Minitab與Quality Companion 在Six Sigma中整合之應用

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公司簡介

- **Minitab® Statistical Software**於1972年開發成功
- Minitab Inc. 成立於1983年
  - 總公司位於美國賓州
  - 員工人數約200人
- **Quality Companion®**於2002年上市
- 致力於資料分析研究已有35年歷史

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主要市場

- 學術教學

- 一般統計應用

- 工業統計

- 六標準差(Six Sigma)

Minitab® Statistical Software

- 全球約有4000所大專院校採用Minitab為教學軟體

- 超過300本以上的專業參考書籍

- 一般業界的使用者領域包括
  - 半導體、電子、航太、化工、醫療產品及設備、電腦工業、汽車、電信、金屬製造、造紙、控制設備、石油煉製等等…
  - 服務業

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Quality Companion

- 一套能夠處理 Six Sigma 所有工具的系統
- 系統化專案準則(Roadmap)導引方式展開專案
- 集中及分享專案資料 (data sharing)
- 內建多種表單 (Forms)
- 可以客製化各種表單 (Customization)
- 腦力激盪工具 (Brainstorming)
- 與Minitab結合使用
- 內建專案呈現功能 (Presentation)

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範例說明

> 您在一間網路書店工作，一直以來都有很多顧客抱怨貨品遞送太慢。經過和業務以及運輸部門討論過後，並且重新檢視現有資料，希望能運用六標準差專案將遞送時間縮短，提高客戶滿意度，以及縮短訂單完成時間。

> 整合Quality Companion和Minitab來完成此專案，縮短訂單完成時間

Quality Companion

選擇專案種類

> DMAIC

Project Manager
- 🌐 Order Fulfillment
  - 🗄 Management
    - 🏠 Project Today
    - 👤 Team Members
    - 📋 Tasks
    - ⊞ Data Store
    - 📈 Y Metrics
    - 📄 Related Documents
  - 🗄 Roadmap
    - Define 1: Define and Scope Project
    - Define 2: Define Defect
    - Define 3: Plan and Document Project
    - Measure 1: Evaluate Measurement System
    - Measure 2: Establish Baseline
    - Measure 3: Set Improvement Goals
    - Measure 4: Map Process and Identify Inputs
    - Analyze 1: Isolate Key Inputs
    - Analyze 2: Develop $Y = f(X)$ Function
    - Analyze 3: Determine Optimal Settings
    - Improve 1: Implement Proposed Improvement
    - Improve 2: Validate Proposed Improvement
    - Control 1: Implement Control Strategy
    - Control 2: Close Out Project

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加入組員

➤ 也可以從Outlook通訊錄或其他通訊錄類型檔案匯入祖員資料

	Name	E-mail	Business Phone	Role
	Click here to add a team member			
	Kristina Rowlf	krowlf@buymorebooks.com		Team Member
	Li Kim	lkim@buymorebooks.com		Team Member
	Yang			Process Owner

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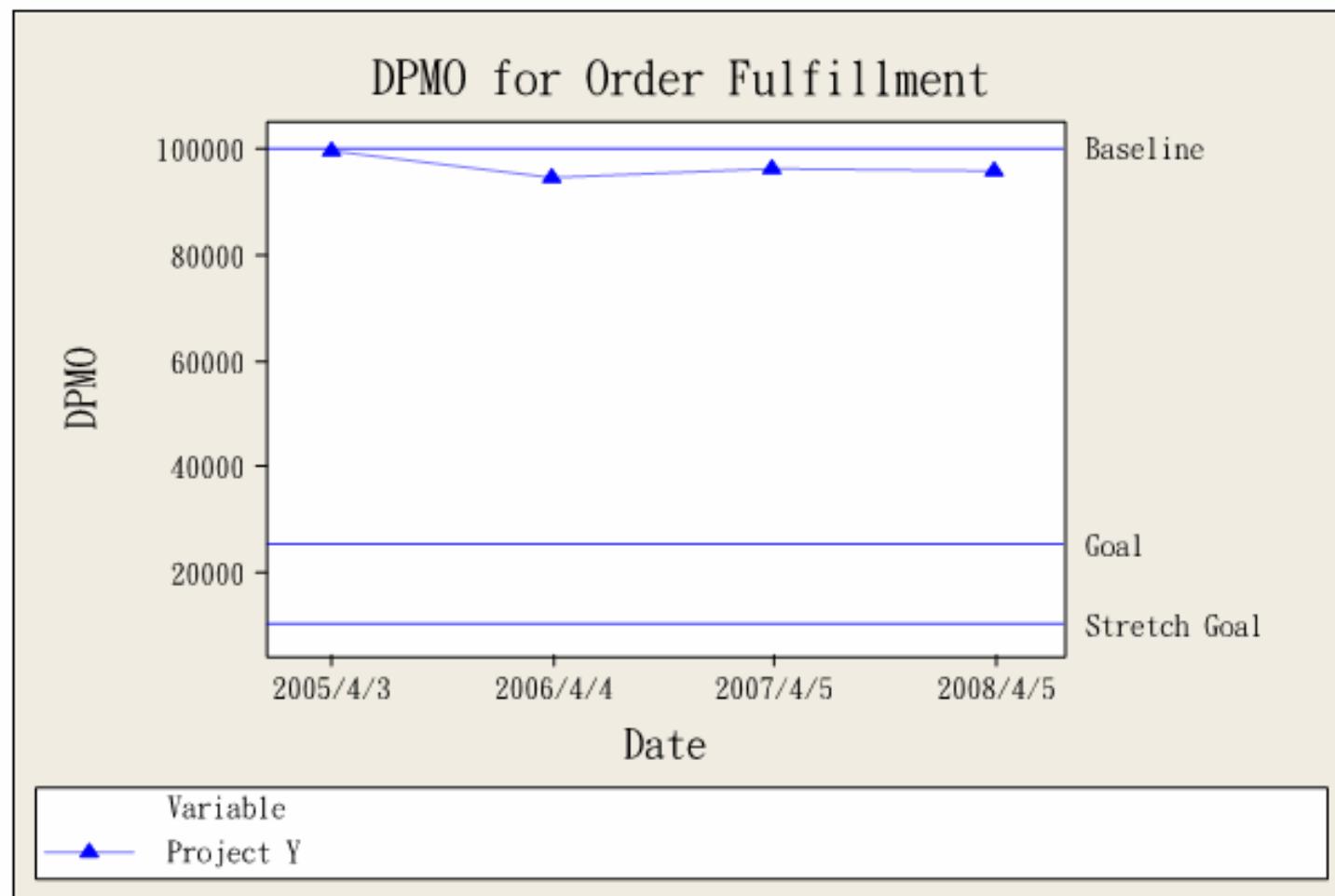
建立基線 (Baseline)

▶ Defect：Cycle time > 32小時

▶ 協助您了解您的流程在不同時間 (里程碑) 下改變的情況，並可利用基線與目標的設定來監控您的流程隨時間變化之狀況。您亦可利用此工具來定義一個未來的目標，一個您或許無法立刻達成、一個理想化的目標。

DPMO

目標 ➡

極限目標 ➡

	Date	Project Y
Baseline		100000
Goal		25000
Stretch Goal		10000
	2005/4/4	99700
	2006/4/4	94500
	2007/4/4	96300
	2008/4/4	95800

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DPMO for Order Fulfillment

專案章程 (Project Charter)

Project Charter

Project Authorization

Organization:	Champion:	Process Owner:
buymorebooks.com	Fred Mitchell	Yang

Project:	Project #:
顧客沒有準時收到貨	

Problem Statement:

Project Objective:

縮短訂單完成時間(cycle time)

Estimated Defect Level:	Initial Goal:	Estimated Benefits:

Approval Date:	Champion Signature:	Process Owner Signature:

Estimated Completion Date:	Project Leader:	Finance Analyst:

Project Team

Name	Role	Comments	Phone
Yang	Process Owner		
Kristina Rowlf	Team Member		
Li Kim	Team Member		
Fred Mitchell	Champion		

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Project Definition and Scoping

Metrics (unit of measure):

訂單完成時間(小時)=收到訂單到貨品送出之時間

Critical to Satisfaction (linkage to customer):

顧客滿意度調查，確認的確有貨品延遲送達之問題

Defect Definition (include opportunity):

Cycle time的目標為24小時。超過32小時代表延遲交貨。

Goals and Benefits

Defect Levels/Goals:

	Date	DPMO(LT)	Zbench(ST)	Cpk
Baseline		100000	0.00	0.00
Goal		25000	0.00	0.00
Stretch Goal		10000	0.00	0.00
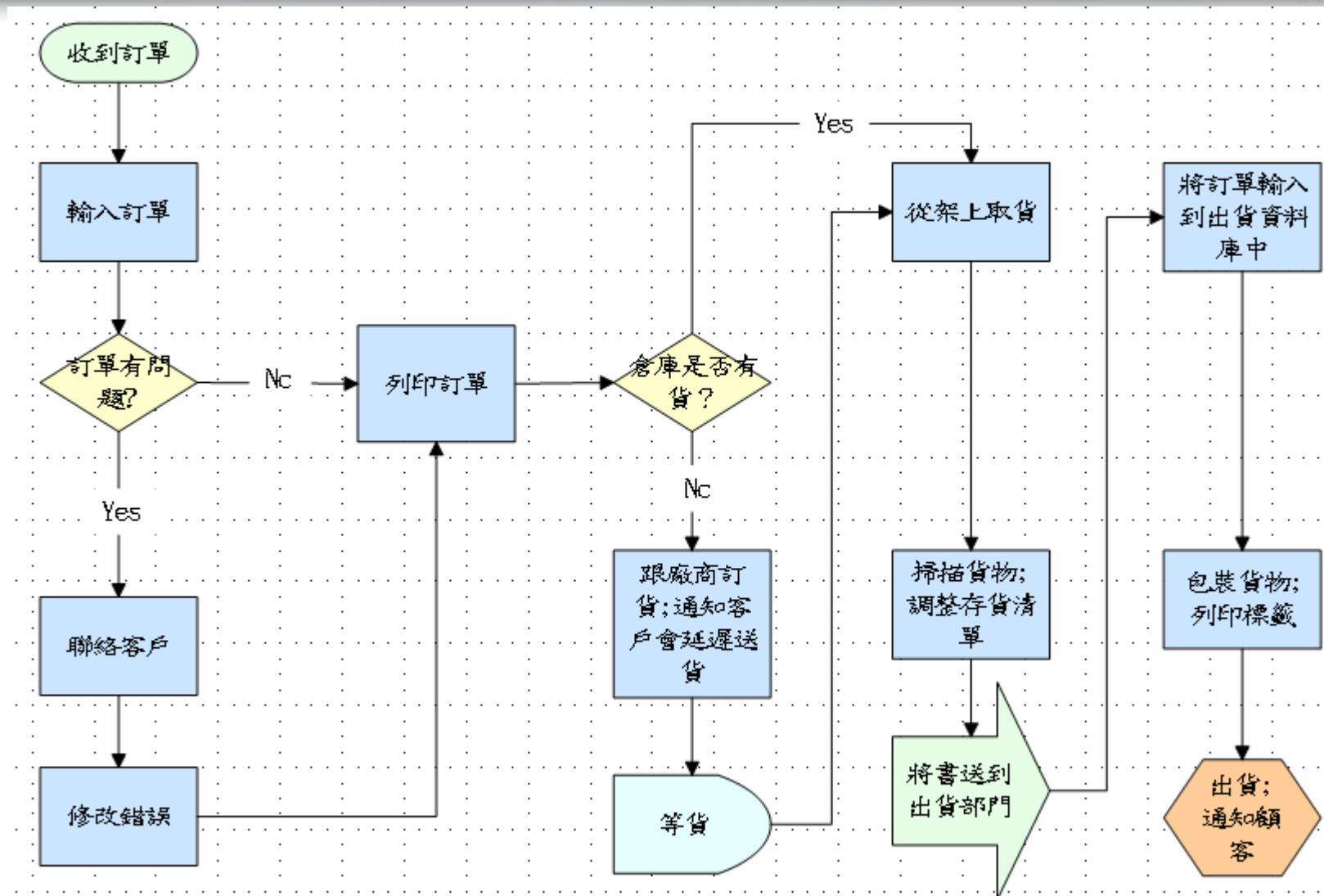
Estimated Financial Benefits:

⚠ Important information

Hard Savings	$150,000
Soft Savings	$20,000
Implementation Costs	$0
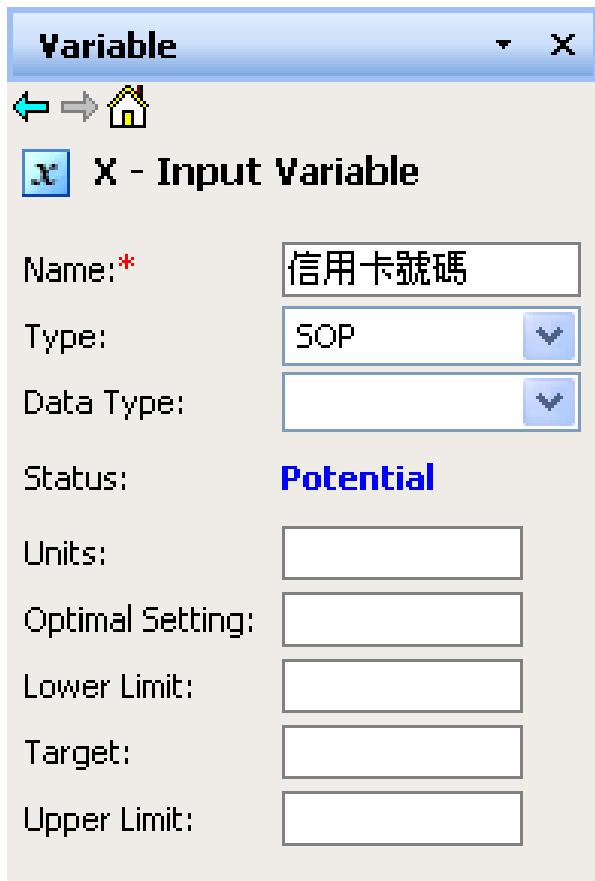
Based on how many months: 12

流程圖 (Process Map)

輸入與輸出變數

> X's & Y's

Variable ▾ ✕

X - Input Variable

Name:* 信用卡號碼

Type: SOP

Data Type:

Status: **Potential**

Units:

Optimal Setting:

Lower Limit:

Target:

Upper Limit:

Variables ▾ ✕

Variables | Process | Lean

X - Input Variables
信用卡號碼

New | Move | Copy X or Y

**Y - Output Variables**
訂單確認號碼

New | Move | Copy Y or X

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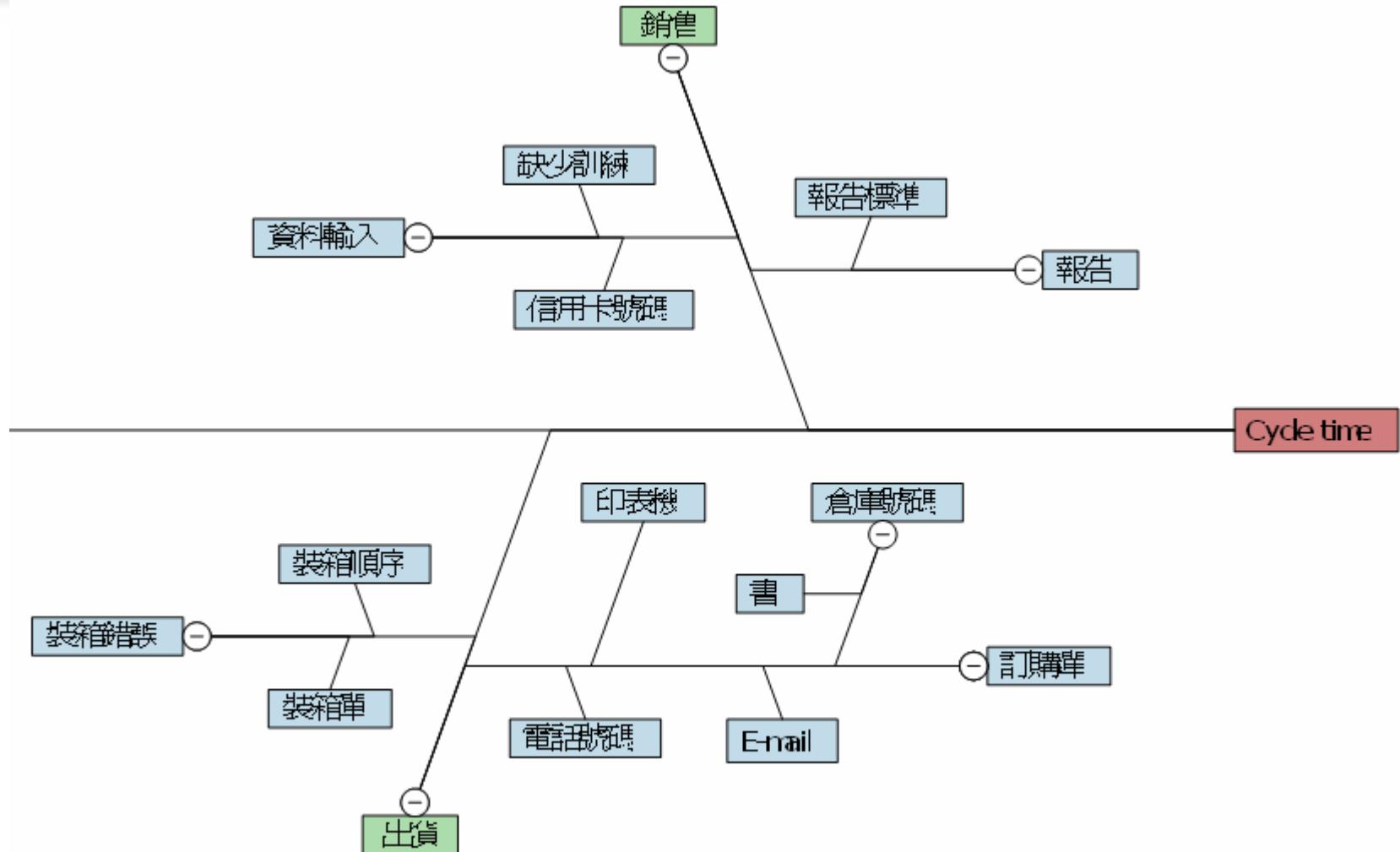
腦力激盪 (Brainstorming)
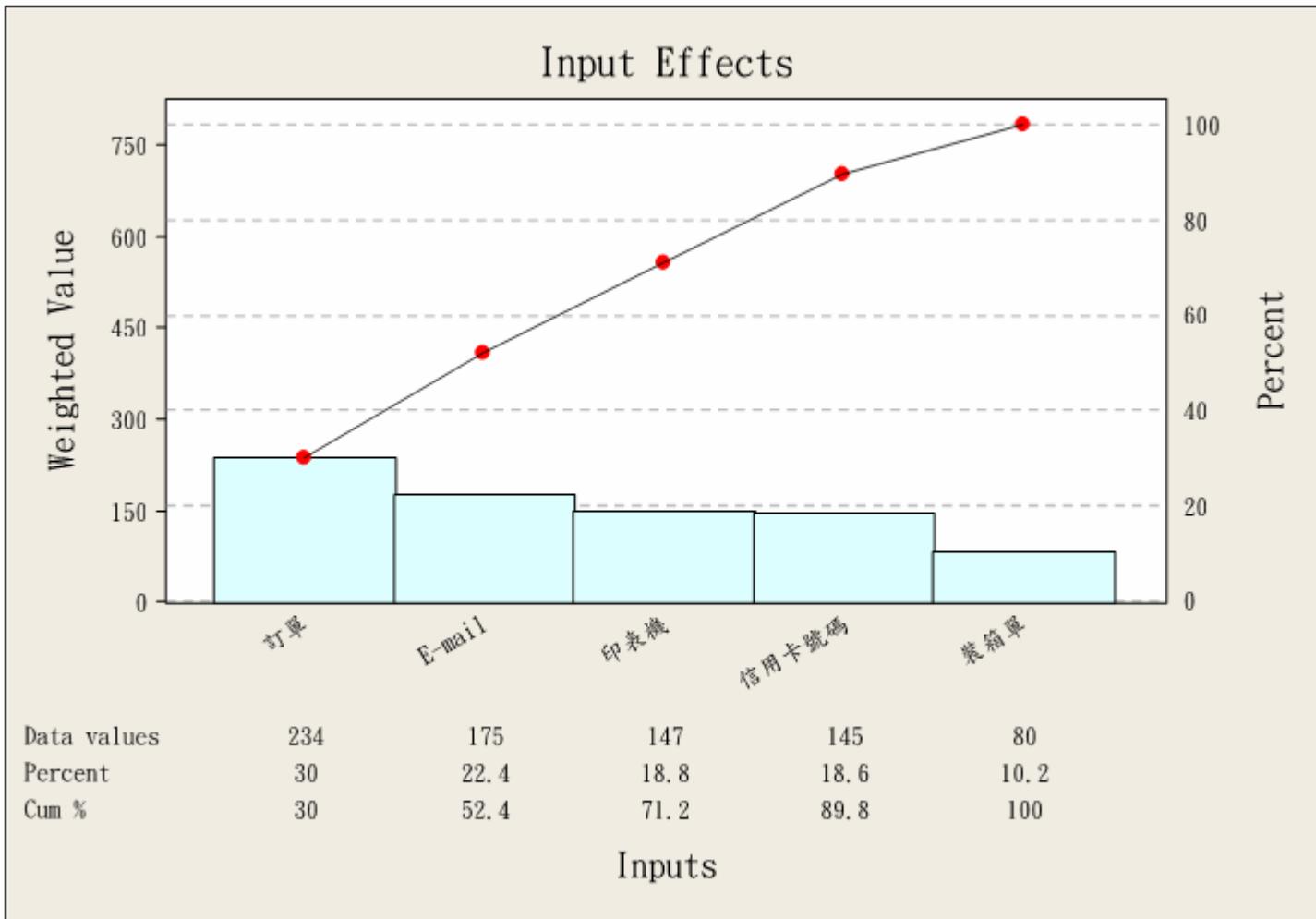
C&E Matrix

Rating Scale - Min [1] Max [9]

	Importance of each output to the customer	9	8	9			
	Outputs	出貨資料庫記錄	銷售資料庫記錄	正確的訂單			
Process Map - Activity	**Inputs (X Variable)**				**Weighted Value by Input**	**% of Net Effect by Input**	**Status**
Order Process - 輸入訂單	信用卡號碼	8	8	1	145	18.6%	Potential
Order Process - 列印訂單	印表機	3	6	8	147	18.8%	Potential
Order Process - 從架上取貨	訂單	9	9	9	234	30.0%	Potential
Order Process - 將訂單輸入到出貨資料.	E-mail	8	5	7	175	22.4%	Potential
Order Process - 包裝貨物;列印標籤	裝箱單	7	1	1	80	10.2%	Potential
	Weighted effect on each output	315	232	234			

柏拉圖

教練功能 (Coach)

分析結果擷取功能 (Analysis Capture)

Input

Output / Y / Response:

Cycle time

Null Hypothesis (Ho):

訂單重新設計後的平均cycle time和設計前的平均cycle time一樣

Alternative Hypothesis (Ha):

訂單重新設計後的平均cycle time比設計前的平均cycle time短

Factor: 定單	Level Names:	Cycle time
Unit of Measure: 小時	Sample 1 Size:	101
Alpha: 0.05	Sample 2 Size:	169

Checklist

Are the data reasonably normal? (test is very robust to non-normal data) ⦿ Yes ◯ No

Has the measurement system been validated? ⦿ Yes ◯ No

Note: Do not check "Assume equal variances" unless variances have been shown to be equal.
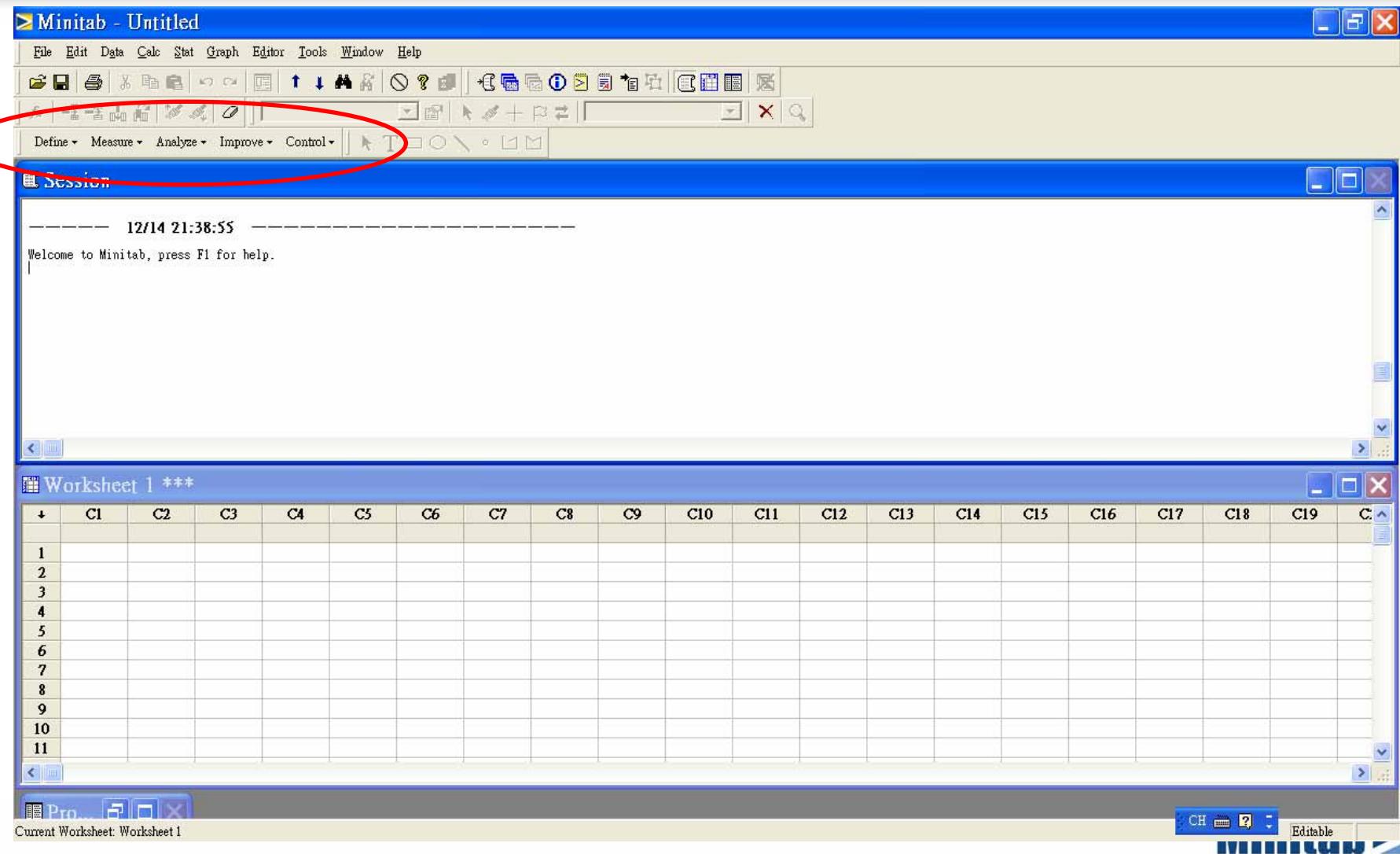
Have you determined the sample size requirements? ◯ Yes ⦿ No

- What is the recommended sample size? (this should be the smaller of the two samples)

✔ Sample Size Details

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Minitab Statistical Software
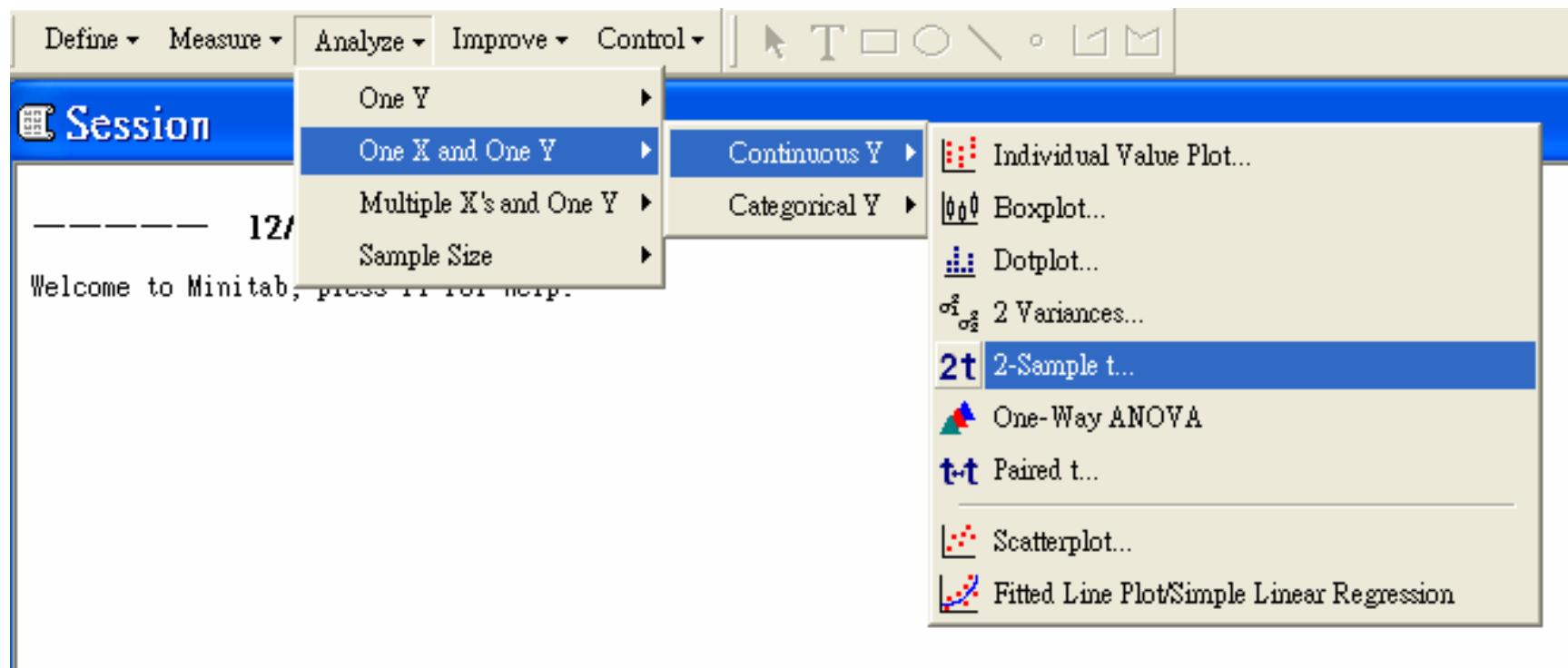
▶ 修改訂單格式

▶ 使用2-Sample t-檢定來分析修改訂單過後cycle time是
否有改善

↓	C1	C2
	CycleTime (hours)	CycleTime (1st improve)
1	27.8361	24.3549
2	30.9050	22.9411
3	26.5750	22.4652
4	20.0897	24.4087
5	29.7823	17.1074
6	24.5451	20.4114
7	37.5159	19.2766
8	27.7990	20.3478
9	32.3924	28.4899
10	25.1350	12.2420
11	27.6265	22.6881
12	14.2901	23.7376
13	20.6814	19.0575
14	41.8120	25.4038
15	27.1591	27.6185
16	21.3394	20.2836
17	23.4274	20.0992
18	31.0774	28.8619

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DMAIC工具列

> Minitab 15版免費下載安裝

2-Sample t-test

Two-Sample T-Test and CI: CycleTime (hours), CycleTime (1st improve)

Two-sample T for CycleTime (hours) vs CycleTime (1st improve)

```
                          N    Mean   StDev   SE Mean
CycleTime (hours)        101   28.62   5.77     0.57
CycleTime (1st improve)  169   22.13   4.06     0.31
```
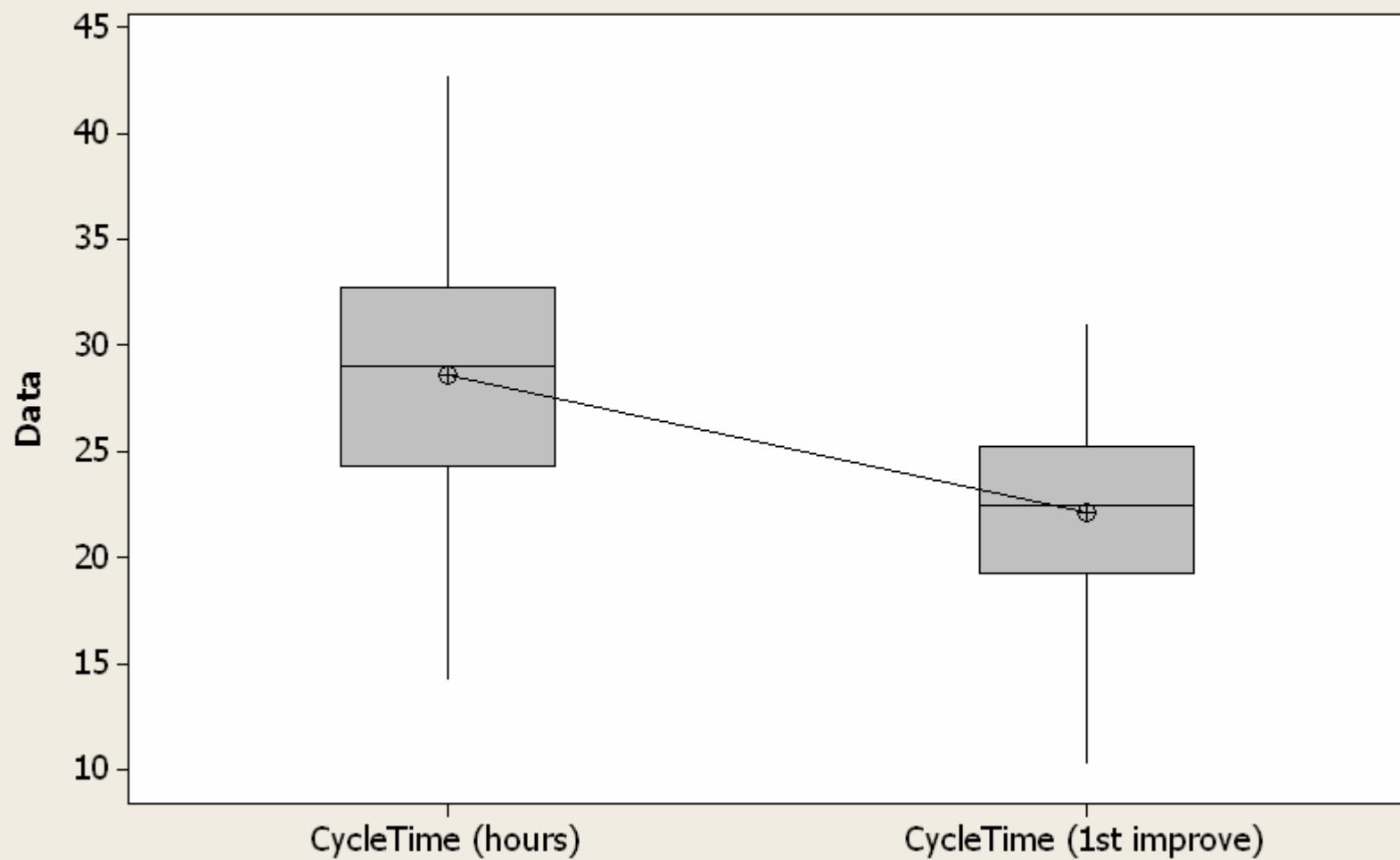
Difference = mu (CycleTime (hours)) - mu (CycleTime (1st improve))
Estimate for difference: 6.495
95% lower bound for difference: 5.413
T-Test of difference = 0 (vs >): T-Value = 9.93   P-Value = 0.000   DF = 159

Boxplot of CycleTime (hours), CycleTime (1st improve)

Output

p-value: 0.000

Graphical (Optional, may include Histograms or Individual Value Plots of both samples, etc):

Session (Output from t-test, Output fr...
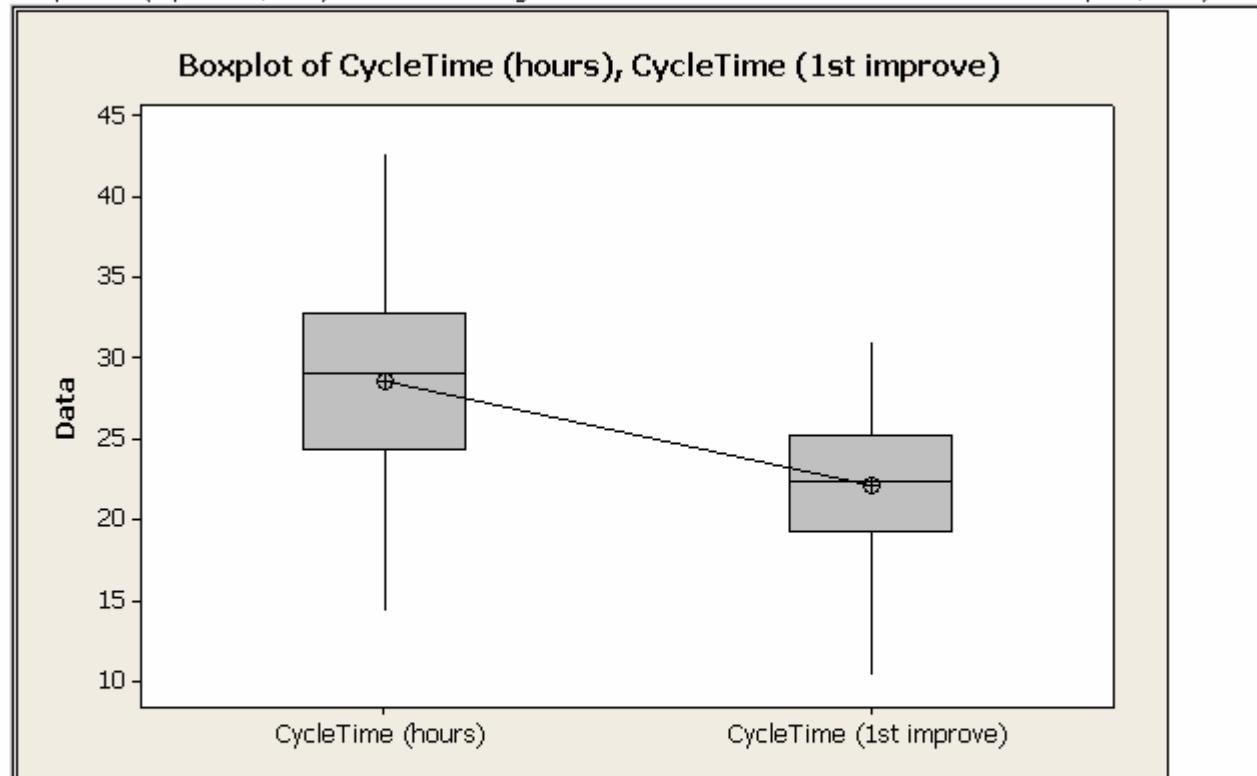
```
Two-Sample T-Test and CI: CycleT

Two-sample T for CycleTime (hour

                        N    N
CycleTime (hours)      101   28
CycleTime (1st improve) 169   22


Difference = mu (CycleTime (hour
Estimate for difference:  6.495
95% lower bound for difference:
T-Test of difference = 0 (vs >):
```


Boxplot of CycleTime (hours), CycleTime (1st improve)
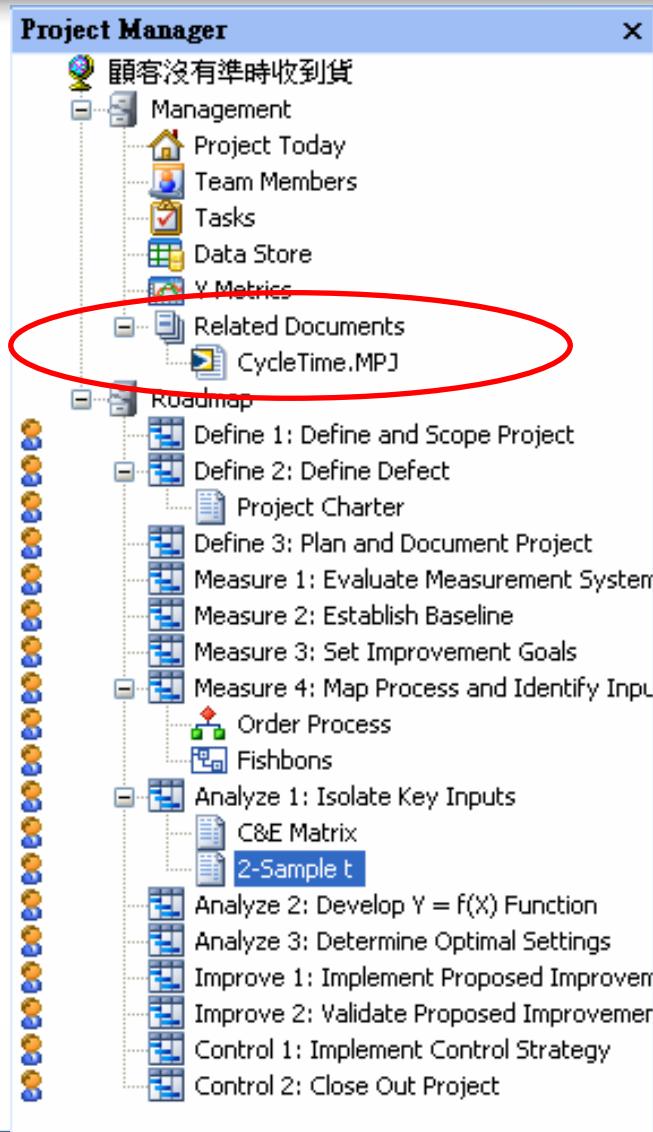
Conclusion

Observations:
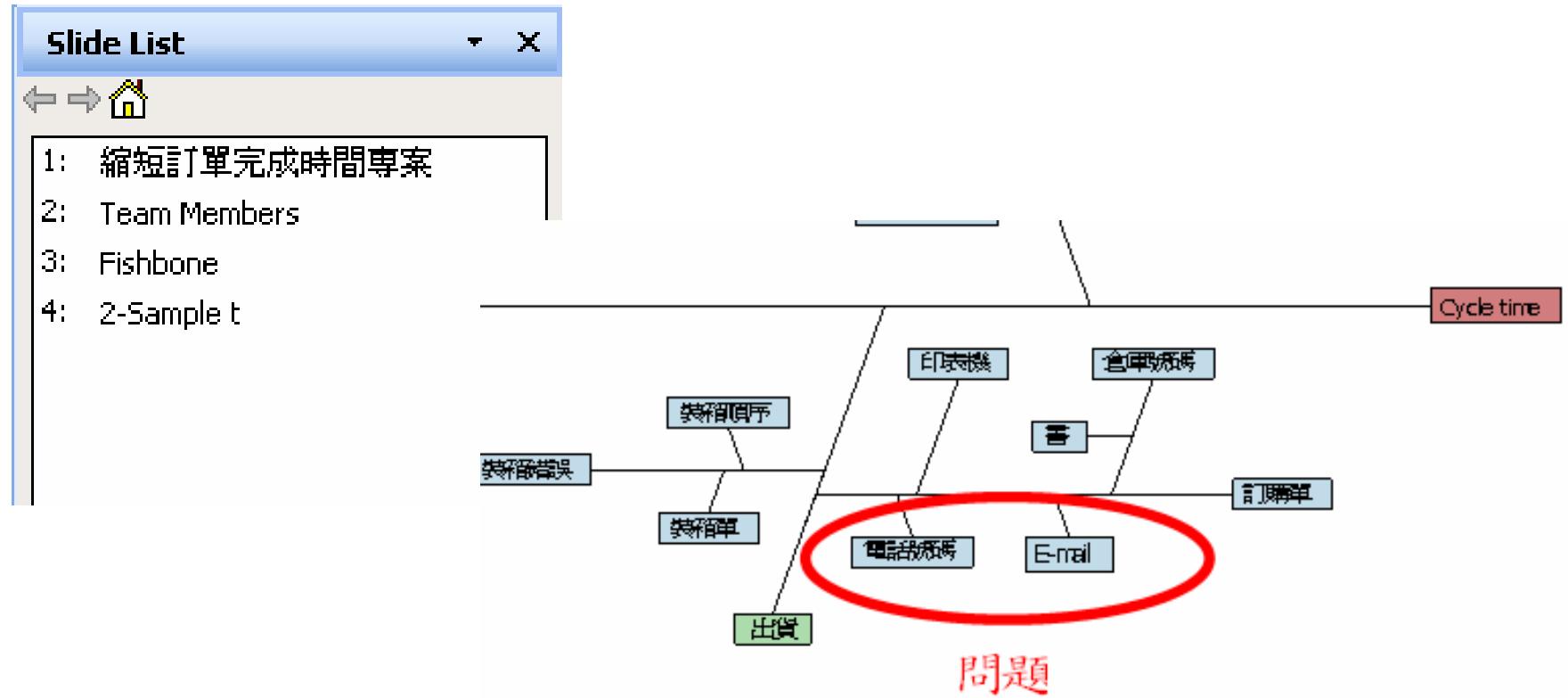
P值接近0,代表重新設計的訂單有顯著的縮短cycle time

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相關檔案

簡報管理員 (Presentation Manager)

> 能夠匯出至Powerpoint

其他整合工具

- **Quality Companion Viewer**
  - 提供讀取QC專案的功能，但是不能修改
- **Quality Companion Dashboard**
  - 列出所有進行中或已完成的專案
  - 日期，財務狀況或團隊成員…過濾或列出所有相關專案
  - 提供客製化功能
- 兩種工具都是完全免費下載安裝

Dashboard

Q & A