

BAB 6

KESIMPULAN DAN SARAN

6.1. Kesimpulan

Pada penelitian ini dapat disimpulkan bahwa :

a. Pengaruh waktu proses pada sistem Kanban dan CONWIP :

1. Semakin besar nilai standar deviasi semakin banyak jumlah kartu yang diperlukan untuk mencapai titik optimum tetapi dengan output yang dihasilkan semakin berkurang.
2. Urutan standar deviasi tidak terlalu berpengaruh terhadap output yang dihasilkan serta jumlah kartu yang diperlukan.
3. Urutan mean tidak terlalu berpengaruh terhadap output yang dihasilkan serta jumlah kartu yang diperlukan.

b. Untuk variasi waktu proses yang sama apabila jumlah stasiun kerja ditambah sehingga lintasan produksi semakin panjang maka akan semakin sedikit output yang dihasilkan dan semakin banyak jumlah kartu yang digunakan untuk mencapai titik optimum.

c. Perbandingan antara sistem kanban dengan sistem CONWIP :

1. Pada sistem kontrol CONWIP jumlah kartu akan mempunyai nilai yang sama dengan WIP nya.
2. Pada sistem kontrol kanban jumlah WIP sering berbeda dengan jumlah kartu yang digunakan,

tetapi jumlah WIP tidak akan melebihi dari jumlah kartu yang digunakan.

3. Antara CONWIP dan kanban apabila dilihat dari output yang dihasilkan mempunyai nilai yang cenderung sama tetapi apabila dilihat dari average WIP secara keseluruhan CONWIP lebih baik daripada kanban.

6.2. Saran

Penulis menyarankan agar penelitian selanjutnya kartu kanban yang digunakan untuk tiap stasiun kerja berbeda sehingga dapat diketahui dengan lebih jelas tentang perbedaan average WIP antara CONWIP dan kanban.

DAFTAR PUSTAKA

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LAMPIRAN 1

Source code conwip dengan 3 stasiun kerja

```

:
:
: Model statements for module: Create 1
:
9$ CREATE, 1,MinutesToBaseTime(0.0),Entity
1:MinutesToBaseTime(2):NEXT(10$);

10$ ASSIGN: Create 1.NumberOut=Create 1.NumberOut + 1:NEXT(8$);
:
:
: Model statements for module: Decide 1
:
8$ BRANCH, 1:
IF,NQ(Hold 1.Queue) < 10,13$,Yes:
Else,14$,Yes;
13$ ASSIGN: Decide 1.NumberOut True=Decide 1.NumberOut True + 1:NEXT(0$);
14$ ASSIGN: Decide 1.NumberOut False=Decide 1.NumberOut False + 1:NEXT(7$);
:
:
: Model statements for module: Hold 1
:
0$ QUEUE, Hold 1.Queue;
SCAN: conwip > 0:NEXT(3$);
:
:
: Model statements for module: Assign 1
:
3$ ASSIGN: conwip=conwip - 1;
Entity.Type=Entity 2:NEXT(2$);
:
:
: Model statements for module: Process 1
:
2$ ASSIGN: Process 1.NumberIn=Process 1.NumberIn + 1;
Process 1.WIP=Process 1.WIP+1;
44$ STACK, 1:Save:NEXT(18$);
18$ QUEUE, Process 1.Queue;
17$ SEIZE, 2,VA:
mesin 1,1:NEXT(16$);
16$ DELAY: Normal(20,2),,VA:NEXT(59$);
59$ ASSIGN: Process 1.WaitTime=Process 1.WaitTime + Diff.WaitTime;
23$ TALLY: Process 1.WaitTimePerEntity,Diff.WaitTime,1;
25$ TALLY: Process 1.TotalTimePerEntity,Diff.StartTime,1;
49$ ASSIGN: Process 1.VATime=Process 1.VATime + Diff.VATime;
50$ TALLY: Process 1.VATimePerEntity,Diff.VATime,1;
15$ RELEASE: mesin 1,1;
64$ STACK, 1:Destroy:NEXT(63$);
63$ ASSIGN: Process 1.NumberOut=Process 1.NumberOut + 1;
Process 1.WIP=Process 1.WIP-1:NEXT(5$);
:
:

```

Model statements for module: Process 2

```
5$    ASSIGN:    Process 2.NumberIn=Process 2.NumberIn + 1;
          Process 2.WIP=Process 2.WIP+1;
95$   STACK,    1:Save:NEXT(69$);

69$   QUEUE,    Process 2.Queue;
68$   SEIZE,    2,VA:
          mesin 2,1:NEXT(67$);
67$   DELAY:    Normal(20,2),,VA:NEXT(110$);
110$  ASSIGN:    Process 2.WaitTime=Process 2.WaitTime + Diff.WaitTime;
74$   TALLY:    Process 2.WaitTimePerEntity,Diff.WaitTime,1;
76$   TALLY:    Process 2.TotalTimePerEntity,Diff.StartTime,1;
100$  ASSIGN:    Process 2.VATime=Process 2.VATime + Diff.VATime;
101$  TALLY:    Process 2.VATimePerEntity,Diff.VATime,1;
66$   RELEASE:  mesin 2,1;
115$  STACK,    1:Destroy:NEXT(114$);
114$  ASSIGN:    Process 2.NumberOut=Process 2.NumberOut + 1;
          Process 2.WIP=Process 2.WIP-1:NEXT(6$);
```

Model statements for module: Process 3

```
6$    ASSIGN:    Process 3.NumberIn=Process 3.NumberIn + 1;
          Process 3.WIP=Process 3.WIP+1;
146$  STACK,    1:Save:NEXT(120$);
120$  QUEUE,    Process 3.Queue;
119$  SEIZE,    2,VA:
          mesin 3,1:NEXT(118$);
118$  DELAY:    Normal(20,2),,VA:NEXT(161$);
161$  ASSIGN:    Process 3.WaitTime=Process 3.WaitTime + Diff.WaitTime;
125$  TALLY:    Process 3.WaitTimePerEntity,Diff.WaitTime,1;
127$  TALLY:    Process 3.TotalTimePerEntity,Diff.StartTime,1;
151$  ASSIGN:    Process 3.VATime=Process 3.VATime + Diff.VATime;
152$  TALLY:    Process 3.VATimePerEntity,Diff.VATime,1;
117$  RELEASE:  mesin 3,1;
166$  STACK,    1:Destroy:NEXT(165$);
165$  ASSIGN:    Process 3.NumberOut=Process 3.NumberOut + 1;
          Process 3.WIP=Process 3.WIP-1:NEXT(4$);
```

Model statements for module: Assign 2

```
4$    ASSIGN:    Entity.Type=Entity 1;
          conwip=conwip + 1:NEXT(7$);
```

Model statements for module: Dispose 1

```
7$    ASSIGN:    Dispose 1.NumberOut=Dispose 1.NumberOut + 1;
168$  DISPOSE:  Yes;
```

LAMPIRAN 2

Source code kanban dengan 3 stasiun kerja

```

:
:
: Model statements for module: Create 1
:
15$ CREATE, 1,MinutesToBaseTime(0.0),Entity
1:MinutesToBaseTime(2);NEXT(16$);
16$ ASSIGN: Create 1.NumberOut=Create 1.NumberOut + 1:NEXT(14$);
:
:
: Model statements for module: Decide 1
:
14$ BRANCH, 1:
      IF,NQ(Hold 1.Queue) < 10,19$,Yes:
      Else,20$,Yes;
19$ ASSIGN: Decide 1.NumberOut True=Decide 1.NumberOut True + 1:NEXT(0$);
20$ ASSIGN: Decide 1.NumberOut False=Decide 1.NumberOut False + 1:NEXT(13$);
:
:
: Model statements for module: Hold 1
:
0$ QUEUE, Hold 1.Queue;
SCAN: kanban a > 0:NEXT(3$);
:
:
: Model statements for module: Assign 1
:
3$ ASSIGN: kanban a=kanban a - 1:
      Entity.Type=Entity 2:NEXT(2$);
:
:
: Model statements for module: Process 1
:
2$ ASSIGN: Process 1.NumberIn=Process 1.NumberIn + 1:
      Process 1.WIP=Process 1.WIP+1;
24$ QUEUE, Process 1.Queue;
23$ SEIZE, 2,VA:
      mesin 1,1:NEXT(22$);

22$ DELAY: Normal(15,1.5),VA;
21$ RELEASE: mesin 1,1;
69$ ASSIGN: Process 1.NumberOut=Process 1.NumberOut + 1:
      Process 1.WIP=Process 1.WIP-1:NEXT(4$);
:
:
: Model statements for module: Hold 2
:
4$ QUEUE, Hold 2.Queue;
SCAN: kanban b > 0:NEXT(6$);
:
:
: Model statements for module: Assign 3

```

6\$ ASSIGN: kanban b=kanban b - 1;
kanban a=(kanban a + 1:NEXT(7\$);

Model statements for module: Process 2

7\$ ASSIGN: Process 2.NumberIn=Process 2.NumberIn + 1;
Process 2.WIP=Process 2.WIP+1;
75\$ QUEUE, Process 2.Queue;
74\$ SEIZE, 2,VA:
mesin 2,1:NEXT(73\$);
73\$ DELAY: Normal(20,2),,VA;
72\$ RELEASE: mesin 2,1;
120\$ ASSIGN: Process 2.NumberOut=Process 2.NumberOut + 1;
Process 2.WIP=Process 2.WIP-1:NEXT(8\$);

Model statements for module: Hold 3

8\$ QUEUE, Hold 3.Queue;
SCAN: kanban c > 0:NEXT(10\$);

Model statements for module: Assign 5

10\$ ASSIGN: kanban c=kanban c - 1;
kanban b=kanban b + 1:NEXT(11\$);

Model statements for module: Process 3

11\$ ASSIGN: Process 3.NumberIn=Process 3.NumberIn + 1;
Process 3.WIP=Process 3.WIP+1;
126\$ QUEUE, Process 3.Queue;
125\$ SEIZE, 2,VA:
mesin 3,1:NEXT(124\$);
124\$ DELAY: Normal(10,1),,VA;
123\$ RELEASE: mesin 3,1;
171\$ ASSIGN: Process 3.NumberOut=Process 3.NumberOut + 1;
Process 3.WIP=Process 3.WIP-1:NEXT(12\$);

Model statements for module: Assign 6

12\$ ASSIGN: Entity.Type=Entity 1;
kanban c=kanban c + 1:NEXT(13\$);

Model statements for module: Dispose 1

13\$ ASSIGN: Dispose 1.NumberOut=Dispose 1.NumberOut + 1;
174\$ DISPOSE: Yes;

ARENA Simulation Results

ANDI - License: STUDENT

Output Summary for 10 Replications

Project: Unnamed Project
Analyst: ME

Run execution date: 5/14/2007
Model revision date: 5/14/2007

OUTPUTS

Identifier	Av	Half-width	Min	Max	Rep
Process 1 Accum Wait Time	71.438	3.3948	62.748	78.485	10
Process 3 Accum Wait Time	65.148	2.1902	59.658	69.225	10
Process 1 Number Out	662.10	.40604	661.00	663.00	10
Process 3 Number Out	662.00	.33720	661.00	663.00	10
Process 2 Accum VA Time	9929.2	5.2552	9919.8	9944.4	10
Process 2 Number In	662.10	.40604	661.00	663.00	10
Process 2 Accum Wait Time	64.329	4.6618	53.539	72.075	10
Process 2 Number Out	662.10	.22620	662.00	663.00	10
Process 3 Accum VA Time	9927.5	5.0868	9912.4	9936.1	10
Process 1 Number In	662.00	.33720	661.00	663.00	10
Process 3 Number In	662.10	.22620	662.00	663.00	10
Process 1 Accum VA Time	9934.8	6.3935	9918.1	9950.4	10
Entity 1.NumberIn	5663.0	.33720	5662.0	5664.0	10
Entity 1.NumberOut	5662.9	.52780	5661.0	5664.0	10
Entity 2.NumberIn	662.00	.33720	661.00	663.00	10
Entity 2.NumberOut	662.00	.33720	661.00	663.00	10
mesin 1.NumberSeized	662.00	.33720	661.00	663.00	10
mesin 1.ScheduledUtilization	.99367	3.6510E-04	.99291	.99442	10
mesin 2.NumberSeized	662.00	.33720	661.00	663.00	10
mesin 2.ScheduledUtilization	.99312	2.4980E-04	.99248	.99361	10
mesin 3.NumberSeized	662.00	.33720	661.00	663.00	10
mesin 3.ScheduledUtilization	.99311	3.0936E-04	.99257	.99380	10
System.NumberOut	5000.9	.22620	5000.0	5001.0	10

Simulation run time: 0.03 minutes.
Simulation run complete.

Category Overview

Values Across All Replications

med Project

ations: 10 Time Units: Minutes

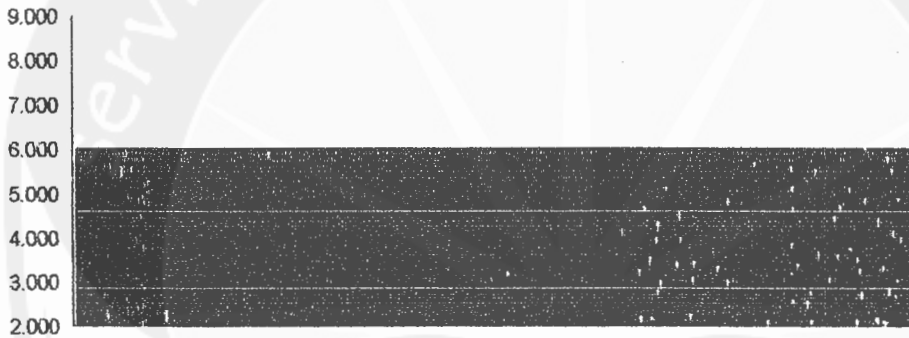
Key Performance Indicators

ystem
Number Out

Average
5,001

ne

Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
5.9958	0,00	5.9932	6.0001	0.00	45.9875



me

Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
0.00	0,00	0.00	0.00	0.00	0.00

ne

Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
20.8051	0,26	20.1548	21.3366	0.00	165.91



r Time

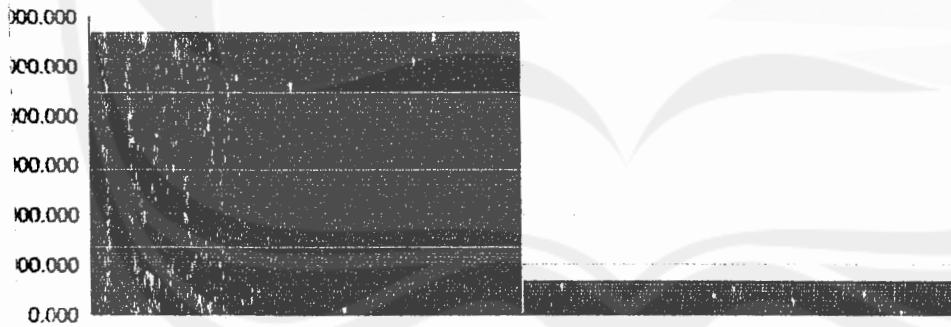
Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
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Category Overview

Time	0.00	0,00	0.00	0.00	0.00	0.00
	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
Time	0.00	0,00	0.00	0.00	0.00	0.00
	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
	26.8009	0,26	26.1490	27.3812	0.00	210.64

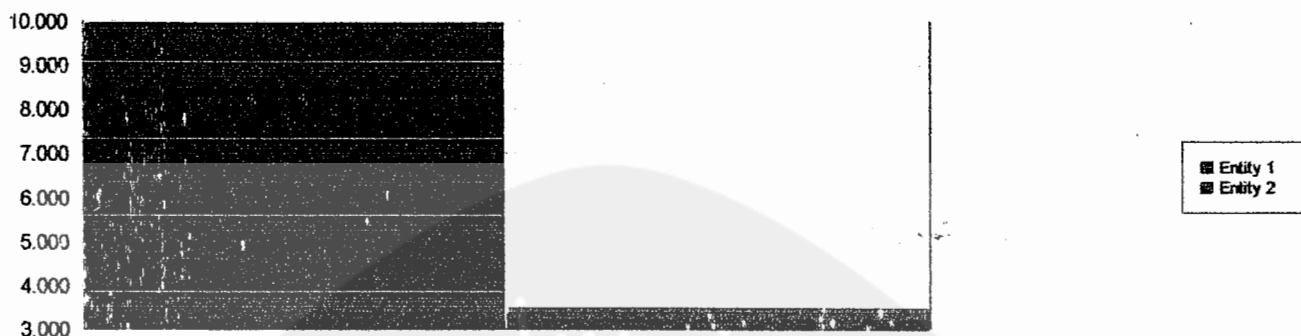


In	Average	Half Width	Minimum Average	Maximum Average
	5667	0,35	5667.00	5668.00
	667	0,35	666.00	667.00



Out	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
	5667	0,30	5667.00	5668.00		
	666	0,35	666.00	667.00		
	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
	9.9337	0,00	9.9310	9.9358	9.0000	11.0000
	3.4769	0,13	3.1422	3.7723	2.0000	5.0000

Category Overview

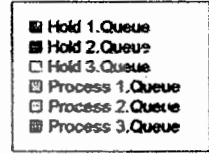


Time	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
Queue	148.99	0,06	148.90	149.17	148.40	151.30
Queue	4.0697	1,64	0.8041	7.7735	0.00071198	12.4458
Queue	3.1847	1,15	1.4056	6.7144	0.00089965	11.3122
Queue	0.00	0,00	0.00	0.00	0.00	0.00
Queue	0.00	0,00	0.00	0.00	0.00	0.00
Queue	0.00	0,00	0.00	0.00	0.00	0.00



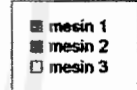
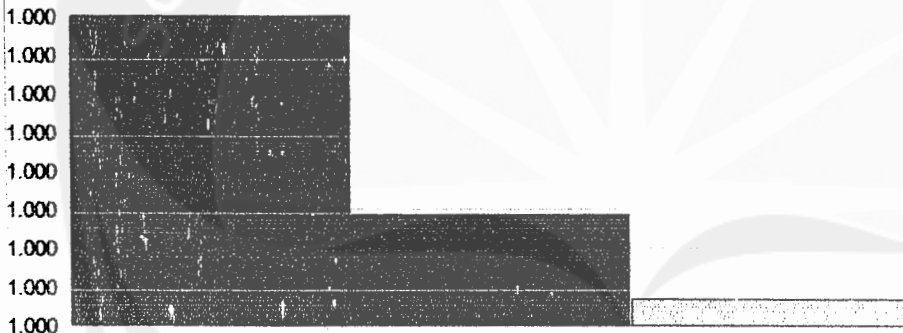
Waiting	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
Queue	9.9337	0,00	9.9310	9.9358	9.0000	10.0000
Queue	0.2689	0,11	0.04687898	0.5183	0.00	1.0000
Queue	0.2086	0,08	0.08897151	0.4479	0.00	1.0000
Queue	0.00	0,00	0.00	0.00	0.00	0.00
Queue	0.00	0,00	0.00	0.00	0.00	0.00
Queue	0.00	0,00	0.00	0.00	0.00	0.00

Category Overview



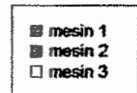
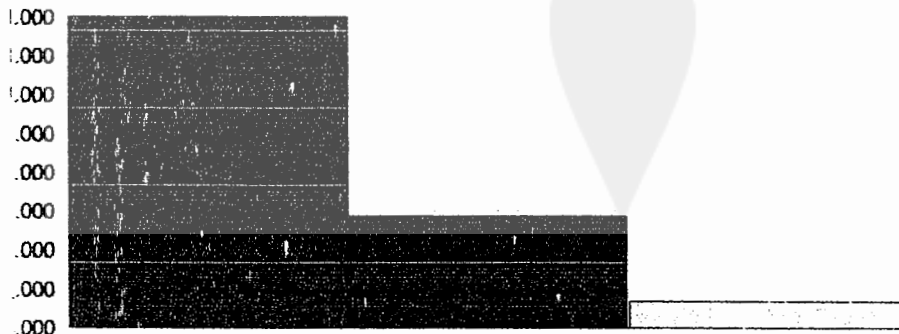
us Utilization

	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
	1.0000	0,00	1.0000	1.0000	0.00	1.0000
	0.9998	0,00	0.9987	1.0000	0.00	1.0000
	0.9997	0,00	0.9990	1.0000	0.00	1.0000



Y

	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
	1.0000	0,00	1.0000	1.0000	0.00	1.0000
	0.9998	0,00	0.9987	1.0000	0.00	1.0000
	0.9997	0,00	0.9990	1.0000	0.00	1.0000

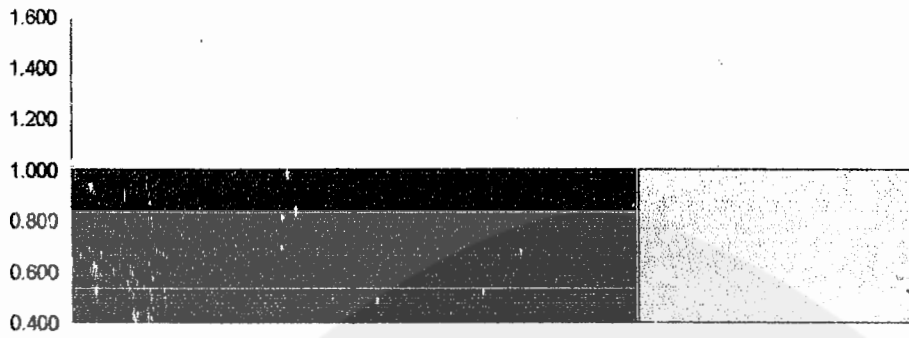


cheduled

Minimum Maximum Minimum Maximum

Category Overview

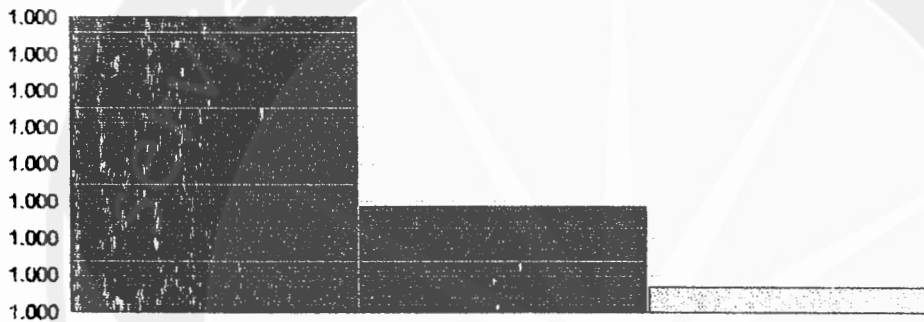
Average	Half Width	Average	Average	Value	Value
1.0000	0,00	1.0000	1.0000	1.0000	1.0000
1.0000	0,00	1.0000	1.0000	1.0000	1.0000
1.0000	0,00	1.0000	1.0000	1.0000	1.0000



mesin 1
mesin 2
mesin 3

led Utilization

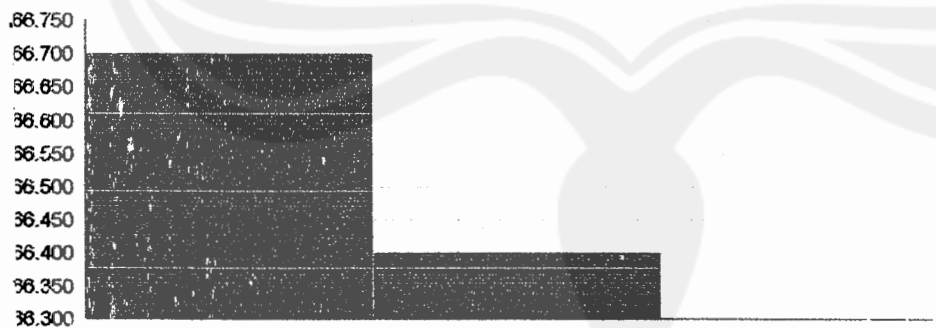
Average	Half Width	Minimum Average	Maximum Average
1.0000	0,00	1.0000	1.0000
0.9998	0,00	0.9987	1.0000
0.9997	0,00	0.9990	1.0000



mesin 1
mesin 2
mesin 3

umber Seized

Average	Half Width	Minimum Average	Maximum Average
666.70	0,35	666.00	667.00
666.40	0,37	666.00	667.00
666.30	0,35	666.00	667.00



mesin 1
mesin 2
mesin 3