Sistem Tanpa Risiko



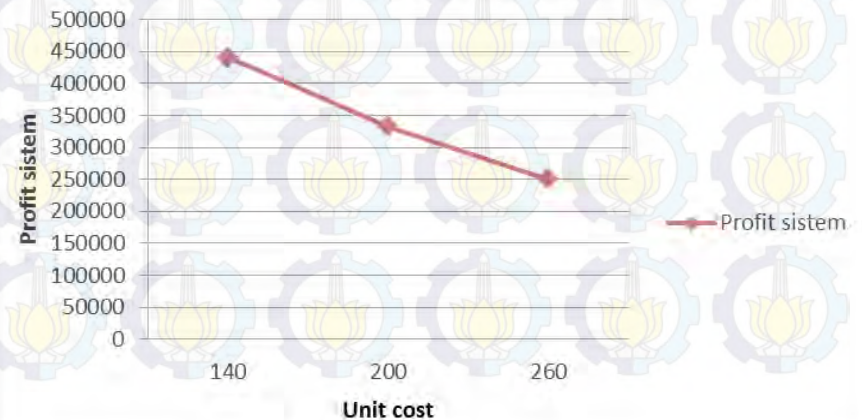
Profit Sistem Tanpa Risiko



Profit Sistem Dengan Risiko



Profit Sistem Dengan Risiko

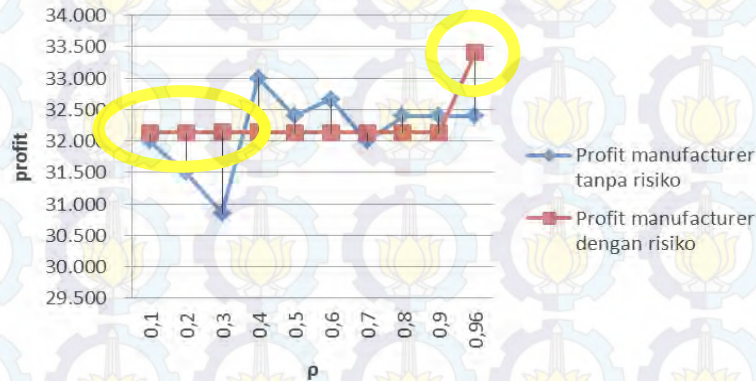


Initial Solution

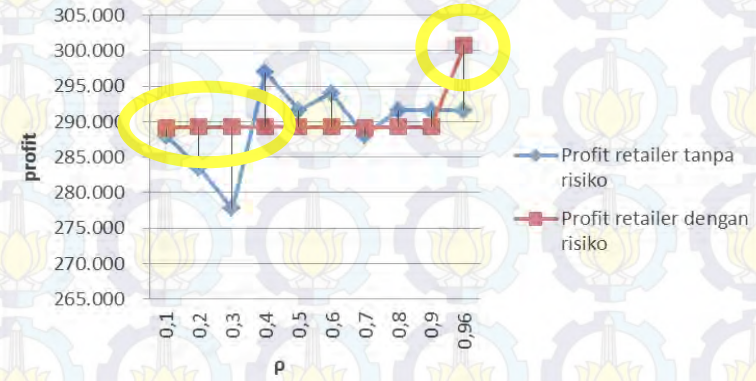
	ρ	Po	Ps	w	Do	Ds	Profit <i>manufacturer</i>	Profit <i>online</i>	Profit <i>retailer</i>	Profit <i>sistem</i>
Tanpa risiko	0.3	220	400	220	257	1543	30,857	5,143	277,714	313,714
Dengan risiko	0.3	269	400	220	180	1607	32,139	11,189	289,252	332,580

Dengan mempertimbangkan risiko, harga jual pada online channel lebih mahal.

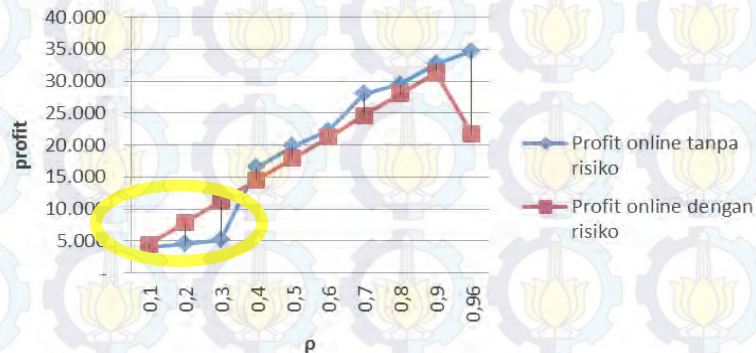
Profit Manufacturer



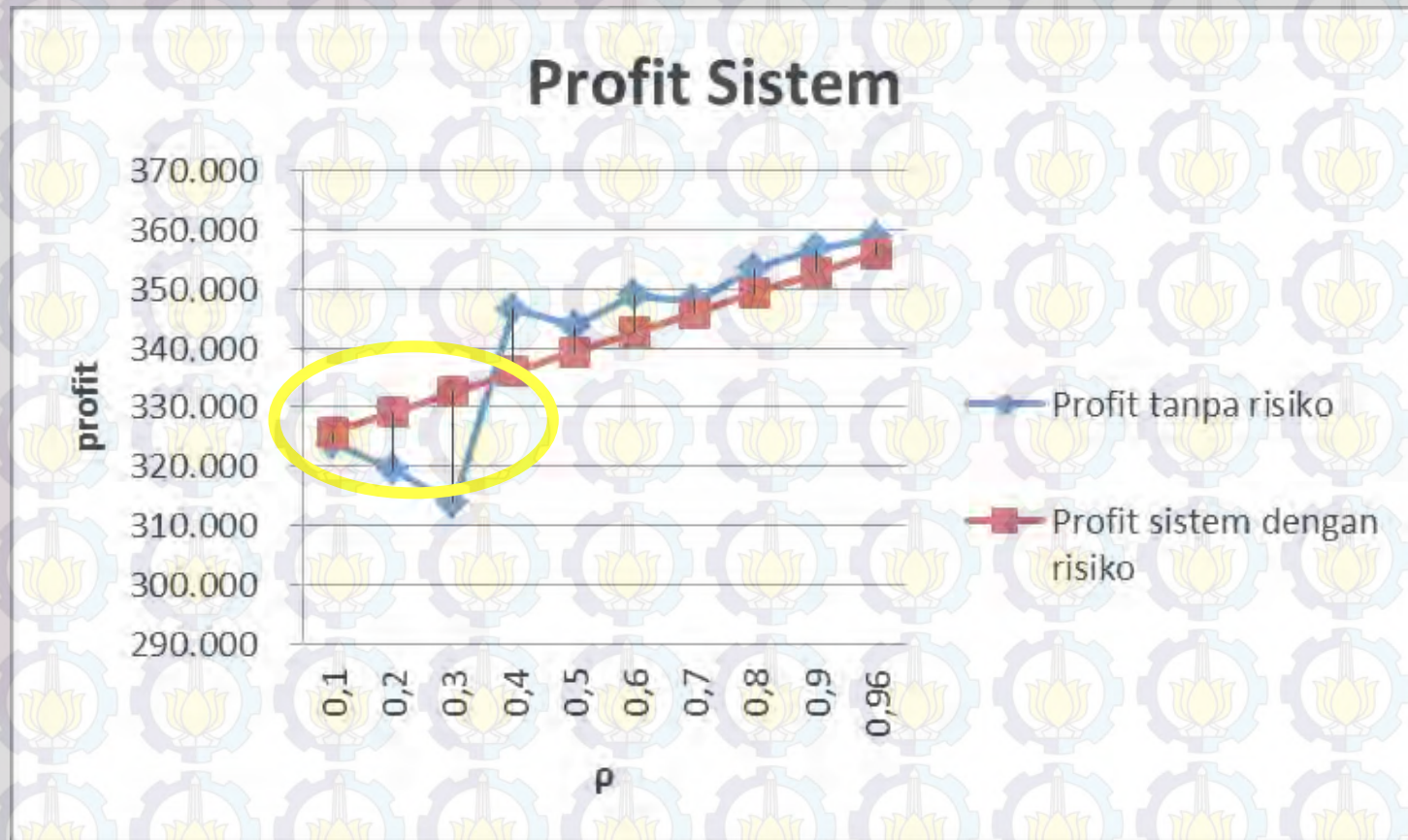
Profit Retailer



Profit Online



Model dengan risiko lebih menguntungkan saat customer acceptance terhadap online channel rendah.



Model dengan risiko lebih menguntungkan saat customer acceptance terhadap online channel rendah.

Analisis Sensitivitas (tanpa risiko)

ρ	P_0	P_s	w	D_0	D_s	Profit <i>manufacturer</i>	Profit <i>online</i>	Profit <i>retailer</i>	Profit <i>sistem</i>
0,21	220	400	220	228	1572	31.443	4.557	282.987	318.987
0,24	220	400	220	237	1563	31.263	4.737	281.368	317.368
0,27	220	400	220	247	1553	31.068	4.932	279.616	315.616
0,3	220	400	220	257	1543	30.857	5.143	277.714	313.714
0,33	310	400	220	194	1666	33.313	14.776	299.821	347.910
0,36	310	400	220	141	1659	33.188	15.469	298.688	347.344
0,39	310	400	220	148	1652	33.049	16.230	297.443	346.721

Peningkatan customer acceptance terhadap online channel membuat :

- **Online profit naik**
- Retailer profit stabil
- Manufacturer profit stabil
- **Sistem profit naik**

Analisis Sensitivitas (dengan risiko)

ρ	Po	Ps	w	Do	Ds	Profit <i>manufacturer</i>	Profit <i>online</i>	Profit <i>retailer</i>	Profit <i>sistem</i>
0,21	252	400	220	179	1607	32.148	8.212	289.330	329.690
0,24	258	400	220	179	1607	32.147	9.212	289.326	330.685
0,27	263	400	220	180	1607	32.136	10.170	289.222	331.528
0,3	269	400	220	180	1607	32.139	11.189	289.252	332.580
0,33	274	400	220	180	1606	32.129	12.168	289.161	333.458
0,36	280	400	220	180	1606	32.129	13.180	289.165	334.474
0,39	286	400	220	180	1607	32.137	14.203	289.232	335.572

Peningkatan customer acceptance terhadap online channel membuat :

- **Online profit naik**
- Retailer profit stabil
- Manufacturer profit stabil
- **Sistem profit naik**

Sensitivity Analysis

α	Po	Ps	w	Do	Ds	Profit <i>manufacturer</i>	Profit <i>online</i>	Profit <i>retailer</i>	Profit <i>sistem</i>
1,715	271	400	220	180	1611	32.218	11.465	289.966	333.650
1,96	270	400	220	180	1610	32.192	11.373	289.728	333.293
2,205	270	400	220	180	1608	32.166	11.281	289.490	332.937
2,45	269	400	220	180	1607	32.139	11.189	289.252	332.580
2,695	268	400	220	180	1606	32.113	11.097	289.014	332.224
2,94	268	400	220	180	1604	32.086	11.005	288.776	331.867
3,185	267	400	220	180	1603	32.060	10.912	288.538	331.511

Peningkatan lead time sensitivity membuat:

- Online profit turun
- Retailer profit stabil
- Manufacturer profit stabil
- Sistem profit turun

Sensitivity Analysis

λ	Pd	Pr	W	Dd	Dr	Profit <i>manufacturer</i>	Profit <i>online</i>	Profit <i>retailer</i>	Profit <i>system</i>
0,665	269	400	220	180	1607	32.139	10.793	289.252	332.184
0,76	269	400	220	180	1607	32.139	10.925	289.252	332.316
0,855	269	400	220	180	1607	32.139	11.057	289.252	332.448
0,95	269	400	220	180	1607	32.139	11.189	289.252	332.580
1	269	400	220	180	1607	32.139	11.258	289.252	332.650

Peningkatan kesuksesan COD membuat :

- Online profit naik
- Retailer profit stabil
- Manufacturer profit stabil
- Sistem profit naik

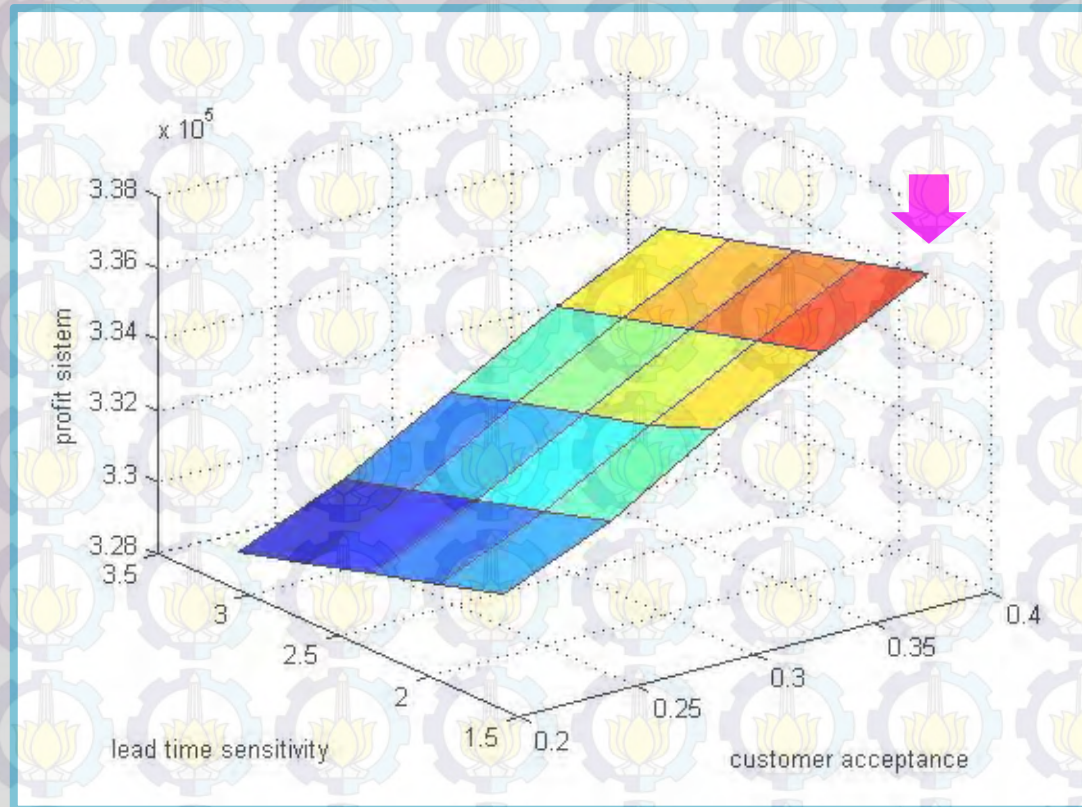
Sensitivity Analysis

r	Pd	Pr	W	Dd	Dr	Profit manuf urer	Profit online	Profit retailer	Profit sistem
0,084	269	400	220	180	1607	32.139	11.511	289.252	332.903
0,096	269	400	220	180	1607	32.139	11.404	289.252	332.795
0,108	269	400	220	180	1607	32.139	11.296	289.252	332.688
0,12	269	400	220	180	1607	32.139	11.189	289.252	332.580
0,132	269	400	220	180	1607	32.139	11.081	289.252	332.473
0,144	269	400	220	180	1607	32.139	10.974	289.252	332.365
0,156	269	400	220	180	1607	32.139	10.866	289.252	332.258

Peningkatan sales return membuat:

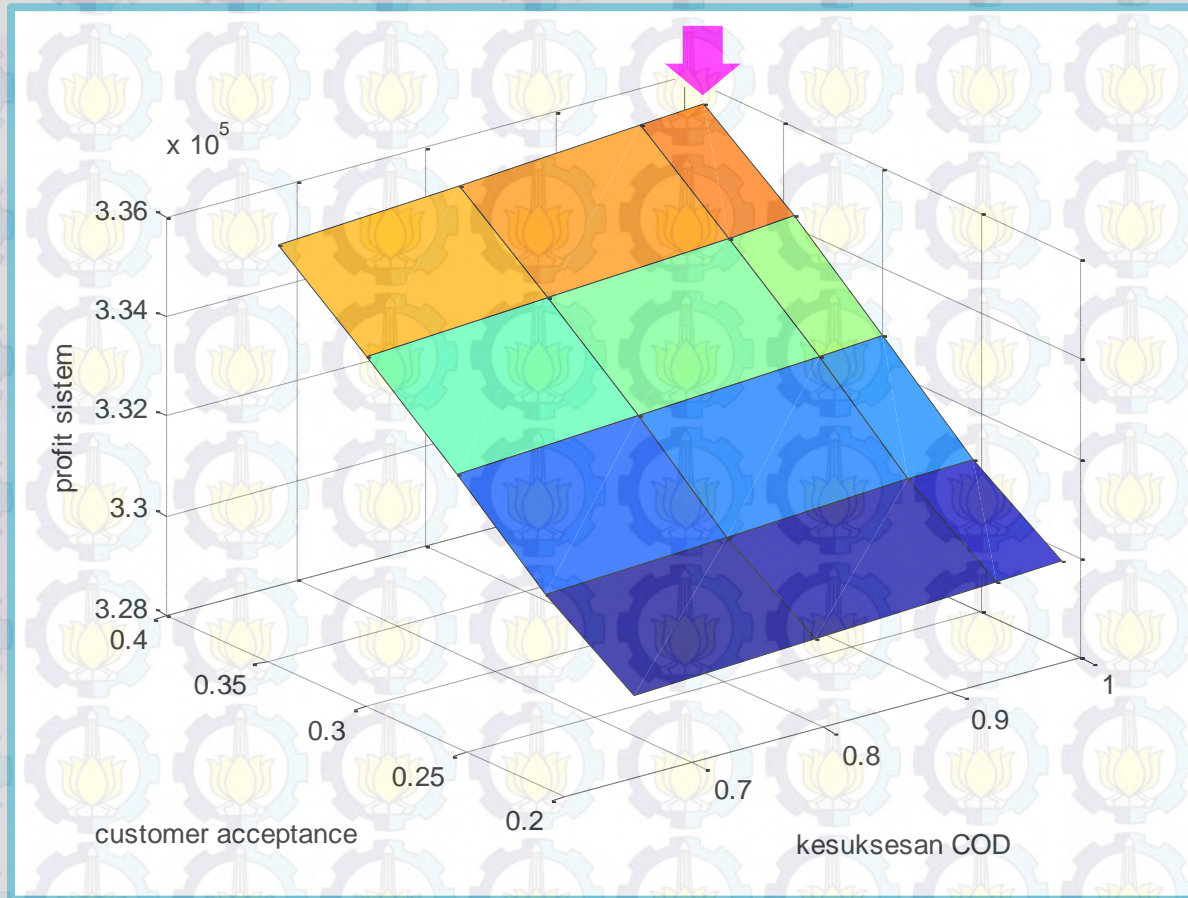
- Online profit turun
- Retailer profit stabil
- Manufacturer profit stabil
- Sistem profit turun

Sensitivity Analysis



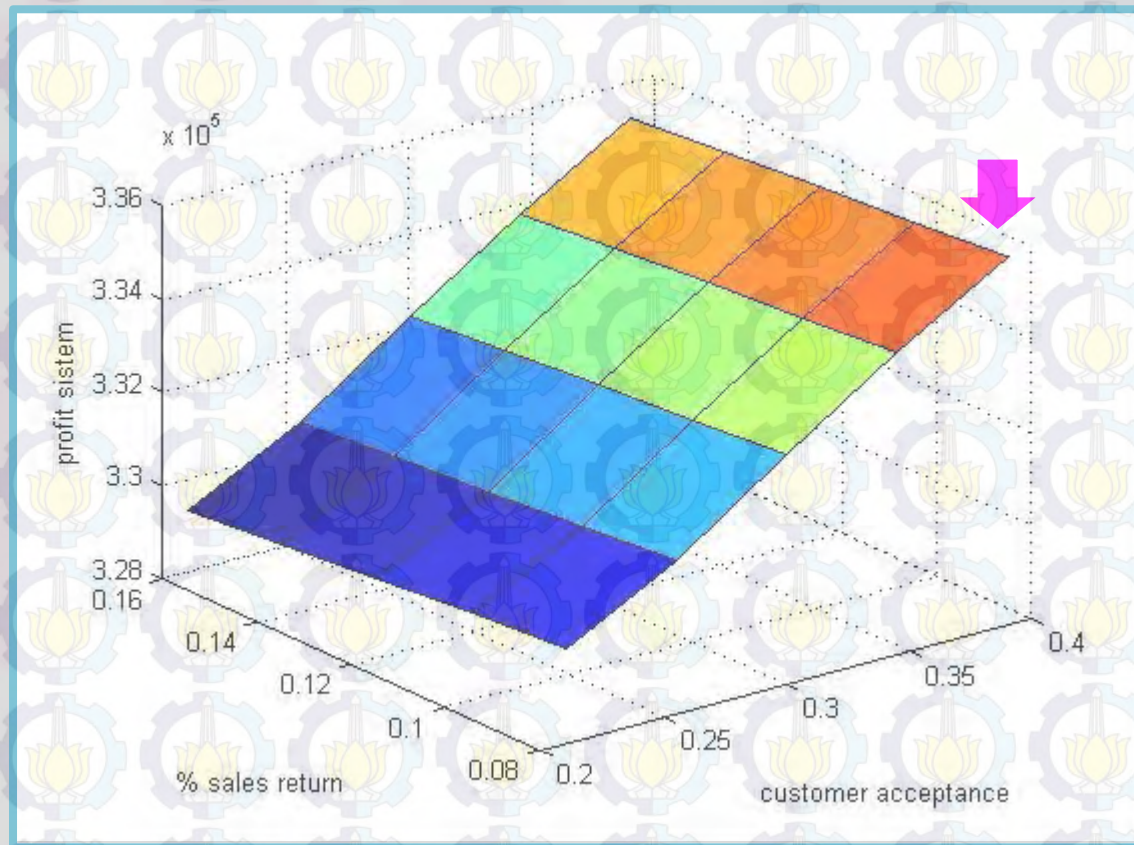
Profit tertinggi dicapai ketika customer acceptance pada online channel tinggi dan lead time sensitivity rendah.

Sensitivity Analysis



Profit tertinggi dicapai ketika customer acceptance pada online channel tinggi dan kesuksesan COD tinggi.

Sensitivity Analysis



Profit tertinggi dicapai ketika customer acceptance pada online channel tinggi dan sales return rendah.

Diskusi

Risiko erat kaitannya dengan peluang risiko dan konsekuensi.

Peluang Risiko

Penentuan risiko dalam penelitian ini yang memperhatikan urutan proses operasional.

- *Sales return* terjadi saat *customer* sudah menerima melakukan pembayaran dan menerima barang. Sehingga, jika aktivitas COD gagal maka tidak dapat dilakukan *sales return*.

Konsekuensi

Konsekuensi mempengaruhi penyusunan model terutama dalam komponen biaya.

Managerial Implication

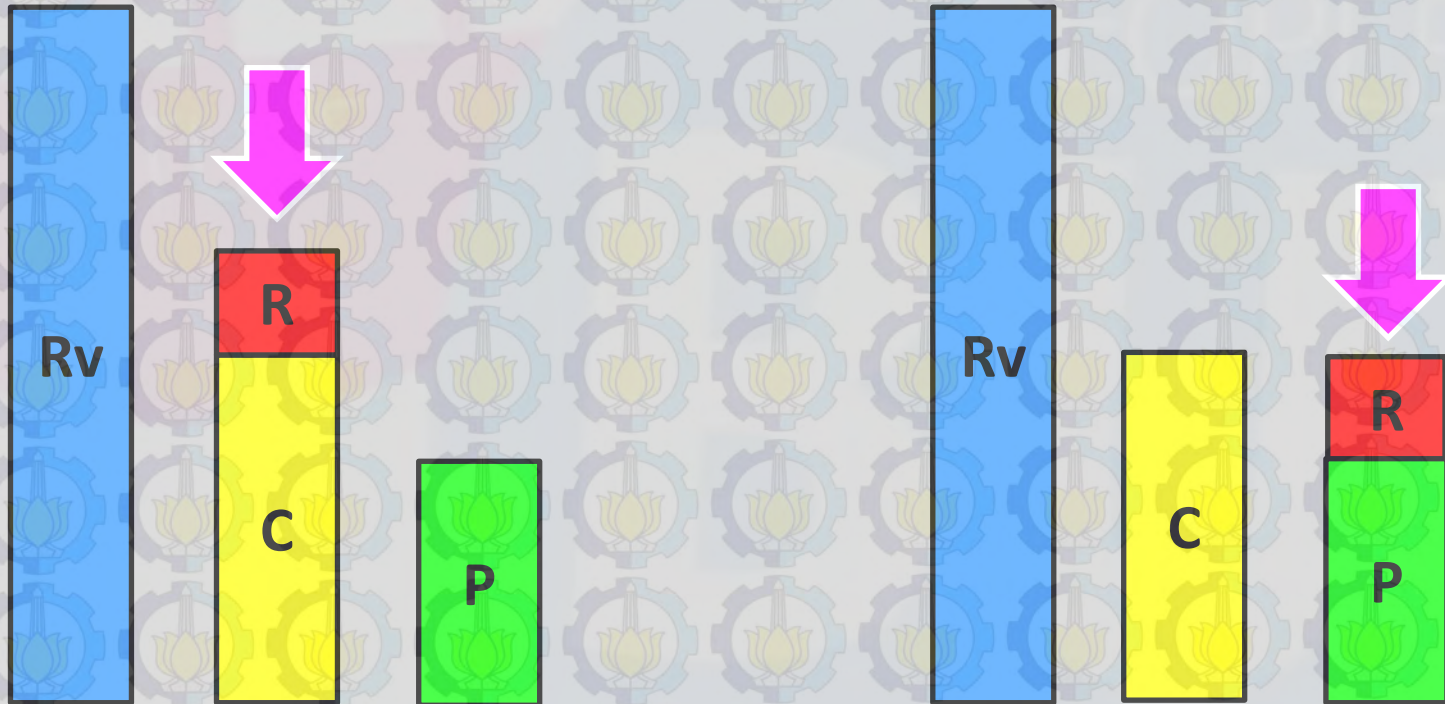
Dengan mempertimbangkan risiko, harga jual produk pada *online channel* ditetapkan lebih mahal dibandingkan tanpa mempertimbangkan risiko.

- Bagi *customer*, harga yang lebih mahal merupakan kompensasi atas sejumlah layanan yang diberikan oleh *online channel*.

Pricing dengan mempertimbangkan risiko lebih menguntungkan pada saat tingkat penerimaan *customer* terhadap *online channel* rendah.

Pada saat tingkat penerimaan *customer* terhadap *online channel* sudah tinggi, maka sebaiknya layanan dapat dikurangi.

Meminimalkan risiko sangat penting untuk meningkatkan keuntungan.



Risiko terjadi

Risiko tidak terjadi

Kesimpulan

Model DCSC dengan mempertimbangkan risiko yang komprehensif sudah berhasil disusun untuk menjawab gap yang diidentifikasi.



Berdasarkan hasil analisis sensitivitas, diketahui bahwa model DCSC dengan mempertimbangkan risiko lebih menguntungkan pada saat *customer acceptance* rendah.

Pada saat *customer acceptance* rendah, dengan mempertimbangkan risiko pada *online channel*, harga jual produk pada *online channel* optimal di atas harga jual produk pada model tanpa mempertimbangkan risiko.

WHEN

Referensi

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