

Appendix A: Model Documentation

Consumption Time=

2
~ Day
~ |

CRT Expenses=

CRT Wages * CRTs
~ dollars/Day
~ |

CRT Overtime Expenses=

(CRT Overtime Pay Proportion + 1) * Overtime Proportion * CRT Expenses
~ dollars/Day
~ Total CRT Overtime Expenses per day.
|

CRT Overtime Pay Proportion=

0.5
~ Dmnl
~ |

CRT Training Rate=

IF THEN ELSE(Target CRTs > CRTs, (Target CRTs - CRTs) / CRT Training Time, 0)
~ Individuals/Day
~ CRTs trained per day.
|

CRT Training Time=

5
~ Day
~ |

CRT Turnover Rate=

0
~ Individuals/Day
~ |

CRT Wages=

200
~ dollars/(Day*Individuals)
~ |

CRTs= INTEG (

CRT Training Rate-CRT Turnover Rate,
2)
~ Individuals
~ |

Cululative Turnover= INTEG (

Turnover,
0)
~ Individuals
~ ~ :SUPPLEMENTARY
|

Delay Time=

1

~ Day
~ |

Fixed Expenses=

1 / 2 * Variable Expenses
~ dollars/Day
~ |

Infallible Service Rate per RSSR=

20
~ Sites/(Individuals*Day)
~ |

Max Service Rate per Representative=

30
~ Sites/Individuals/Day
~ |

Maximum New Sites=

350
~ Sites/Day
~ May not be greater than 350
|

New Customer Site Rate=

PULSE(20,1) * New Customer Sites 1 + PULSE(80,1) * New Customer Sites 2 + PULSE(160,\1) * New Customer Sites 3 + PULSE(200,1) * New Customer Sites 4 + PULSE(300, 1) * New Customer Sites 5
~ Sites/Day
~ |

New Customer Sites 1=

150
~ Sites/Day
~ |

New Customer Sites 2=

250
~ Sites/Day
~ |

New Customer Sites 3=

350
~ Sites/Day
~ |

New Customer Sites 4=

225
~ Sites/Day
~ |

New Customer Sites 5=

235
~ Sites/Day
~ |

Operating Expenses=

Variable Expenses + Fixed Expenses
~ dollars/Day
~ Total operating expenses per day.
|

Operating Profit Margin=

(Revenue - Operating Expenses) / Revenue

~ Dmnl

~ Earnings per dollar of revenue.

~ :SUPPLEMENTARY

|

Other Site Service Costs=

5

~ dollars/Sites

~

|

Other Variable Expenses=

Site Service Rate * Other Site Service Costs

~ dollars/Day

~

|

Overtime Expenses=

CRT Overtime Expenses + RSSR Overtime Expenses + Service Supervisor Overtime Expenses

~ dollars/Day

~ Total overtime expenses per day.

~ :SUPPLEMENTARY

|

Overtime Proportion=

IF THEN ELSE(Service Rate per Representative > Target Service Rate per Representative\

, (Service Rate per Representative - Target Service Rate per Representative) / Target Service Rate per

Representative\

, 0)

~ Dmnl

~

|

Profit=

Revenue - Operating Expenses

~ dollars/Day

~ Profit earned per day.

|

Recruitment Quality(

[(0,0)-(14,2)],(0,1.5),(1,1.49),(2,1.48),(3,1.47),(4,1.44),(5,1.38),(6,1.25),(7,1),(\

8,0.75),(9,0.63),(10,0.56),(11,0.53),(12,0.52),(13,0.51),(14,0.5))

~ Dmnl

~

|

Retained Earnings= INTEG (

Profit,

0)

~ dollars

~ Accumulated earnings.

~ :SUPPLEMENTARY

|

Revenue=

Site Service Rate * Revenue per Site

~ dollars/Day

~ Total revenue per day.

|

Revenue per Site=

25.11
~ dollars/Sites
~ |

Rework Rate=

IF THEN ELSE(Schedule Pressure > 0, IF THEN ELSE(Schedule Pressure Rework Table(Schedule Pressure\
) * (1 + Supervisor Deficiency) > 1, 1, Schedule Pressure Rework Table(Schedule Pressure\
) * (1 + Supervisor Deficiency)), 0)
~ Dmnl
~ |

RSSR Average Training Time=

20
~ Day
~ |

RSSR Expenses=

RSSR Wages * RSSRs
~ dollars/Day
~ |

RSSR Overtime Expenses=

(RSSR Overtime Pay Proportion + 1) * Overtime Proportion * RSSR Expenses
~ dollars/Day
~ |

RSSR Overtime Pay Proportion=

0.5
~ Dmnl
~ |

RSSR Recruitment Rate=

IF THEN ELSE(Target RSSRs > (RSSRs + RSSR Trainees), (Target RSSRs - (RSSRs + RSSR Trainees\
)) / RSSR Recruitment Time, 0)
~ Individuals/Day
~ RSSRs recruited per day.
~ |

RSSR Recruitment Time=

7
~ Day
~ May not be less than 1
~ |

RSSR Trainee Expenses=

RSSR Trainee Wages * RSSR Trainees
~ dollars/Day
~ |

RSSR Trainee Wages=

96
~ dollars/(Day*Individuals)
~ per Day
~ |

RSSR Trainees= INTEG (

RSSR Recruitment Rate-RSSR Training Rate,
0)
~ Individuals
~ |

RSSR Training Rate=

IF THEN ELSE(CRTs <= RSSR Trainees, CRTs / (RSSR Average Training Time * Recruitment Quality\
(RSSR Recruitment Time)), RSSR Trainees / (RSSR Average Training Time * Recruitment Quality\
(RSSR Recruitment Time)))
~ Individuals/Day
~ RSSRs Trained per day.
|

RSSR Turnover Rate=

RSSRs * Turnover Rate
~ Individuals/Day
~ |

RSSR Wages=

160
~ dollars/Day/Individuals
~ |

RSSRs= INTEG (

RSSR Training Rate-CRT Training Rate-RSSR Turnover Rate,
23)
~ Individuals
~ |

Schedule Pressure= INTEG (

Schedule Pressure Generation Rate-Schedule Pressure Relief Rate,
0)
~ Stress
~ |

Schedule Pressure Generation Rate=

IF THEN ELSE((Service Rate per Representative - Infallible Service Rate per RSSR) * \
Stress Conversion Factor <0, 0, (Service Rate per Representative
- Infallible Service Rate per RSSR) * Stress Conversion Factor
)
~ Stress/Day
~ |

Schedule Pressure Relief Rate= DELAY FIXED (

Schedule Pressure Generation Rate, Schedule Pressure Relief Time, Schedule Pressure Generation Rate\
)
~ Stress/Day
~ |

Schedule Pressure Relief Time=

1
~ Day
~ |

Schedule Pressure Rework Table(

[(0,0)-(11,0.1)],(0,0),(1,0.004),(2,0.009),(3,0.015),(4,0.022),(5,0.03),(6,0.039),(7\
,0.049),(8,0.06),(9,0.072),(10,0.086))
~ Dmnl
~ |

Schedule Pressure Turnover Table(

[(0,0)-(10,0.1)],(0,0),(1,0),(2,0),(3,0.002),(4,0.004),(5,0.007),(6,0.011),(7,0.016)\
,(8,0.022),(9,0.029),(10,0.037))
~ 1/Day

~ |

Service Rate per Representative=

IF THEN ELSE((Total Service Representatives) * Max Service Rate per Representative >= \

Unserviced Sites / Service Time, Unserviced Sites

/ Service Time / Total Service Representatives

, Max Service Rate per Representative)

~ Sites/(Individuals*Day)

~ |

Service Supervisor Expenses=

Service Supervisor Wages * Service Supervisors

~ dollars/Day

~ |

Service Supervisor Overtime Expenses=

(Service Supervisor Overtime Pay Proportion + 1) * Overtime Proportion * Service Supervisor Expenses

~ dollars/Day

~ Total Service Supervisor Overtime Expenses per day.

|

Service Supervisor Overtime Pay Proportion=

0.5

~ Dmnl

~ |

Service Supervisor Wages=

320

~ dollars/(Day*Individuals)

~ Service Supervisor Wages per day.

|

Service Supervisors= INTEG (

Supervisor Recruitment Rate-Supervisor Turnover Rate,

25/15)

~ Individuals

~ |

Service Time=

1

~ Day

~ |

Serviced Sites= INTEG (

Site Service Rate - Site Consumption Rate,

500)

~ Sites

~ |

Serviced Sites RSSR Ratio=

0.5

~ Dmnl

~ Serviced Sites RSSR Ratio + Unserviced Sites RSSR Ratio = 1

|

Site Acquisition Rate=

MIN(New Customer Site Rate, Maximum New Sites)

~ Sites/Day

~ |

Site Consumption Rate= DELAY FIXED (
 Serviced Sites / Delay Time, Consumption Time -1, Serviced Sites / Delay Time)
 ~ Sites/Day
 ~ |

Site Loss Rate=
 Unsatisfied Customers
 ~ Sites/Day
 ~ |

Site Service Percent=
 Site Service Rate / (Unserviced Sites / Service Time)
 ~ Dmnl
 ~ |

Site Service Rate=
 Service Rate per Representative * Total Service Representatives * (1 - Rework Rate)
 ~ Sites/Day
 ~ |

Stress Conversion Factor=
 1
 ~ Stress * Individuals / Sites
 ~ |

Supervisor Deficiency=
 IF THEN ELSE(Target Service Supervisors > Service Supervisors - Supervisors on Service Calls\
 , (1 - (Service Supervisors
 - Supervisors on Service Calls) / Target Service Supervisors) * Supervisor Deficiency Multiplier\
 , 0)
 ~ 1
 ~ 0 = no supervision, 1 = full supervision
 |

Supervisor Deficiency Multiplier=
 1
 ~ Dmnl
 ~ |

Supervisor Recruitment Rate=
 IF THEN ELSE(Target Service Supervisors > Service Supervisors, (Target Service Supervisors\
 - Service Supervisors) / Supervisor Recruitment Time, 0)
 ~ Individuals/Day
 ~ |

Supervisor Recruitment Time=
 14
 ~ Day
 ~ |

Supervisor Service Call Threshold=
 0.3
 ~ Dmnl
 ~ % of (Max Service Rate per RSSR - Target Service Rate per RSSR)
 |

Supervisor Service Call Threshold Rate=
 Supervisor Service Call Threshold * (Max Service Rate per Representative - Target Service Rate per Representative\
) + Target Service Rate per Representative
 ~ Sites/(Individuals*Day)

~ |

Supervisor Turnover Rate=

0

~ Individuals/Day

~ |

Supervisors on Service Calls=

IF THEN ELSE(Unserviced Sites / Service Time / (RSSRs + CRTs) > Supervisor Service Call Threshold Rate

,IF THEN ELSE(Unserviced Sites / Service Time / Supervisor Service Call Threshold Rate\

- RSSRs - CRTs < Service Supervisors, Unserviced Sites / Service Time / Supervisor Service Call Threshold Rate\

- RSSRs - CRTs , Service Supervisors),0)

~ Individuals

~ |

Target CRT to RSSR Ratio=

1/10

~ Dmnl

~ May not be less than 1/20

|

Target CRTs=

Target CRT to RSSR Ratio * (RSSR Trainees + RSSRs)

~ Individuals

~ |

Target RSSRs=

(Serviced Sites * Serviced Sites RSSR Ratio * 2 + Unserviced Sites * Unserviced Sites RSSR Ratio\

* 2) / Target Service Rate per Representative / Consumption Time - CRTs

~ Individuals

~ |

Target Service Rate per Representative=

20

~ Sites/Individuals/Day

~ May not be more than 30

|

Target Service Supervisors=

Target Supervisor to RSSR Ratio * (RSSR Trainees + RSSRs + CRTs)

~ Individuals

~ |

Target Supervisor to RSSR Ratio=

1/15

~ Dmnl

~ May not be less than 1/30

|

Total Customer Sites=

Serviced Sites + Unserviced Sites

~ Sites

~ ~ :SUPPLEMENTARY

|

Total Service Representatives=

RSSRs + CRTs + Supervisors on Service Calls

~ Individuals

~ |

Turnover=

RSSR Turnover Rate
~ Individuals/Day
~ |

Turnover Rate=

Schedule Pressure Turnover Table(Schedule Pressure)
~ 1/Day
~ |

Unsatisfied Customers=

IF THEN ELSE((1 - Site Service Percent) > Unsatisfied Service Threshold, Unserviced Sites\
* (1 - Site Service Percent) * Unsatisfied Service Loss Rate, 0)
~ Sites / Day
~ |

Unsatisfied Service Loss Rate=

0.5
~ 1 / Day
~ |

Unsatisfied Service Threshold=

0.02
~ Dmnl
~ |

Unserviced Sites= INTEG (

Site Acquisition Rate + Site Consumption Rate - Site Service Rate - Site Loss Rate,
500)
~ Sites
~ |

Unserviced Sites RSSR Ratio=

0.5
~ Dmnl
~ Serviced Sites RSSR Ratio + Unserviced Sites RSSR Ratio = 1
|

Variable Expenses=

Wage Expenses + Other Variable Expenses
~ dollars/Day
~ |

Wage Expenses=

RSSR Trainee Expenses + RSSR Expenses + RSSR Overtime Expenses + CRT Expenses + CRT Overtime Expenses\
+ Service Supervisor Expenses + Service Supervisor Overtime Expenses
~ dollars/Day
~ |

.Control
*****~
Simulation Control Parameters
|

FINAL TIME = 365

~ Day
~ The final time for the simulation.
|

INITIAL TIME = 0

~ Day
~ The initial time for the simulation.
|

SAVEPER =

TIME STEP

~ Day [0,?]
~ The frequency with which output is stored.
|

TIME STEP = 0.25

~ Day [0,?]
~ The time step for the simulation.
|