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APPENDICES

APPENDIX A

The normal probability plot of performance value of each KPIs before and after implementing KPIs

Normal Probability Plot

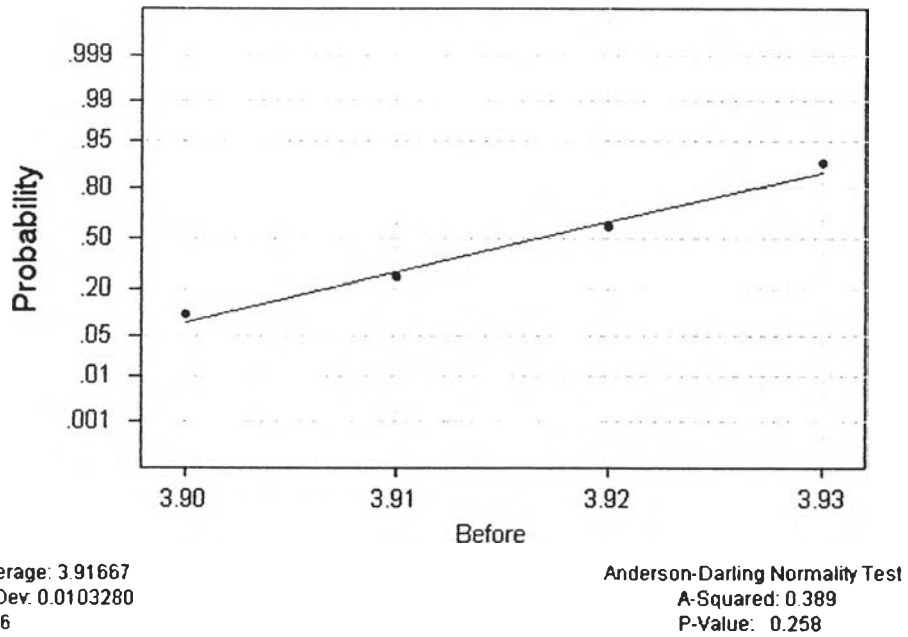


Figure 1 The normal probability plot of performance value of raw material cost per unit production before implementing KPIs

Normal Probability Plot

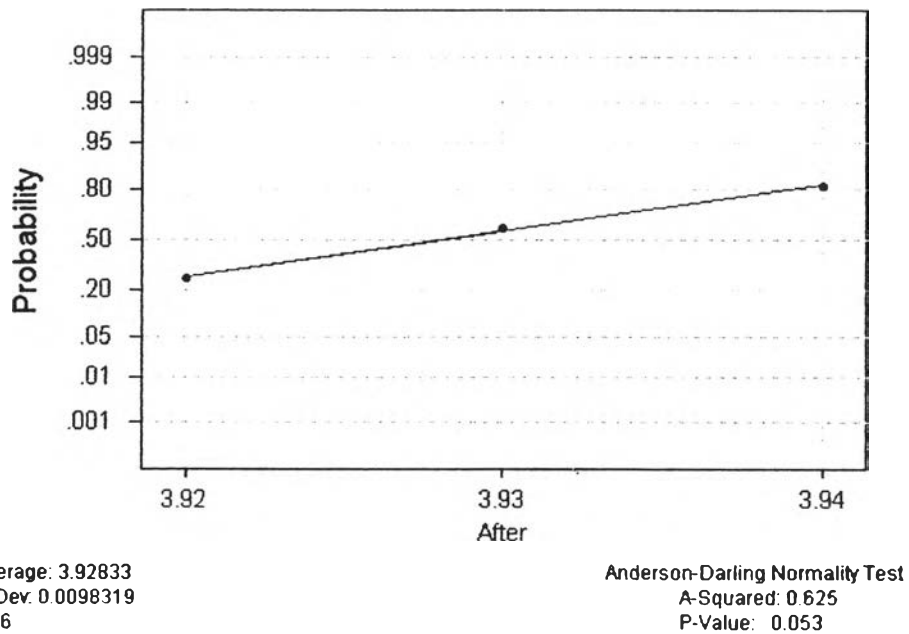
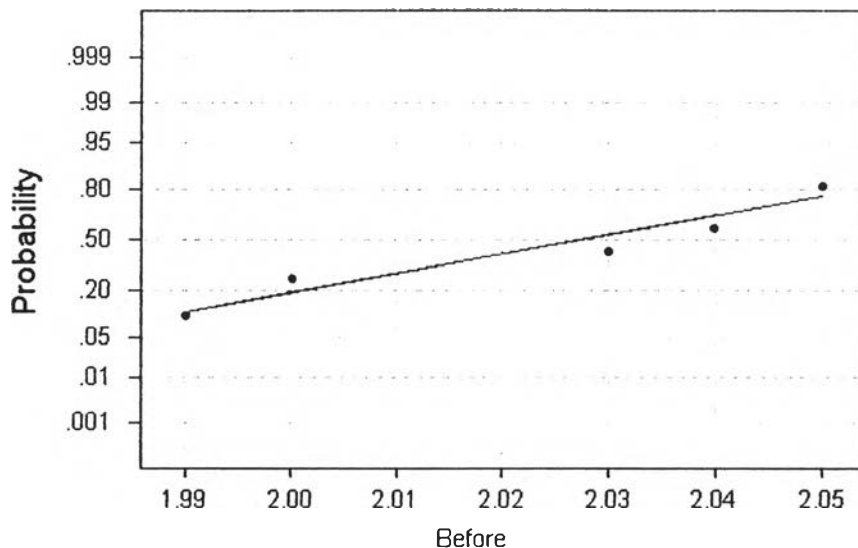


Figure 2 The normal probability plot of performance value of raw material cost per unit production after implementing KPIs

Normal Probability Plot

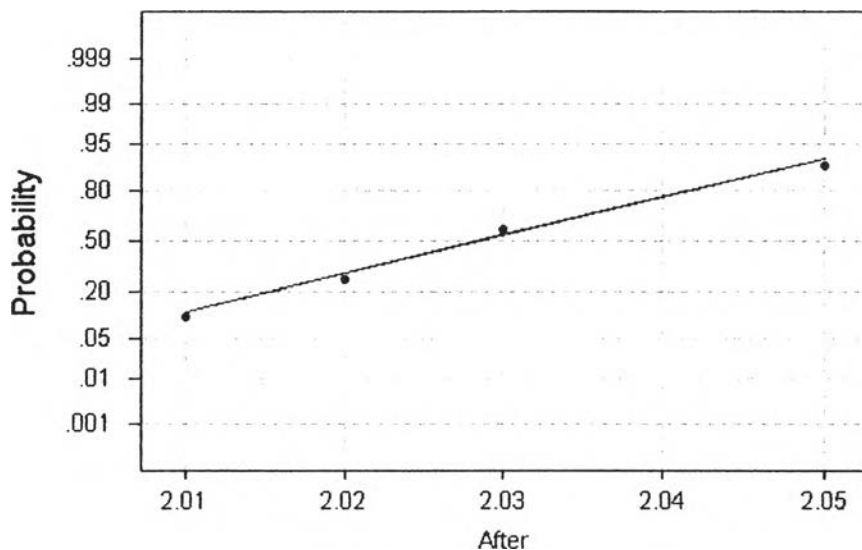


Average: 2.02667
 StDev: 0.0258199
 N: 6

Anderson-Darling Normality Test
 A-Squared: 0.419
 P-Value: 0.212

Figure 3 The normal probability plot of performance value of defect ratio that occur when using out of specification of raw material before implementing KPIs

Normal Probability Plot



Average: 2.02833
 StDev: 0.0132916
 N: 6

Anderson-Darling Normality Test
 A-Squared: 0.380
 P-Value: 0.275

Figure 4 The normal probability plot of performance value of defect ratio that occur when using out of specification of raw material after implementing KPIs

Normal Probability Plot

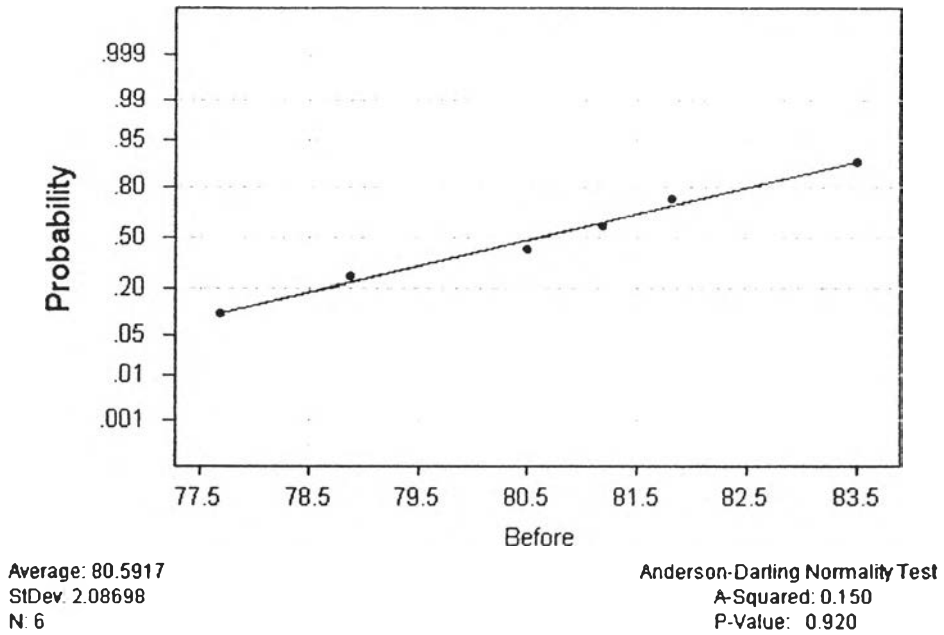


Figure 5 The normal probability plot of performance value of raw material cost to product cost ratio before implementing KPIs

Normal Probability Plot

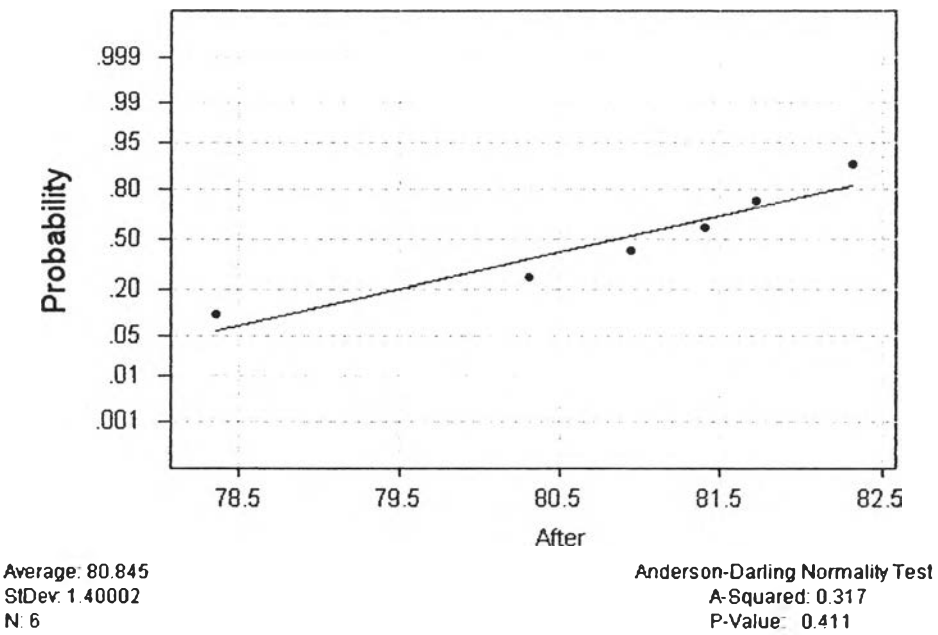


Figure 6 The normal probability plot of performance value of raw material cost to product cost ratio after implementing KPIs

Normal Probability Plot

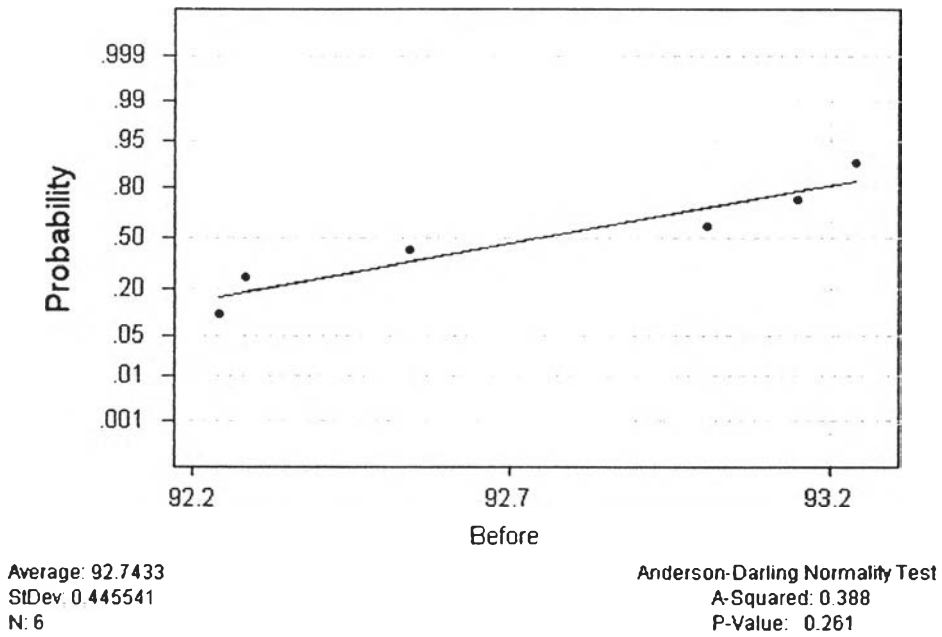


Figure 7 The normal probability plot of performance value of performance ratio before implementing KPIs

Normal Probability Plot

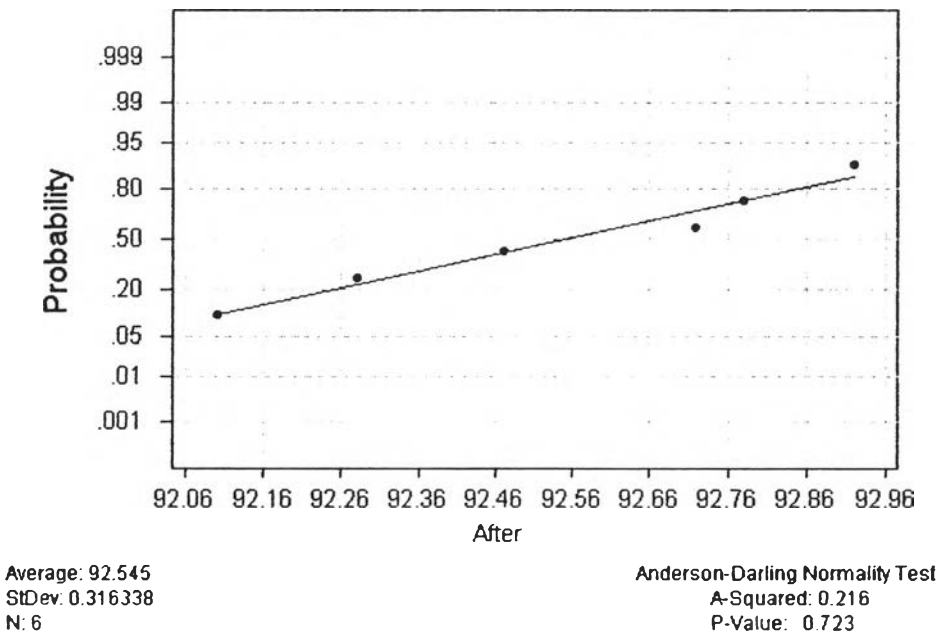


Figure 8 The normal probability plot of performance value of performance ratio after implementing KPIs

Normal Probability Plot

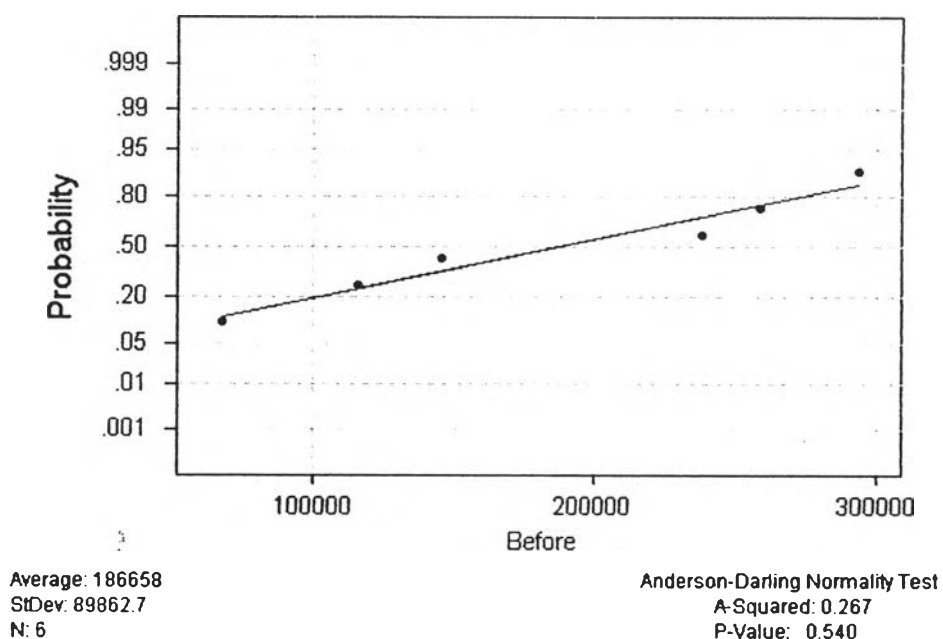


Figure 9 The normal probability plot of performance value of value of product uncompleted on time before implementing KPIs

Normal Probability Plot

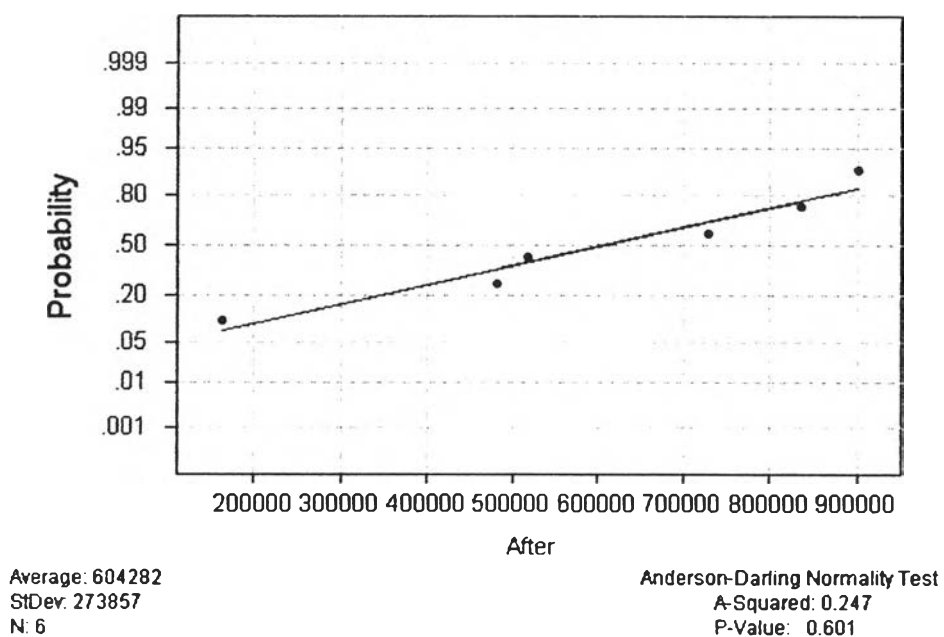
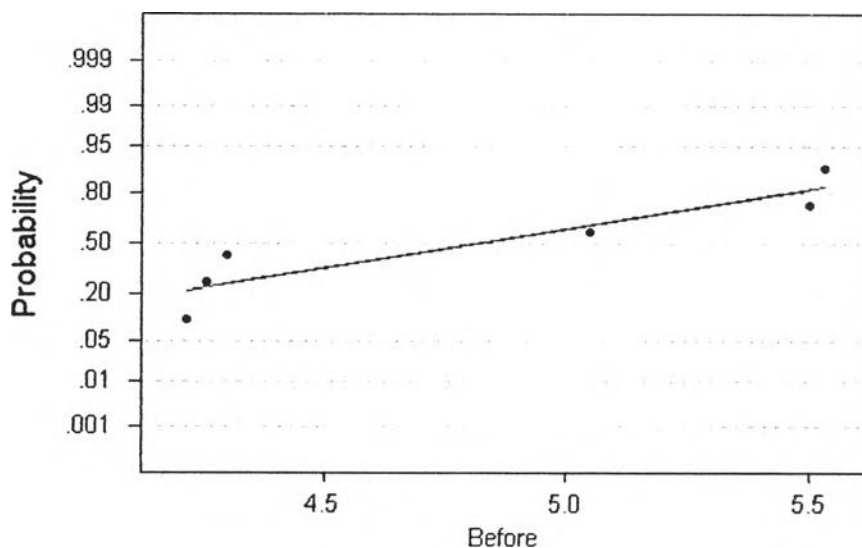


Figure 10 The normal probability plot of performance value of value of product uncompleted on time after implementing KPIs

Normal Probability Plot

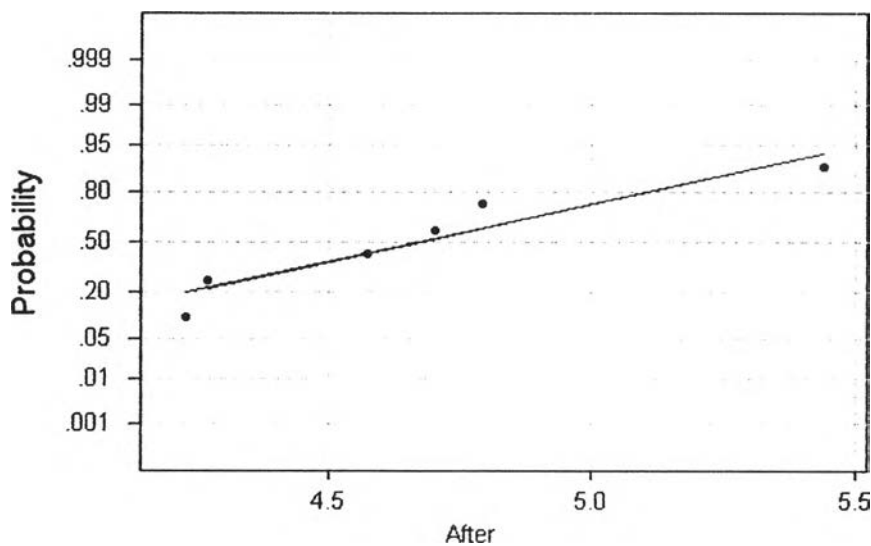


Average: 4.81
 StDev: 0.626546
 N: 6

Anderson-Darling Normality Test
 A-Squared: 0.555
 P-Value: 0.085

Figure 11 The normal probability plot of performance value of machine idle time ratio before implementing KPIs

Normal Probability Plot

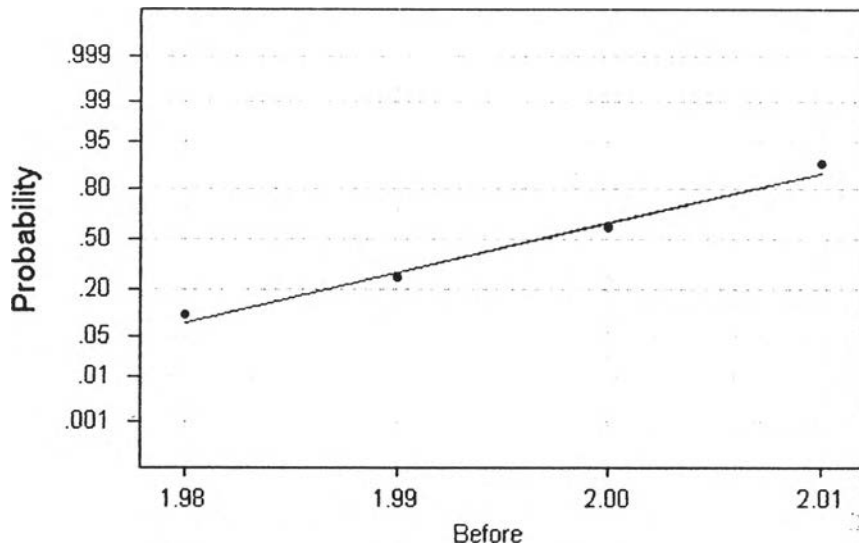


Average: 4.66667
 StDev: 0.440848
 N: 6

Anderson-Darling Normality Test
 A-Squared: 0.330
 P-Value: 0.379

Figure 12 The normal probability plot of performance value of machine idle time ratio after implementing KPIs

Normal Probability Plot

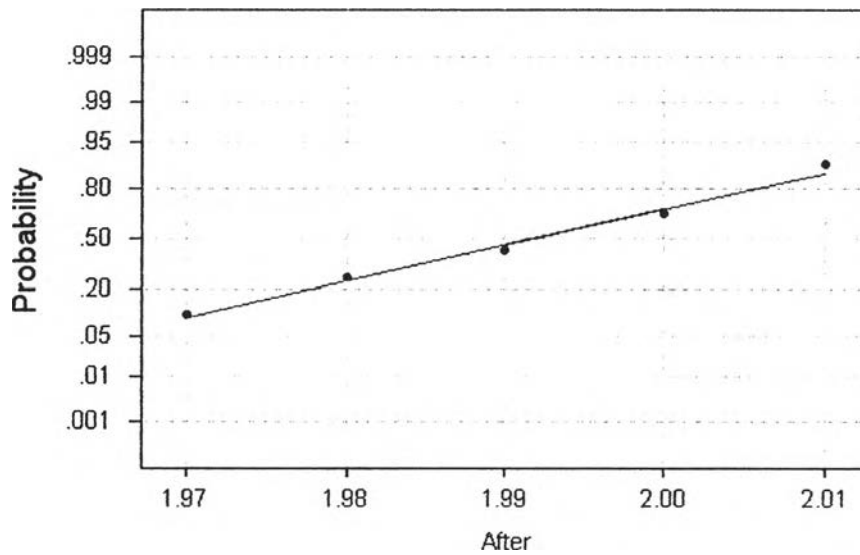


Average: 1.99667
 StDev: 0.0103280
 N: 6

Anderson-Darling Normality Test
 A-Squared: 0.389
 P-Value: 0.258

Figure 13 The normal probability plot of performance value of non-conform raw material per total raw material used before implementing KPIs

Normal Probability Plot

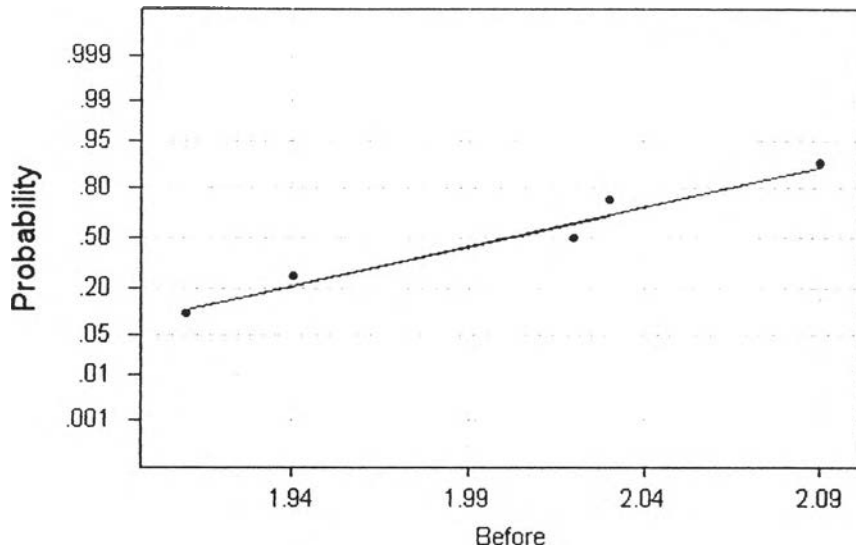


Average: 1.99167
 StDev: 0.0147196
 N: 6

Anderson-Darling Normality Test
 A-Squared: 0.220
 P-Value: 0.708

Figure 14 The normal probability plot of performance value of non-conform raw material per total raw material used after implementing KPIs

Normal Probability Plot

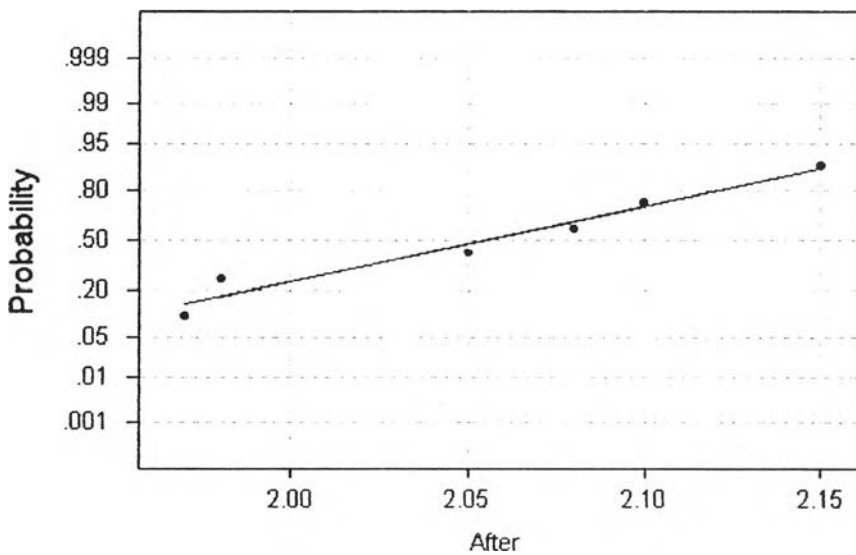


Average: 2.00167
 StDev: 0.0655490
 N: 6

Anderson-Darling Normality Test
 A-Squared: 0.339
 P-Value: 0.358

Figure 15 The normal probability plot of performance value of quantity of defect per quantity of production before implementing KPIs

Normal Probability Plot



Average: 2.055
 StDev: 0.0700714
 N: 6

Anderson-Darling Normality Test
 A-Squared: 0.230
 P-Value: 0.669

Figure 16 The normal probability plot of performance value of quantity of defect per quantity of production after implementing KPIs

Normal Probability Plot

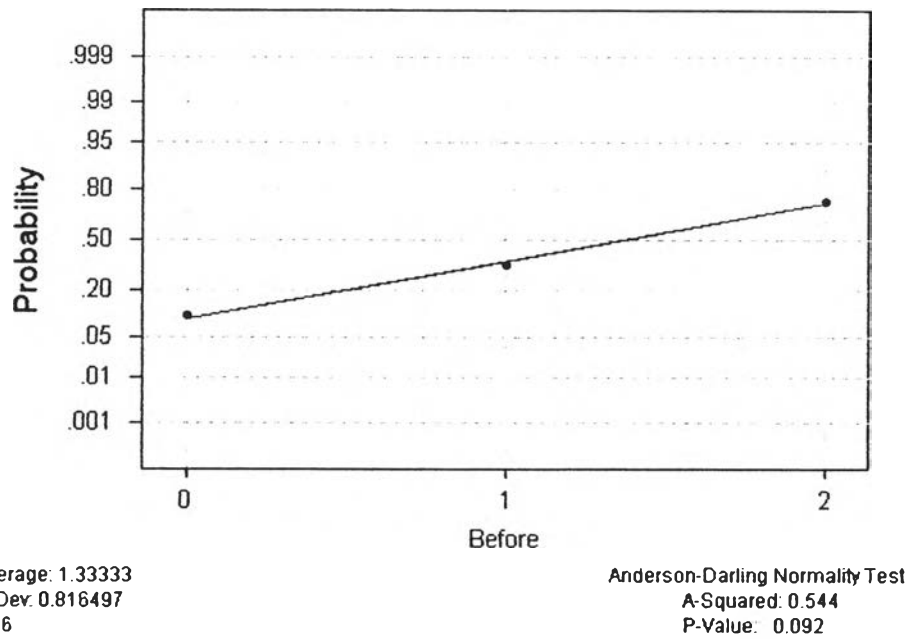


Figure 17 The normal probability plot of performance value of number of delayed lot before implementing KPIs

Normal Probability Plot

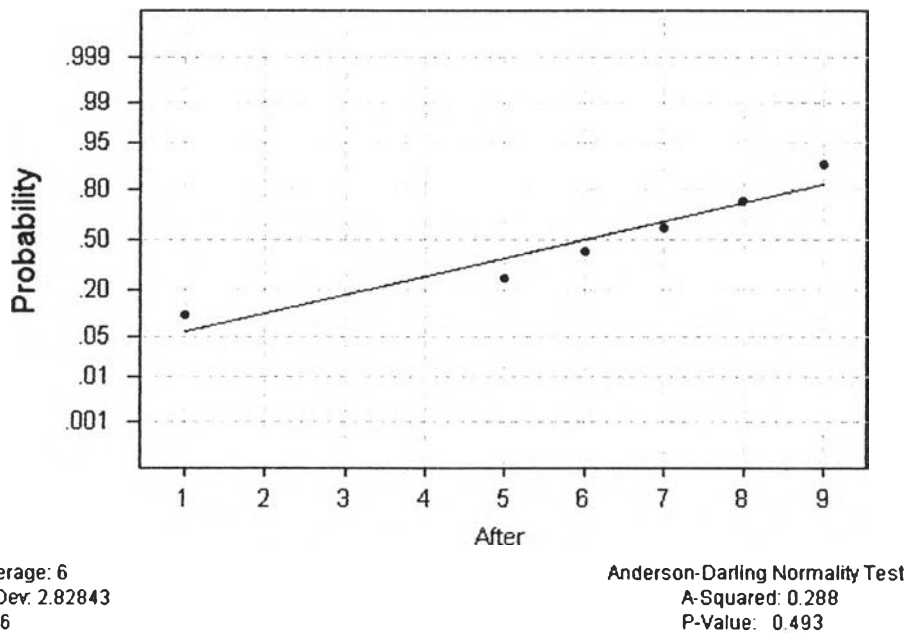
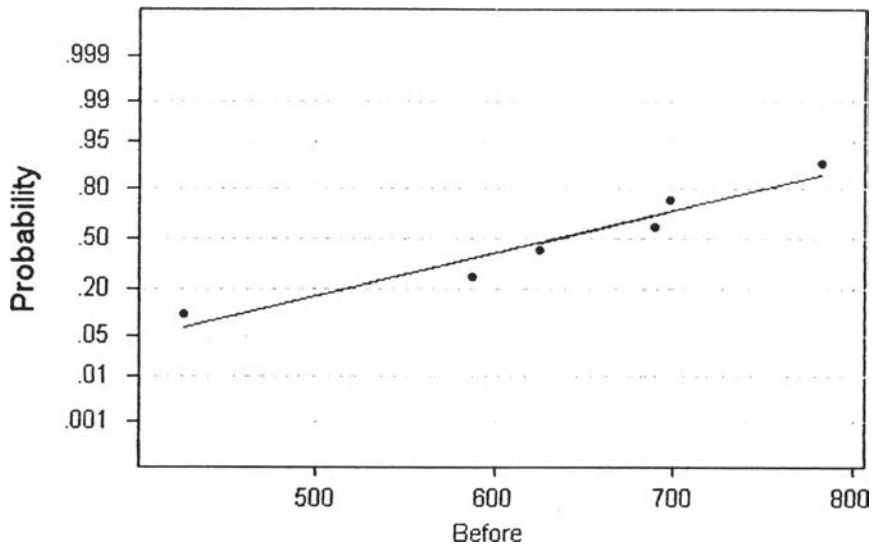


Figure 18 The normal probability plot of performance value of number of delayed lot after implementing KPIs

Normal Probability Plot

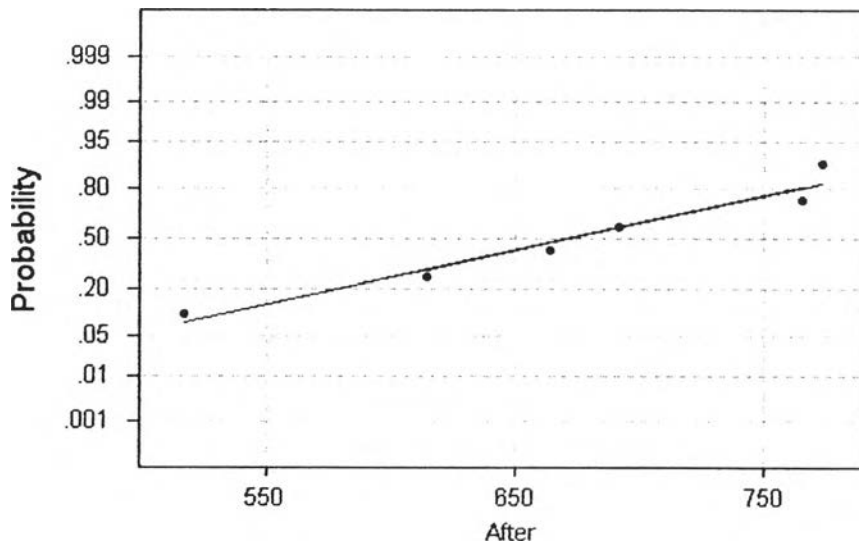


Average: 634.833
 StDev: 122.460
 N: 6

Anderson-Darling Normality Test
 A-Squared: 0.257
 P-Value: 0.567

Figure 19 The normal probability plot of performance value of accumulate idle time before implementing KPIs

Normal Probability Plot



Average: 670.833
 StDev: 96.6383
 N: 6

Anderson-Darling Normality Test
 A-Squared: 0.225
 P-Value: 0.688

Figure 20 The normal probability plot of performance value of accumulate idle time after implementing KPIs

Normal Probability Plot

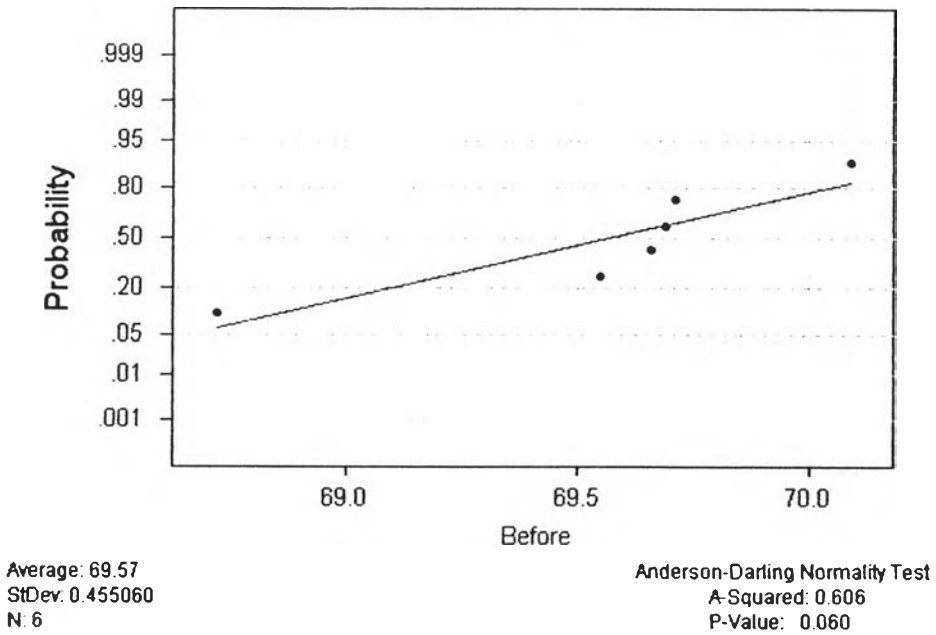


Figure 21 The normal probability plot of performance value of unit production per machine before implementing KPIs

Normal Probability Plot

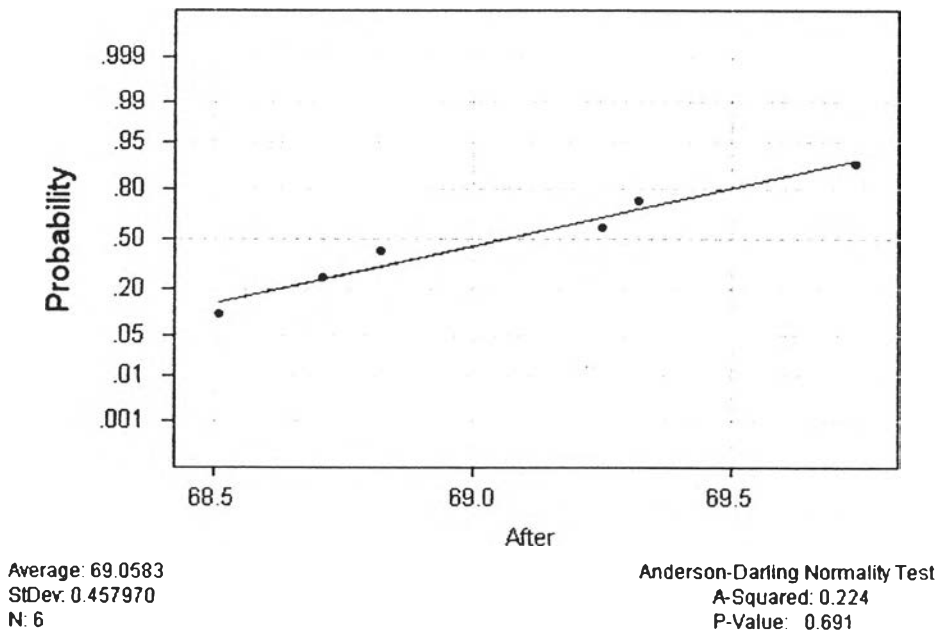


Figure 22 The normal probability plot of performance value of unit production per machine after implementing KPIs

Normal Probability Plot

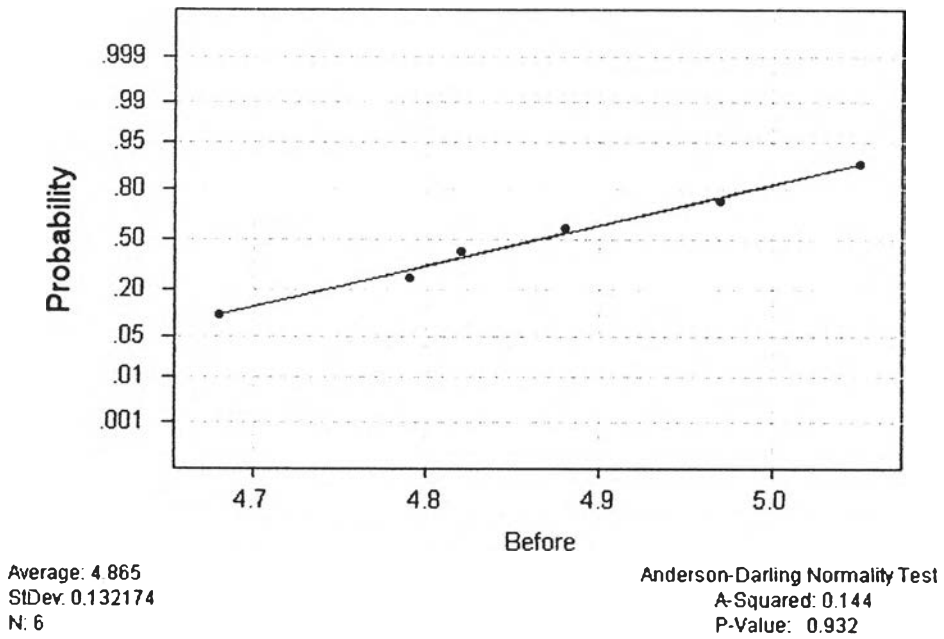


Figure 23 The normal probability plot of performance value of product cost per unit before implementing KPIs

Normal Probability Plot

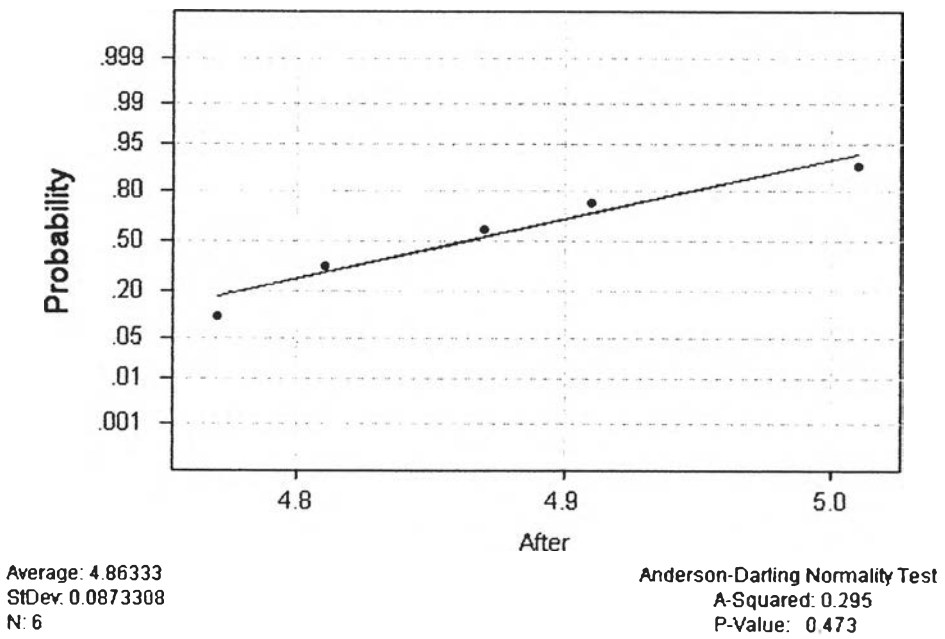


Figure 24 The normal probability plot of performance value of product cost per unit after implementing KPIs

Normal Probability Plot

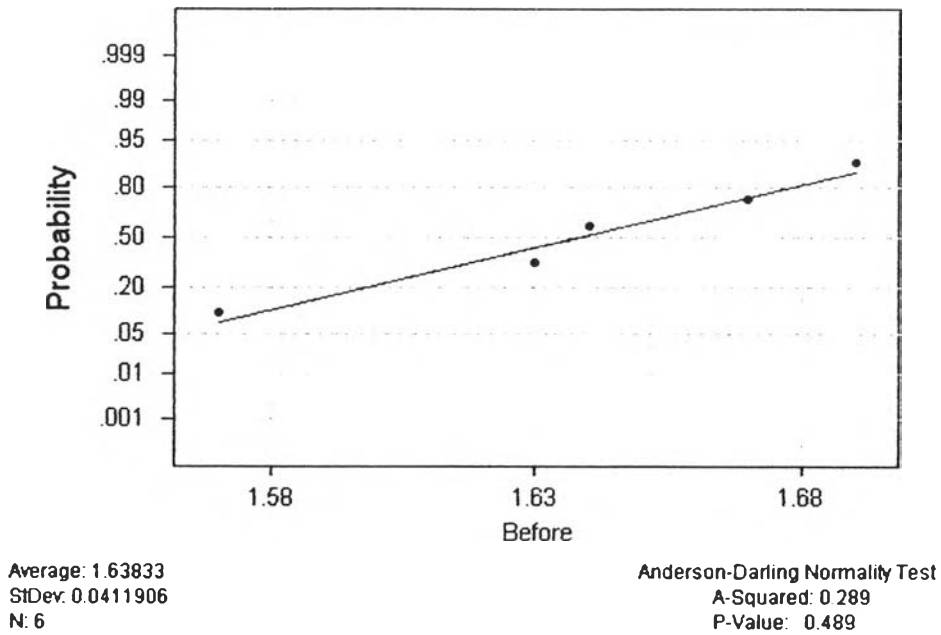


Figure 25 The normal probability plot of performance value of power cost to product cost ratio before implementing KPIs

Normal Probability Plot

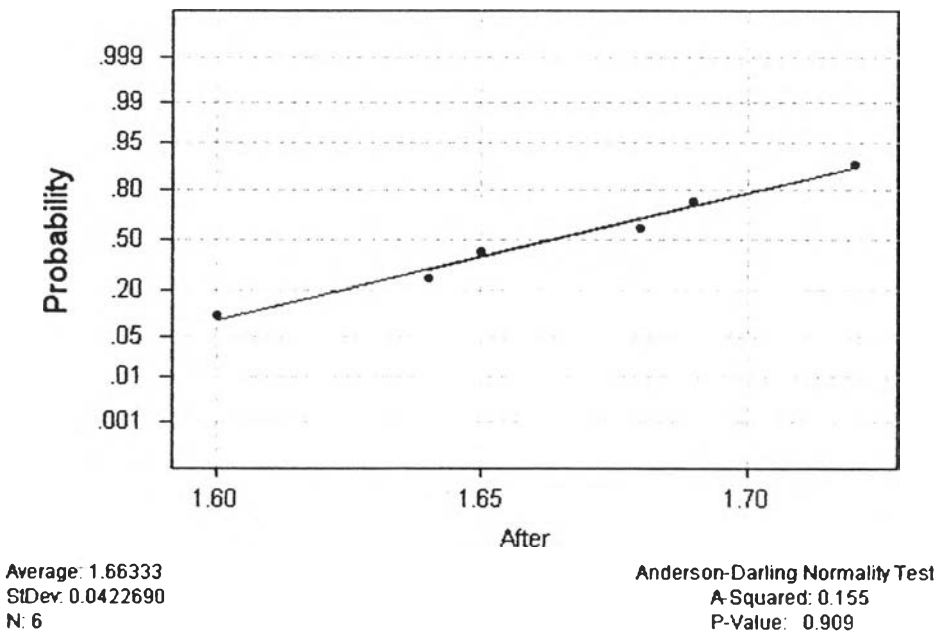


Figure 26 The normal probability plot of performance value of power cost to product cost ratio after implementing KPIs

Normal Probability Plot

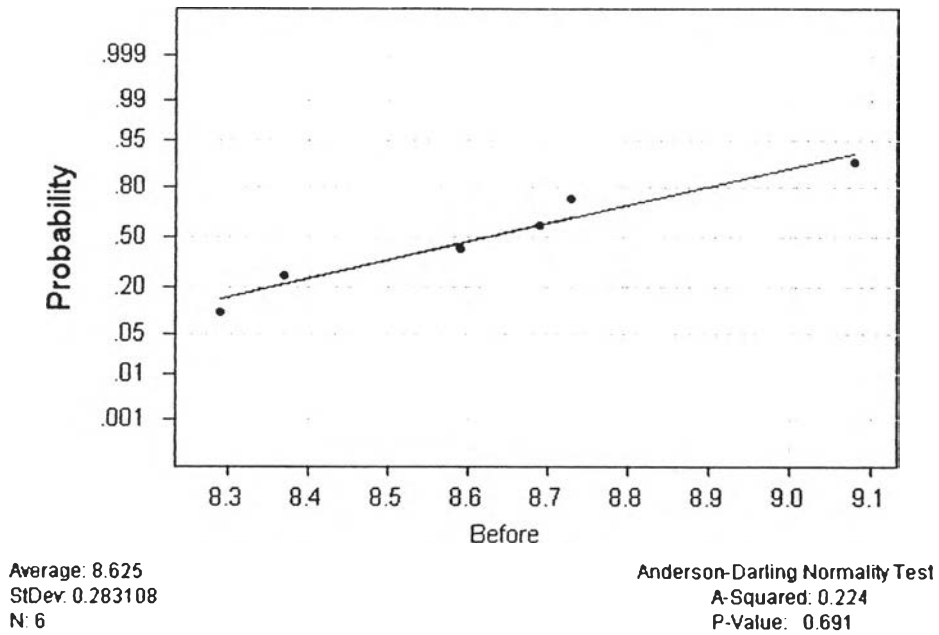


Figure 27 The normal probability plot of performance value of depreciation to product cost ratio before implementing KPIs

Normal Probability Plot

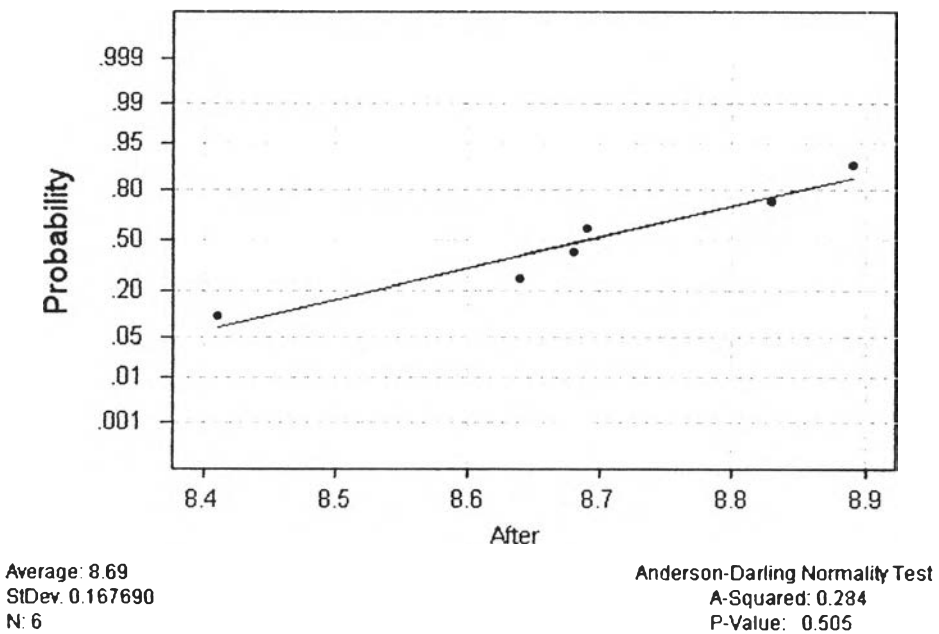


Figure 28 The normal probability plot of performance value of depreciation to product cost ratio after implementing KPIs

Normal Probability Plot

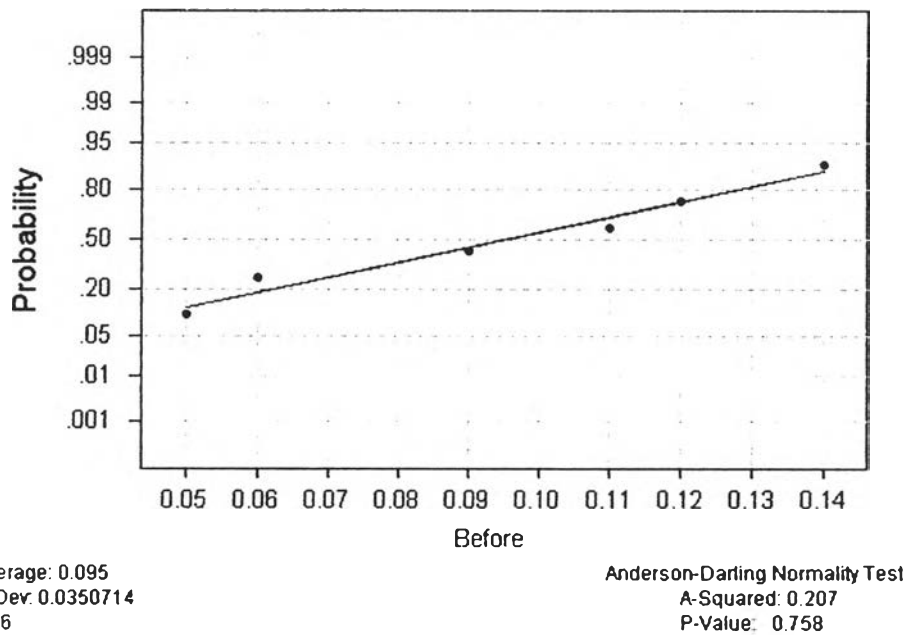


Figure 29 The normal probability plot of performance value of number of customer complain per number of good sold before implementing KPIs

Normal Probability Plot

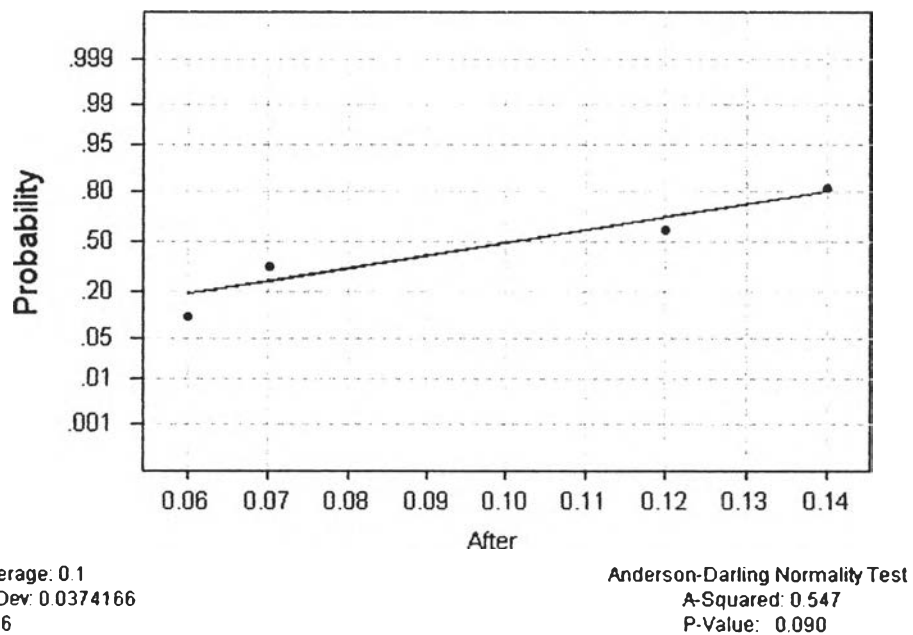


Figure 30 The normal probability plot of performance value of number of customer complain per number of good sold after implementing KPIs

Normal Probability Plot

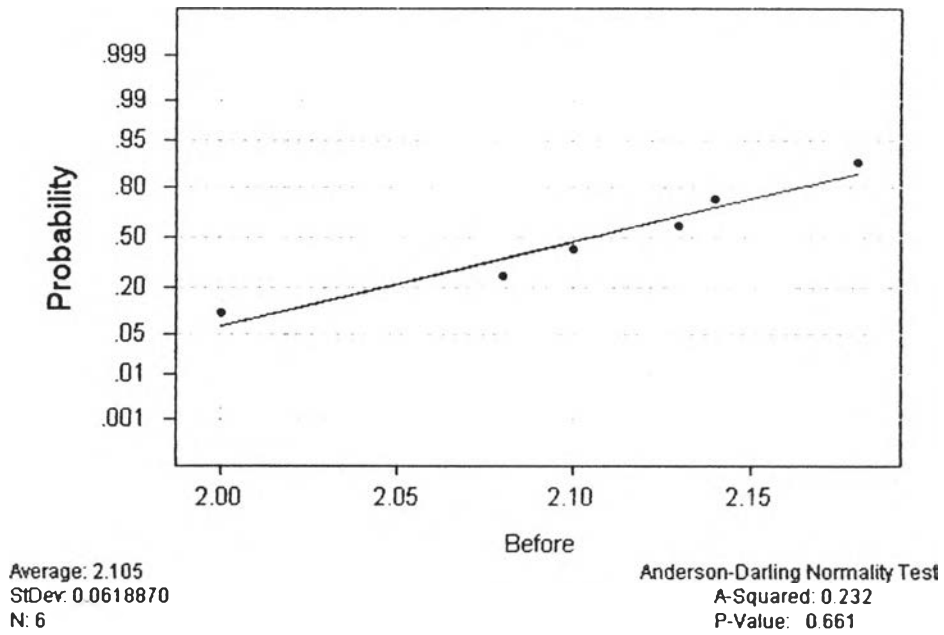


Figure 31 The normal probability plot of performance value of defect rate found from in-line production before implementing KPIs

Normal Probability Plot

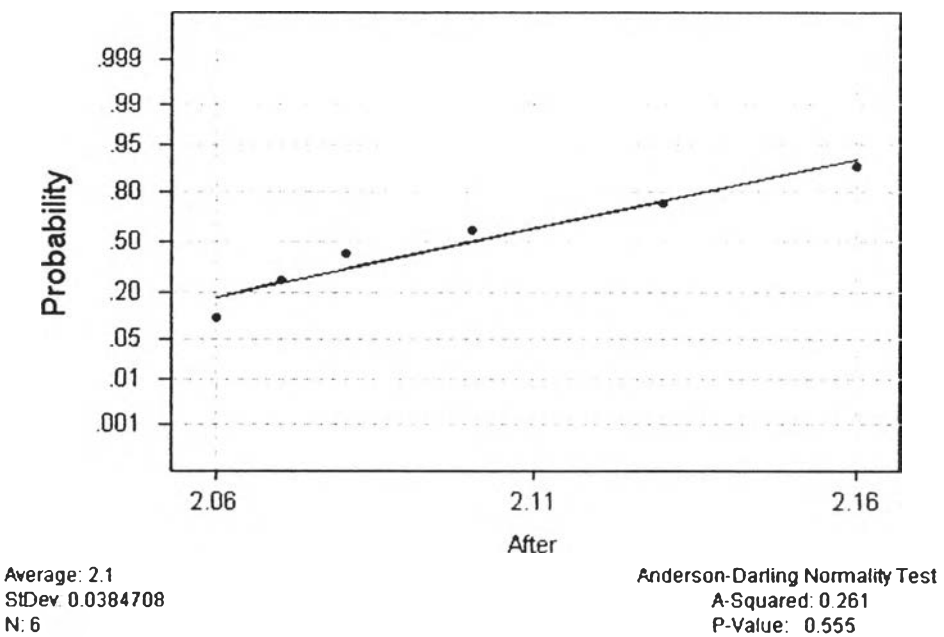


Figure 32 The normal probability plot of performance value of defect rate found from in-line production after implementing KPIs

Normal Probability Plot

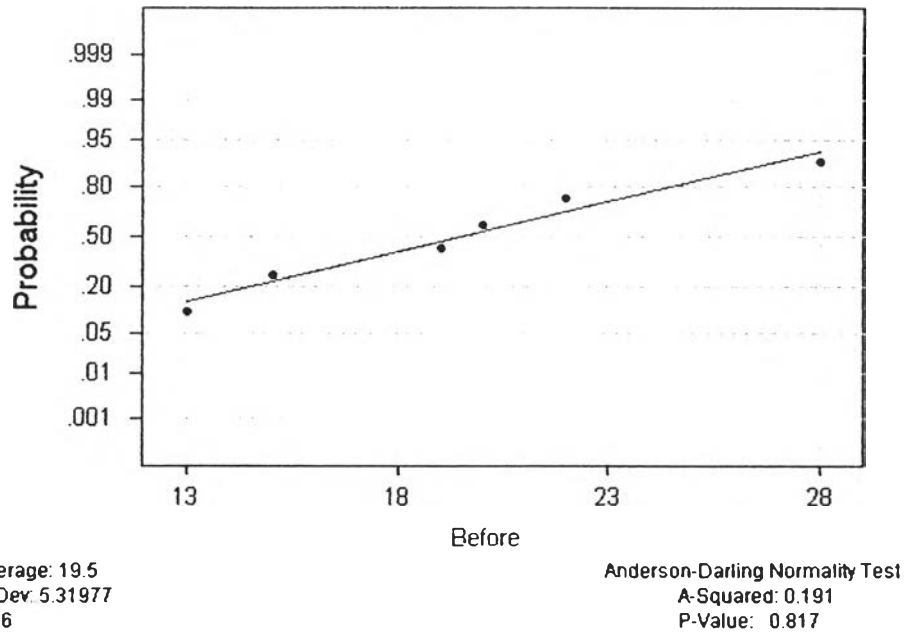


Figure 33 The normal probability plot of performance value of total machine downtime before implementing KPIs

Normal Probability Plot

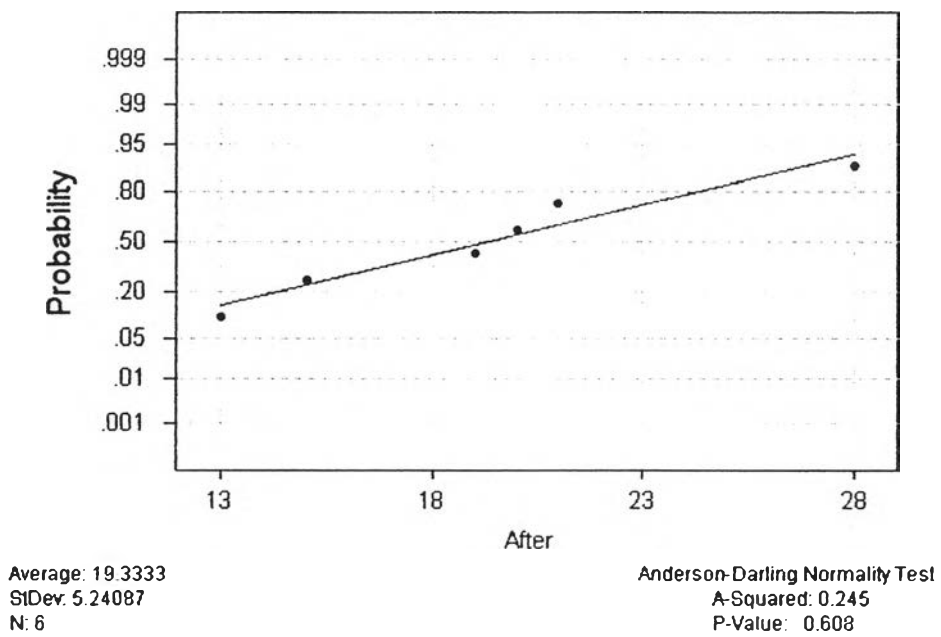
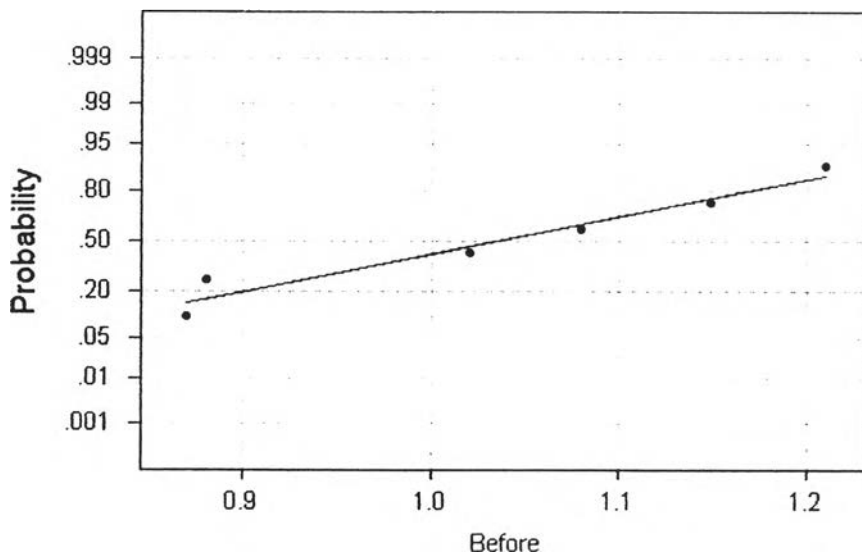


Figure 34 The normal probability plot of performance value of total machine downtime after implementing KPIs

Normal Probability Plot

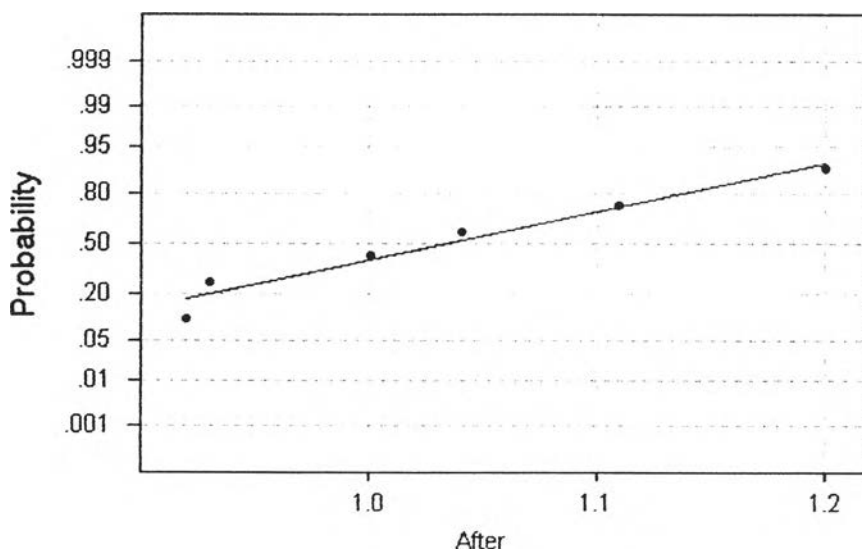


Average: 1.035
 StDev: 0.139535
 N: 6

Anderson-Darling Normality Test
 A-Squared: 0.256
 P-Value: 0.573

Figure 35 The normal probability plot of performance value of maintenance cost to product cost ratio before implementing KPIs

Normal Probability Plot



Average: 1.03333
 StDev: 0.108012
 N: 6

Anderson-Darling Normality Test
 A-Squared: 0.221
 P-Value: 0.705

Figure 36 The normal probability plot of performance value of maintenance cost to product cost ratio after implementing KPIs

APPENDIX B

Test for equal variances of performance value of each KPIs before and after
implementing KPIs

Test for Equal Variances

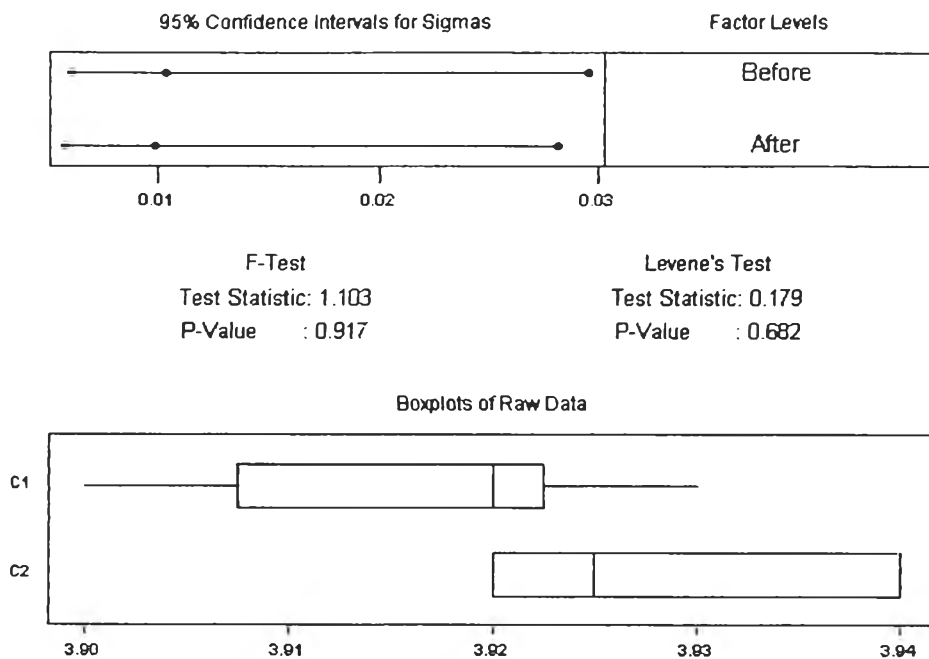


Figure 1 Test for equal variances of raw material cost per unit production

Test for Equal Variances

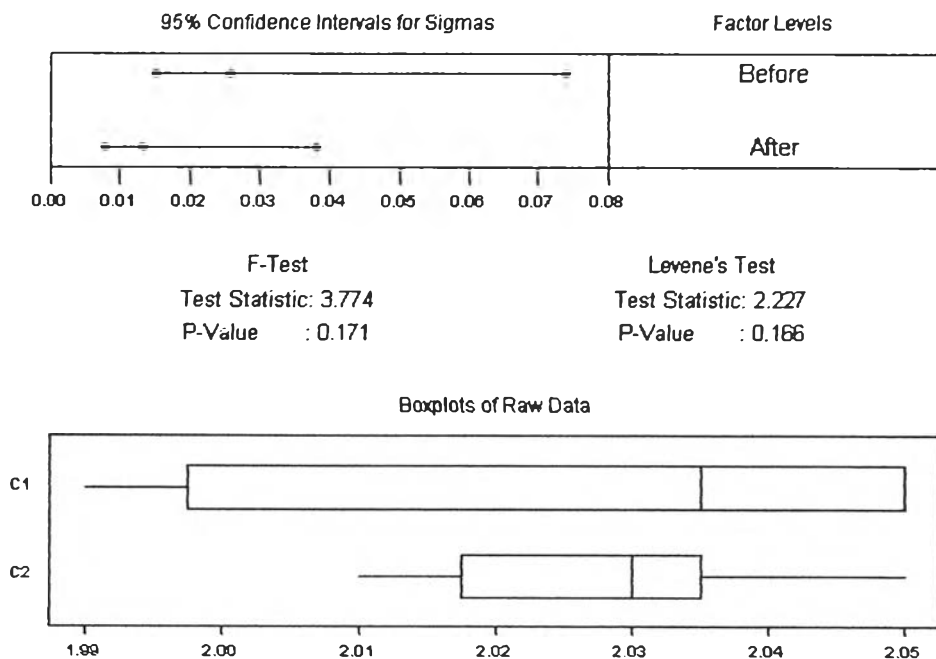


Figure 2 Test for equal variances of defect ratio that occur when using out of specification of raw material

Test for Equal Variances

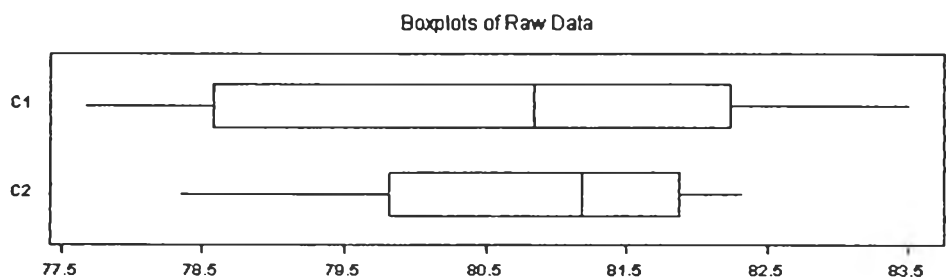
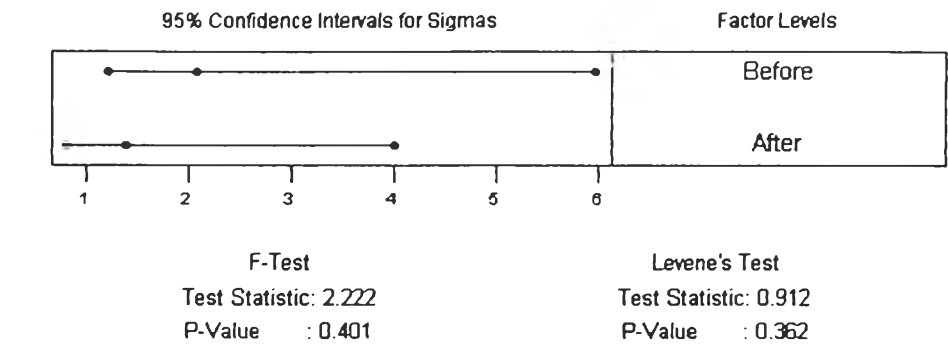


Figure 3 Test for equal variances of raw material cost to product cost ratio

Test for Equal Variances

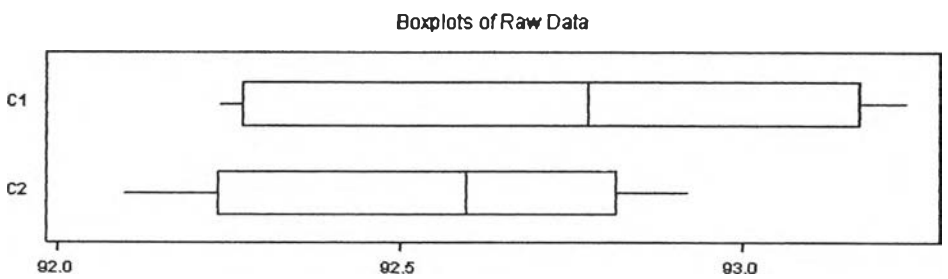
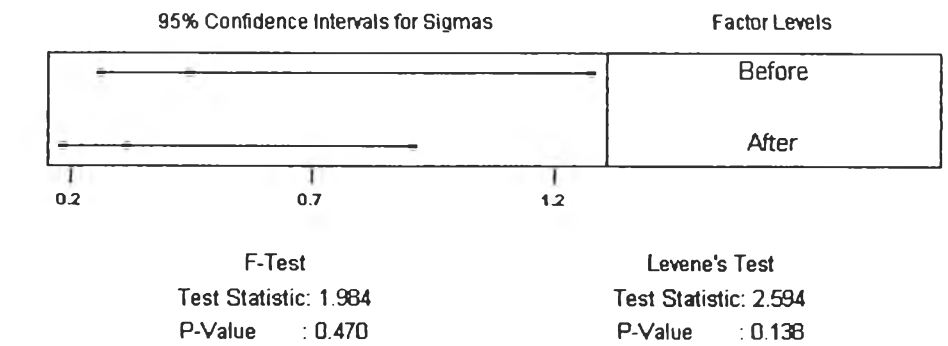


Figure 4 Test for equal variances of performance ratio

Test for Equal Variances

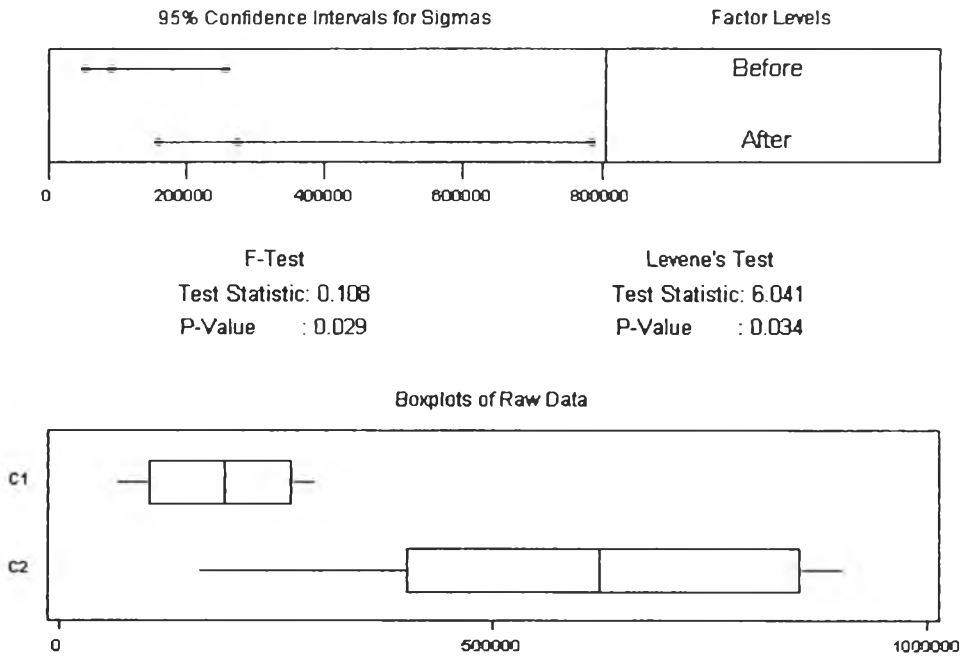


Figure 5 Test for equal variances of value of product uncompleted on time

Test for Equal Variances

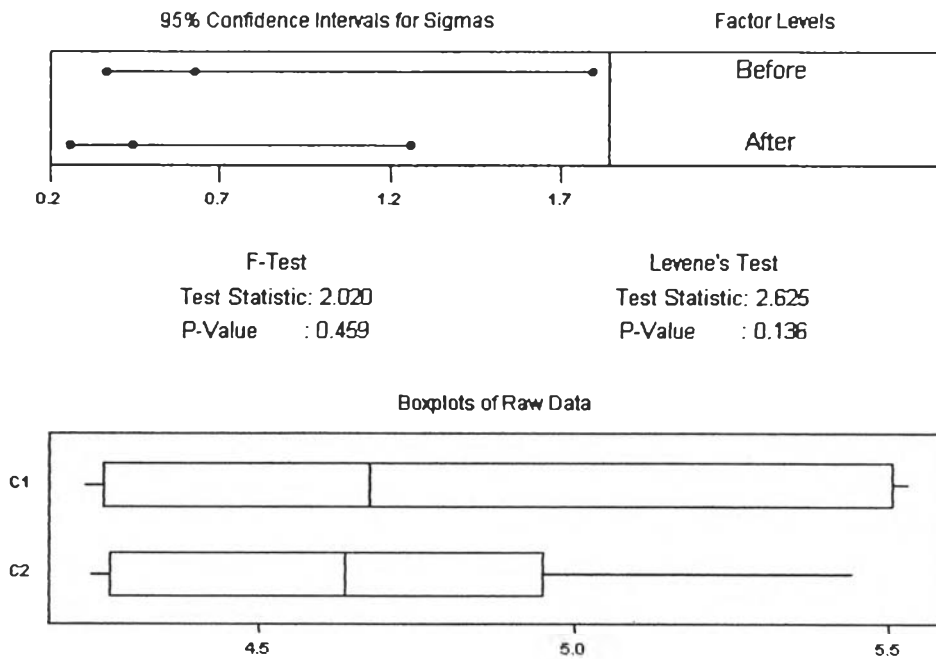


Figure 6 Test for equal variances of machine idle time ratio

Test for Equal Variances

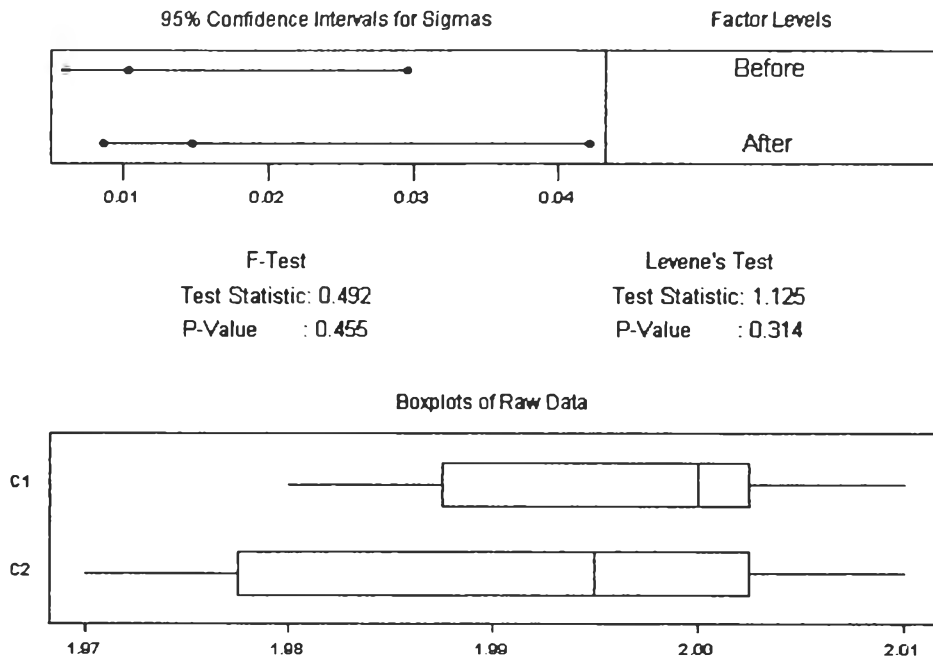


Figure 7 Test for equal variances of non-conform raw material per total raw material used

Test for Equal Variances

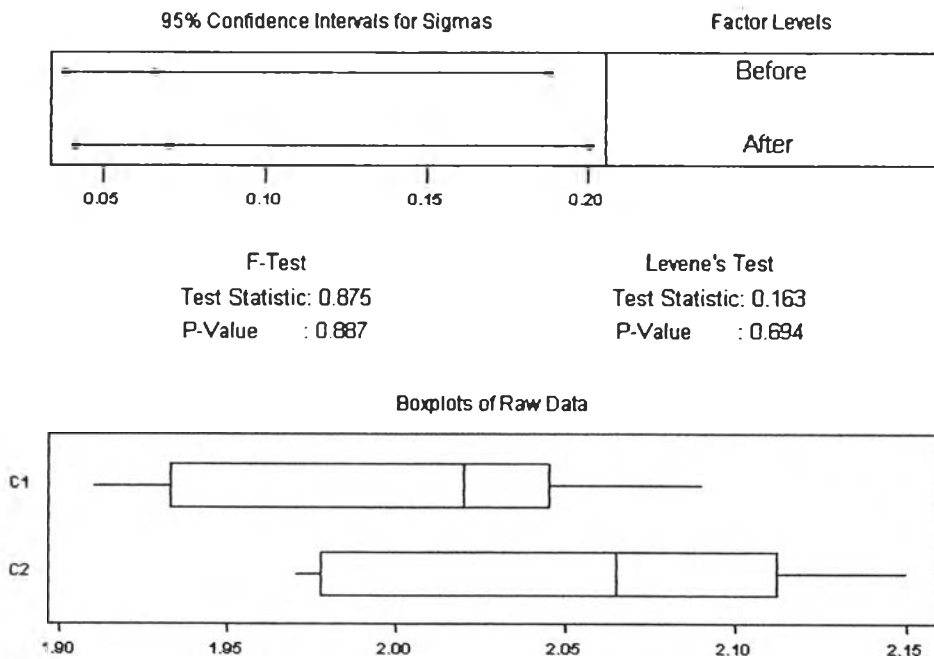


Figure 8 Test for equal variances of quantity of defect per quantity of production

Test for Equal Variances

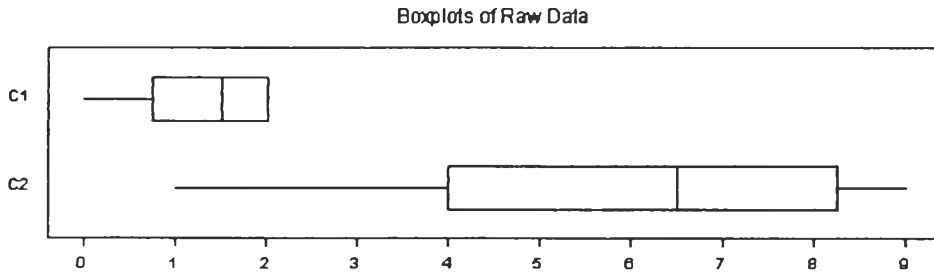
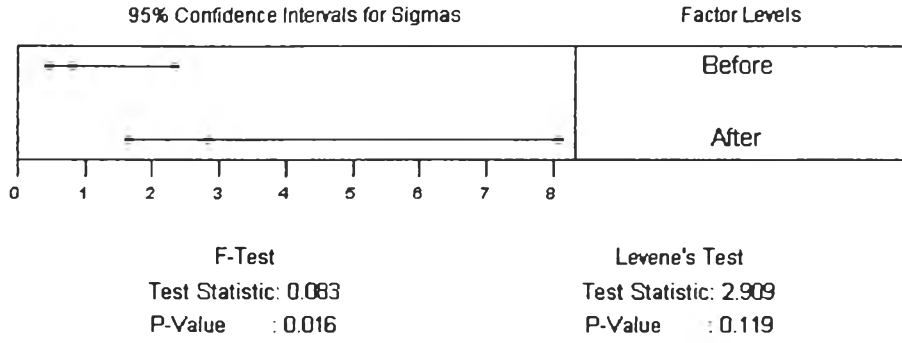


Figure 9 Test for equal variances of number of delayed lot

Test for Equal Variances

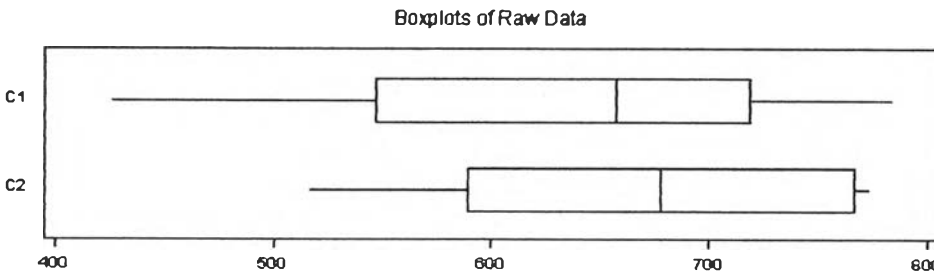
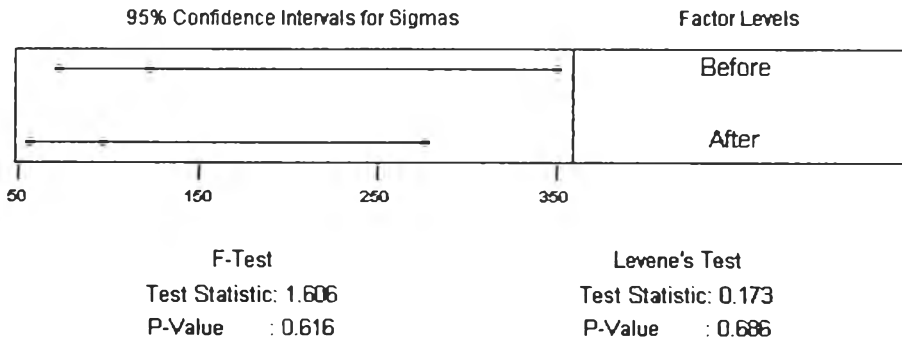


Figure 10 Test for equal variances of accumulate idle time

Test for Equal Variances

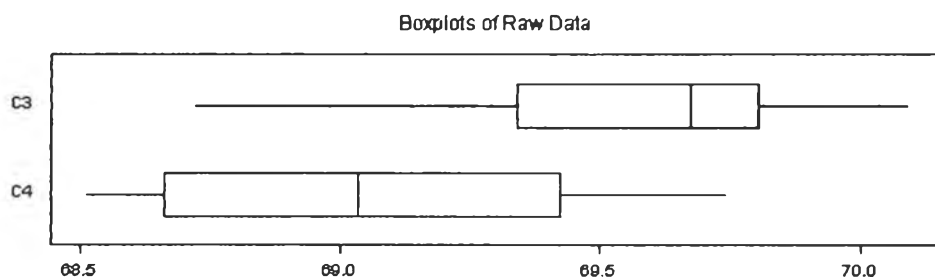
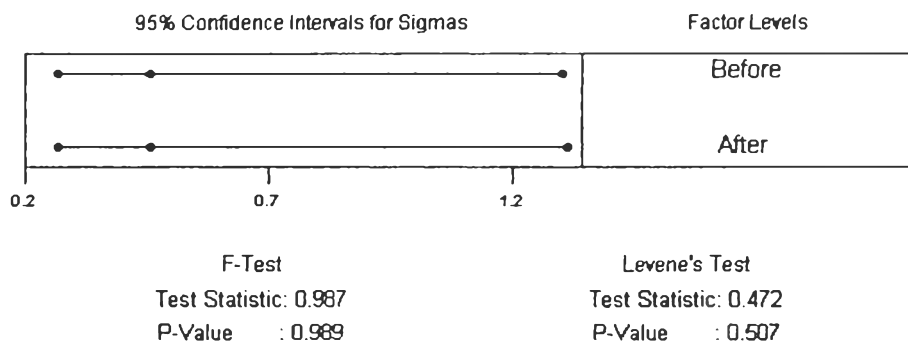


Figure 11 Test for equal variances of unit production per machine

Test for Equal Variances

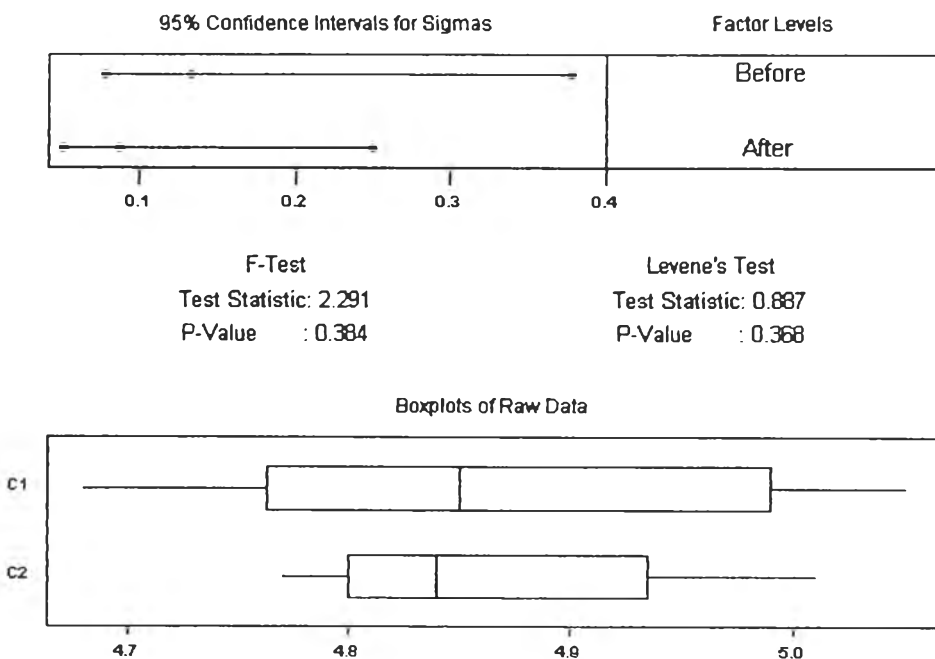


Figure 12 Test for equal variances of product cost per unit

Test for Equal Variances

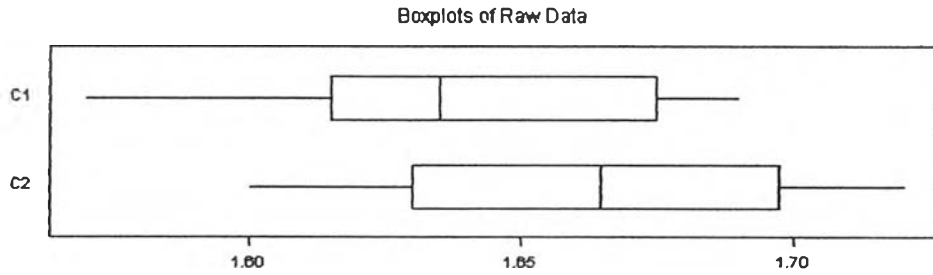
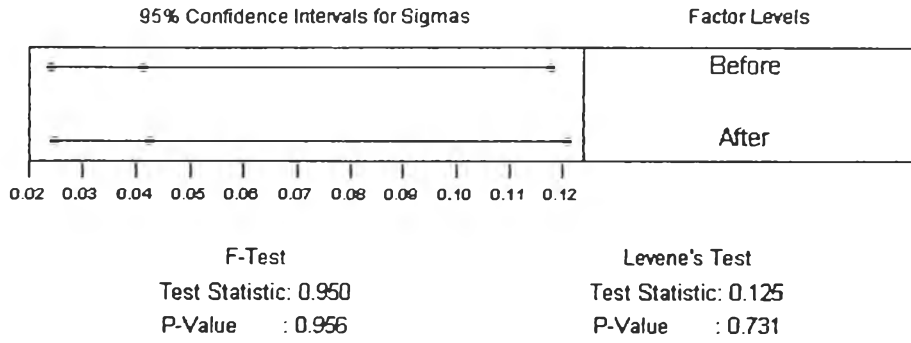


Figure 13 Test for equal variances of power cost to product cost ratio

Test for Equal Variances

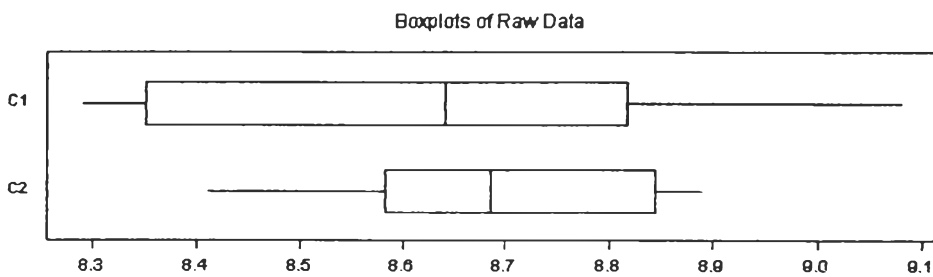
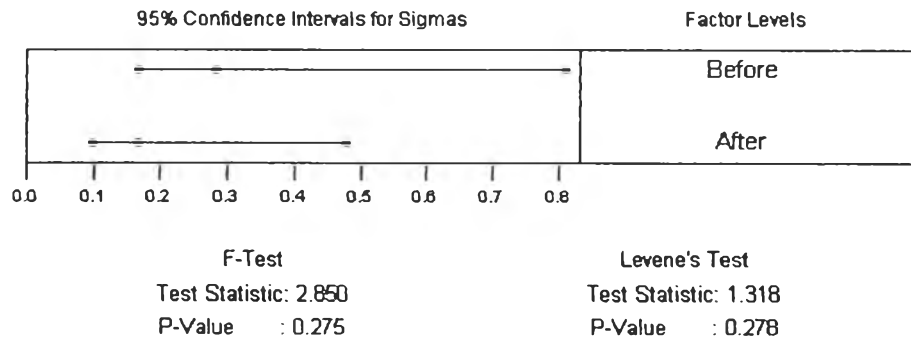


Figure 14 Test for equal variances of depreciation to product cost ratio

Test for Equal Variances

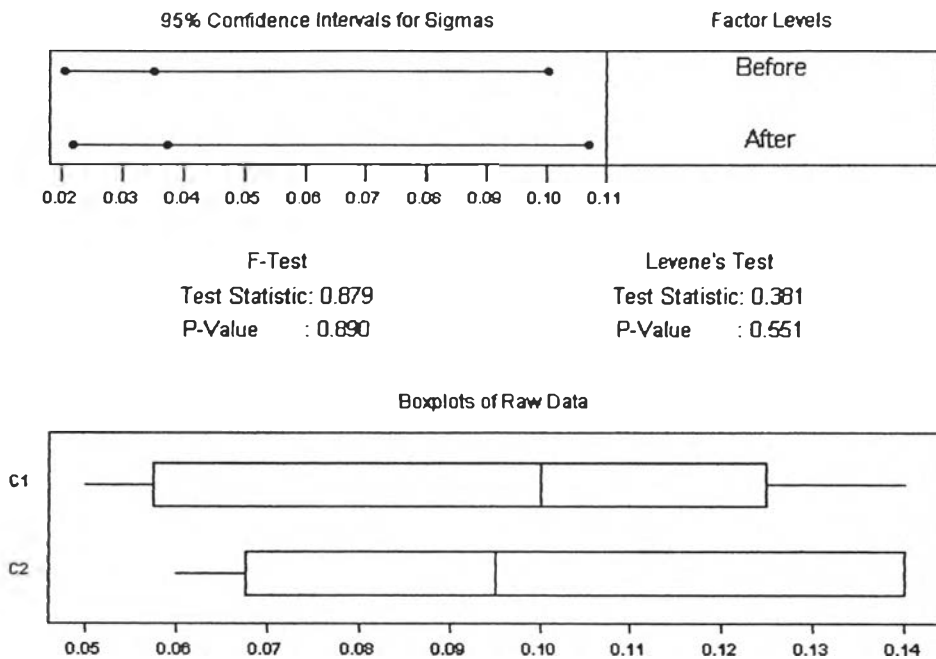


Figure 15 Test for equal variances of number of customer complain per number of good sold

Test for Equal Variances

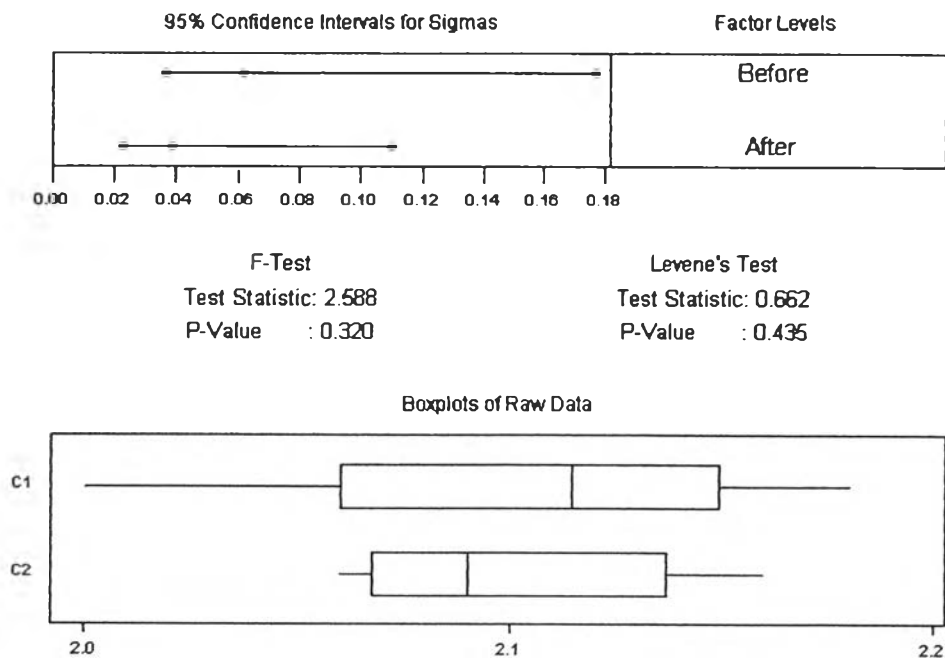


Figure 16 Test for equal variances of defect rate found from in-line production

Test for Equal Variances

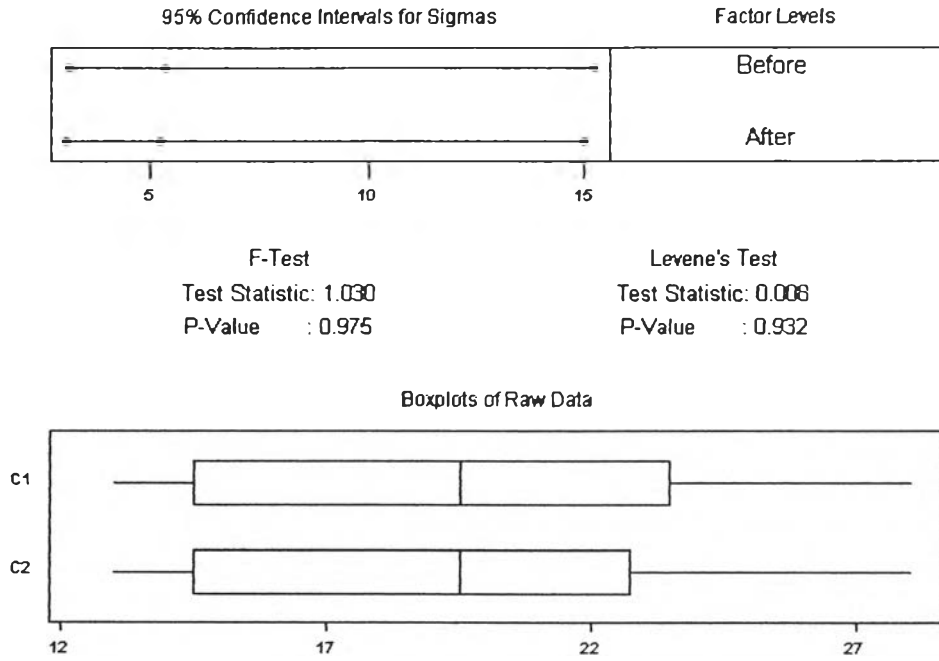


Figure 17 Test for equal variances of total machine downtime

Test for Equal Variances

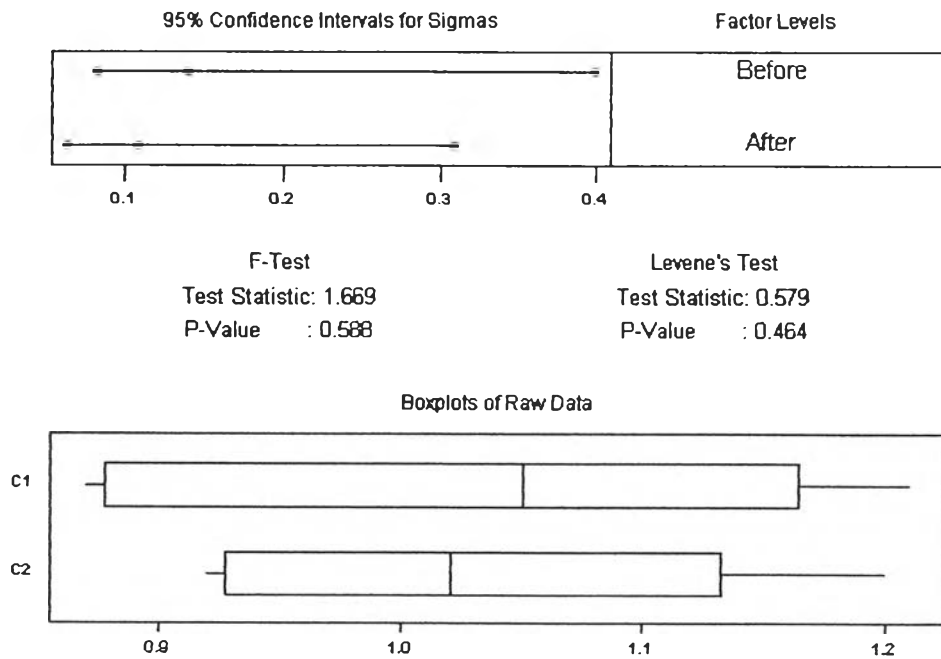


Figure 18 Test for equal variances of maintenance cost to product cost ratio

APPENDIX C

Examples of check sheet in the factory

รายงานการเตรียมวัตถุดิบ

วันที่..... ๖ ก.พ ๒๕๖๐.....

ชื่อ..... โฉม.....

เวลา	จำนวนวัตถุดิบที่ใช้ (กิโลกรัม)	จำนวนของเสียที่เกิดจากวัตถุดิบไม่ได้ มาตรฐาน (กิโลกรัม)	วัตถุดิบที่ผสมผิตส่วน (กิโลกรัม)
08.00-10.00	๒๘๐	๔.๘๗	๖.๕๖
10.00-12.00	๒๘๐	๕.๑๖	๗.๐๙
13.00-15.00	๒๘๐	๕.๐๑	๗.๘๓
15.00-17.00	๒๘๐	๔.๓๕	๗.๒๗
รวม	๑๑๒๐	๑๙.๓๙	๒๘.๗๕

หมายเหตุ :

ผู้รับรอง..... โฉม.....

รายงานการผลิต

วันที่ 5 กุมภาพันธ์ 2546

ชื่อ ใจ

แผนการผลิต 100 กิโลกรัม

เวลา	วัตถุดิบที่ใช้		จำนวนที่ผลิต	
	Lot Number	กิโลกรัม	กิโลกรัม	ชิ้น
08.00-10.00	050203101	280	259.01	8634
10.00-12.00	050203102	280	259.10	8637
13.00-15.00	050203103	280	257.30	8577
15.00-17.00	050203104	280	253.60	8453
รวม		1120	1,029.01	34,300

หมายเหตุ :

ผู้รับรอง นาย

รายงานการตรวจสอบคุณภาพ

วันที่ 5 ก.พ. 2546

ชื่อ วิชา

เวลา	จำนวนที่ผลิต		จำนวนของเสีย (กิโลกรัม)	
	กิโลกรัม	ชิ้น	ตรวจพบใน สายการผลิต	ตรวจพบเมื่อ ผลิตเสร็จ
08.00-10.00	259.01	8,634	5.11	4.45
10.00-12.00	259.10	8,637	4.78	3.87
13.00-15.00	257.30	8,577	4.52	5.34
15.00-17.00	253.60	8,453	8.86	5.92
รวม	1,029.01	34,300	23.27	19.58

หมายเหตุ :

ผู้รับรอง..... วิชา

รายงานการใช้เครื่องจักร

เครื่อง..... Roaster.....

หมายเลขเครื่อง..... 1.....

วันที่ 5 กุมภาพันธ์ 2546

ชื่อ..... ชง.....

เวลาเข้างาน..... 8.05..... (ช่วงเช้า)

เวลาเลิกงาน..... 11.55.....

เวลาเข้างาน..... 13.10..... (ช่วงบ่าย)

เวลาเลิกงาน..... 17.00.....

งาน	เวลาเริ่ม	เวลาเสร็จ
1. เตรียมเดินเครื่อง	8.05	8.15
2. เดินเครื่อง	8.15	10.30
3. แก้ปัญหา	10.30	10.55
4. เตรียมเดินเครื่องใหม่	10.55	11.00
5. เดินเครื่องใหม่	11.00	16.45
6. ทำความสะอาด	16.45	16.55

เวลาที่พนักงานทำงาน (นาที)..... 460.....

เวลาที่เครื่องจักรทำงาน (นาที)..... 450.....

เวลาที่เครื่องจักรหยุด (นาที)..... 15.....

เวลาว่างของเครื่องจักร (นาที)..... 20.....

หมายเหตุ :

ผู้รับรอง..... สมชัย.....

ใบส่งของ

เล่มที่ 10.....

เลขที่ 115.....

วันที่ 5 ก.พ. 2546.....

ชื่อ วิรัตน์.....

ลำดับที่	รายการสินค้า	Lot Number	จำนวน (กิโลกรัม)
1	ปลาหมึกสดปวงรส	030203105	100
2	ปลาหมึกสดปวงรส	030203106	100
3	ปลาหมึก อวก ของปวงรส	030203205	50

หมายเหตุ :

ผู้รับรอง..... สมชัย.....

Customer Complained Report

วันที่..... 19 กพ. 254๐.....

ชื่อลูกค้า..... 7-eleven.....

สินค้า..... ปลาหมึกอบกรอบปรุงรส.....

จำนวน..... 1๒0 กระป๋อง.....

ข้อร้องเรียน :

สินค้าไม่กรอบ

สาเหตุ :

ปลากระป๋องจืด

ผู้รายงาน..... ดนัย.....

รายงานการส่งสินค้าล่าช้า

วันที่ 12-28 กุมภาพันธ์ 2546

Lot Number	รายการสินค้า	วันส่งสินค้า	วันกำหนดส่ง	วันส่งสินค้าจริง
150203103	ปลาหมึกสด ประมง	10/2/03	14/2/03	15/2/03
180203201	ปลาหมึก อบ กว๊านประมง	10/2/03	14/2/03	17/2/03
190203101	ปลาหมึกสด ประมง	12/2/03	18/2/03	19/2/03
250203103	ปลาหมึกสด ประมง	18/2/03	24/2/03	25/2/03
250203104	ปลาหมึกสด ประมง	18/2/03	24/2/03	25/2/03
260203203	ปลาหมึก อบ กว๊านประมง	18/2/03	24/2/03	26/2/03
270203102	ปลาหมึกสด ประมง	21/2/03	26/2/03	27/2/03
280203201	ปลาหมึก อบ กว๊านประมง	21/2/03	26/2/03	28/2/03

จำนวนล็อตที่ส่งล่าช้า ล็อต

ผู้รับรอง *สมชัย*

Direct Raw Material Cost Report

Period.....1.....

No.	Item	Baht/Kg.	Quantity (Kg.)	Total cost
1	Dried squid	120	16,350	1,962,000

Source : Purchasing section

Income & Expenditure Report

Month.....1.....

No.	Type of income & expenditure	Amount (Baht)
1	Cost of good sold	5,167,614.00
2	Labor cost	380,000.00
3	Power cost	79,551.70
4	Maintenance cost	48,900.50
5	Depreciation cost	420,000.00

Source : Accounting Department

Inventory Report

Month	Beginning Inventory	Receive	Transfer (use)	Ending Inventory
1	450,000	4,000,000	3,894,000	556,000
2	556,000	3,800,000	3,948,000	408,000
3	408,000	4,100,000	3,936,000	572,000

Source : Accounting Department

BIOGRAPHY

Miss Suwitchaya Lertwisut was born on December 20, 1979 in Roi Et, Thailand. She graduated from King Mongkut's Institute of Technology Ladkrabang in 2001 with a Bachelor of Engineering in Food Engineering. In 2001, she started her graduate study at the Regional Centre for Manufacturing Systems Engineering of Chulalongkorn University and Warwick Manufacturing Groups of the University of Warwick and graduated in 2003.