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APPENDICES

APPENDIX A

Element Check List of Item Attributes

HGA Up

Element Check List

Customer Ordering Characteristics		
	Order Timing	Every Thursday wk x, Thai time
	Order Size	Lot for Lot
	Delay in Order Processing	Occasionally (maximum 1 day) came from SAP runtime problem
	Order Cycle	Every week
	Order Type	PO
Demand Patterns		
	Vanability	High Demand Variability. EC Change, Alternative part 1st, 2nd, 3rd ..8th
		MPC: 2 P/N, MRB: 3 P/N, MPA: 2 P/N, MPB: 8P/N
	Ability to Forecast	Difficult to be forecast. Decision to be made between produce and buy
	Demand time frame	Daily PO: 3 weeks, Weekly PO: 10 Weeks, Monthly until the end of honzon
	Any Dependent Demand	No
	Substitution	No
	Demand History	Fluctuate and lumpy, not only the total demand change but also the
		model mix. Model mix create either less or more part requirement
Supply Situation		
	Supplier name	China and TDK
	Lead Time	SLE= 48hrs, SL1= 60hrs, SL2= 72hrs , NFO= 44hrs
	Reliability	
	Flexibility	Low flexibility due to supplier can't react to the urgent request, even though
		there are two suppliers
	Ability to Expedite	there are 4 service levels, NFO, SLE, SL1, and SL2
	Supply Commit (after demand send)	Monday wk x+1
	Minimum Orders	Not available
	Discount (Volume, Freight)	Not available
	Availability	Part supply problem happens occasionally due to high technology
		and yield problem
	Alternate Part	1st, 2nd, and 3rd Priority
		Even there are a lot of alternative part
		but at the end it's difficult to predict the end on hand inventory
	Receiving Inspection	Required
	Supplier and Transportation Lead Time	Depend on service level: Default is SL2
	Inventory Turnover	
Cost Factors		
	Acceptable Stock Out	0%
	Carrying Costs	Undisclosed
	Expediting	Undisclosed
Nature of Product		
	Repairable (Rework or Reused, and Number of Time of Rework)	Reused depend on part condition
	Part Cost	Estimated $6.62
	Safety Stock	1 day
	Scrap Ratio	depend of time frame
Other Issues		
	History of Shortage	Many shortage history since HGA is a high technology component
	History of Expediting	Many history of expediting due to the demand change and urgent
		request, model mix
	Customer Service Target	100%

HGA Down

Element Check List

Customer Ordering Characteristics		
	Order Timing	Every Thursday wk x. Thai time
	Order Size	Lot for Lot
	Delay in Order Processing	Occasionally (maximum 1 day) came from SAP runtime problem
	Order Cycle	Every week
	Order Type	PO
Demand Patterns		
	Variability	high demand variability, EC Change. Alternative part 1st, 2nd, 3rd. 8th
		MPC: 2 P/N, MRB: 4 P/N. MPA: 2 P/N, . MPB: 8P/N
	Ability to Forecast	Difficult to be forecast. Decision to be made between produce and buy
	Demand time frame	Daily PO: 3 weeks, Weekly PO: 10 Weeks, Monthly until the end of horizon
	Any Dependent Demand	No
	Substitution	No
	Demand History	Fluctuate and lumpy
Supply Situation		
	Supplier name	China and TDK
	Lead Time	SLE= 48hrs, SL1= 60hrs. SL2= 72hrs , NFO= 44hrs
	Reliability	Not available
	Flexibility	Low flexibility
	Ability to Expedite	there are 4 service levels. NFO. SLE, SL1, and SL2
	Supply Commit (after demand send)	Monday wk x+1
	Minimum Orders	Not available
	Discount (Volume. Freight)	Not available
	Availability	Part supply problem happens occasionally due to high technology
		and yield problem
	Alternate Part	1st, 2nd, and 3rd Priority
		Even there are a lot of alternative part
		but at the end it's difficult to predict the end on hand inventory
	Receiving Inspection	Required
	Supplier and Transportation Lead Time	Depend on service level: Default is SL2
	Inventory Turnover	
Cost Factors		
	Acceptable Stock Out	0%
	Carrying Costs	Undisclosed
	Expediting	Undisclosed
Nature of Product		
	Repairable (Rework or Reused, and Number of Time of Rework)	Reused depend on part condition
	Part Cost	Estimated $6.62
	Safety Stock	1 day
	Scrap Ratio	depend of time frame
Other Issues		
	History of Shortage	Many shortage history since HGA is a high technology component
		and difficult to
	History of Expediting	Many history of expediting due to the demand change and urgent
		request, model mix
	Customer Service Target	100%

Suspension

Element Check List

Customer Ordering Characteristics		
	Order Timing	Friday wk x. Thai time
	Order Size	Lot for Lot
	Delay in Order Processing	Occasionally (maximum 1 day) came from SAP runtime problem
	Order Cycle	Every week
	Order Type	PO
Demand Patterns		
	Variability	MPC: 2P/N, MRB: 2P/N. and MPA: 2P/N
	Ability to Forecast	Very difficult due to the produce and buy decision and supplier sourcing %
	Demand time frame	Daily PO: 6 weeks. Weekly PO: 7 Weeks. Monthly until the end of horizon
	Any Dependent Demand	No
	Substitution	None
	Demand History	Demand history is unstable and no serious implementation of frozen zone Once the urgent request or demand change occurs, the supply respond is difficult to support since slider is the lowest level of product hierachy and the most complicated one
Supply Situation		
	Supplier Name	NHK Japan, SCC
	Lead Time	SLE= 32hrs, SL1= 60hrs, SL2= 96hrs , NFO= 30hrs
	Reliability	Not Available
	Flexibility	Low flexibility
	Ability to Expedite	there are 4 service levels, NFO, SLE, SL1, and SL2
	Minimum Orders	Not Available
	Discount (Volume, Freight)	Not Available
	Availability	Part supply problem happens occasionally due to high technology and yield problem
	Alternate Part	No
	Receiving Inspection	Required
	Supplier and Transportation Lead Time	Depend on service level: Default is SL2
	Inventory Turnover	Not Available
Cost Factors		
	Acceptable Stock Out	0%
	Carrying Costs	Undisclosed
	Expediting	Undisclosed
Nature of Product		
	Repairable (Rework or Reused, and Number of Time of Rework)	Reused depend on part condition
	Part Cost	Estimated $6.62
	Safety Stock	Vary depends on policy
	Scrap Ratio	0.05
Other Issues		
	History of Shortage	Many shortage history since suspension is a high technology component and produce, buy decision and sourcing was done manually
	History of Expediting	Almost all shipment are using NFO and SLE
	Customer Service Target	100%

Slider

Element Check List

Customer Ordering Characteristics		
	Order Timing	Friday wk x, Thai time
	Order Size	Lot for Lot
	Delay in Order Processing	Occasionally (maximum 1 day) came from SAP runtime problem
	Order Cycle	Every week
	Order Type	PO
Demand Patterns		
	Variability	MPC: 2P/N, MRB: 4P/N, and MPA: 4P/N
	Ability to Forecast	Very difficult due to the produce and buy decision and supplier sourcing %
	Demand time frame	Daily PO: 2 weeks, Weekly PO: 10 Weeks, Monthly until the end of horizon
	Any Dependent Demand	No
	Substitution	None
	Demand History	Demand history is unstable and no serious implementation of frozen zone. Once the urgent request or demand change occurs, the supply respond is difficult to support since slider is the lowest level of product hierachy and the most complicated one.
Supply Situation		
	Supplier Name	ITP Japan, GDL Mexico
	Lead Time	San Jose > SLE= 56hrs, SL1= 80hrs, SL2= 116hrs , NFO= not available Mexico > SLE= 64hrs, SL1= 88hrs, SL2= 124hrs , NFO= not available Japan > SLE= 32hrs, SL1= 60hrs, SL2= 96hrs , NFO= 30hrs
	Reliability	Not Available
	Flexibility	Not Flexibility
	Ability to Expedite	there are 4 service levels SLE, SL1, and SL2
	Minimum Orders	Not Available
	Discount (Volume, Freight)	Not Available
	Availability	Part supply problem happens occasionally due to high technology and yield problem
	Alternate Part	No
	Receiving Inspection	Required
	Supplier and Transportation Lead Time	Depend on service level: Default is SL2
	Inventory Turnover	
Cost Factors		
	Acceptable Stock Out	0%
	Carrying Costs	Undisclosed
	Expediting	Undisclosed
Nature of Product		
	Repairable (Rework or Reused, and Number of Time of Rework)	Reused depend on part condition
	Part Cost	Estimated $7.0
	Safety Stock	Vary depends on policy
	Scrap Ratio	0.05
Other Issues		
	History of Shortage	Many shortage history since slider is a high technology component and produce, buy decision and sourcing was done manually
	History of Expediting	Almost all shipment are using NFO and SL1
	Customer Service Target	100%

Carriage

Element Check List

Customer Ordering Characteristics		
	Order Timing	Thursday wk x, Thai time
	Order Size	N/A: haven't decided yet
	Delay in Order Processing	Occasionally (maximum 1 day) came from SAP runtime problem and PO send to supplier process
	Order Cycle	Every week, Weekly PO
	Order Type	Scheduled Agreement
Demand Patterns		
	Variability	1product/1-2 carriage P/N, mostly 1 product/1 carriage P/N MPC: 1 P/N, MRB: 2 P/N, MPA: 1 P/N
	Ability to Forecast	not so difficult
	Demand time frame	1 year, weekly demand
	Any Dependent Demand	No
	Substitution	None
	Demand History	Even the model mix, it won't be any problem since the consumption of each model is the same
Supply Situation		
	Suppler name	LTEC (lumphun), Totoku
	Lead Time	LTEC > Totoku > SLE= 32hrs, SL1= 60hrs, SL2= 96hrs , NFO= 30hrs
	Reliability	
	Flexibility	Yes
	Ability to Expedite	there are 4 service levels SLE, SL1, and SL2
	Minimum Orders	Not Avaialable
	Discount (Volume, Freight)	Not Avaialable
	Availability	Slight problem on supply availability
	Alternate Part	None
	Receiving Inspection	Required
	Supplier and Transportation Lead Time	Japan: default transportation SL2
	Inventory Turnover	Not Avaialable
Cost Factors		
	Acceptable Stock Out	0%
	Carrying Costs	Undisclosed
	Expediting	Undisclosed
Nature of Product		
	Repairable (Rework or Reused, and Number of Time of Rework)	Reused depend on part condition
	Part Cost	$0.67
	Safety Stock	Vary depends on policy
	Scrap Ratio	0.03
Other Issues		
	History of Shortage	Found history of shortage came from part supply quality problem and company tried to keep very low inventory so that the the requested part supply cannot come on time
	History of Expediting	Found history of expediting due to part supply quality problem and total demand dramatically increase.
	Customer Service Target	100%

Screw

Element Check List

Customer Ordering Characteristics		
	Order Timing	Thursday wk x, Thai time
	Order Size	Not available, 10000 pcs/box
	Delay in Order Processing	Occasionally (maximum 1 day) came from SAP runtime problem and PO send to supplier process
	Order Cycle	Every week, monthly PO
	Order Type	Scheduled Agreement
Demand Patterns		
	Variability	1product/1-2 screw P/N, mostly 1 product/1 screw P/N
	Ability to Forecast	OK according to total demand
	Demand time frame	1 PO covers 3 months requirement
	Any Dependent Demand	None
	Substitution	No
	Demand History	Demand fluctuation has insignificant problem with screw requirement
Supply Situation		
	Supplier Name	Katayama Singapore
	Lead Time	SLE= 32hrs, SL1= 48hrs, SL2= 76hrs , NFO= 30hrs
	Reliability	Yes
	Flexibility	usage of each product is not the same. Even same product but different model, screw usage are not the same.
	Ability to Expedite	Screw is consider as a mechanical part with low value. To expiditing this part, expediting cost maybe higher than part cost.
	Minimum Orders	Not Available
	Discount (Volume, Freight)	Not Available
	Availability	OK
	Alternate Part	None
	Receiving Inspection	required
	Supplier and Transportation Lead Time	Default transportation service level: SL2
	Inventory Turnover	Not Available
Cost Factors		
	Acceptable Stock Out	0%
	Carrying Costs	Undisclosed
	Expediting	Undisclosed
Nature of Product		
	Repairable (Rework or Reused, and Number of Time of Rework)	No
	Part Cost	$0.02
	Safety Stock	Vary depends on policy
	Scrap Ratio	0.2
Other Issues		
	History of Shortage	Yes, due to part supply quality problem. Once it failed receiving inspection, the whole lot was rejected.
	History of Expediting	Found history of expediting due to part supply quality problem
	Customer Service Target	100%

Plate

Element Check List

Customer Ordering Characteristics		
	Order Timing	Thursday wk x, Thai time
	Order Size	Not available, 10000 pcs/box
	Delay in Order Processing	Occasionally (maximum 1 day) came from SAP runtime problem and PO send to supplier process
	Order Cycle	Every week, monthly PO
	Order Type	Scheduled Agreement
Demand Patterns		
	Variability	1 Product/1plate P/N
	Ability to Forecast	OK according to total demand
	Demand time frame	Weekly PO (acumalate daily requirement)
	Any Dependent Demand	None
	Substitution	No
	Demand History	Demand fluctuation has insignificant problem with screw requirement
Supply Situation		
	Supplier Name	NHK JP, NHK (Chachoensao)
	Lead Time	NHK JP > SLE= 32hrs, SL1= 60hrs, SL2= 96hrs , NFO= 30hrs
	Reliability	NHK has a good reputation for supply commitment
	Flexibility	High flexibility due to there are multiple suppliers
	Ability to Expedite	very good relationship, high ability to expedite
	Minimum Orders	Not Available
	Discount (Volume, Freight)	Not Available
	Availability	OK
	Alternate Part	None
	Receiving Inspection	Not required
	Supplier and Transportation Lead Time	Default transportation: SL2
	Inventory Turnover	Not Available
Cost Factors		
	Acceptable Stock Out	0%
	Carrying Costs	Undisclosed
	Expediting	Undisclosed
Nature of Product		
	Repairable (Rework or Reused, and Number of Time of Rework)	Reused depend on part condition
	Part Cost	$0.36
	Safety Stock	Vary depends on policy
	Scrap Ratio	0
Other Issues		
	History of Shortage	Found no history of shortage
	History of Expediting	Found some history of expediting
	Customer Service Target	100%

Flex Cable

Element Check List

Customer Ordering Characteristics		
	Order Timing	Thursday wk x, Thai time
	Order Size	N/A: haven't decided yet
	Delay in Order Processing	Occasionally (maximum 1 day) came from SAP runtime problem and PO send to supplier process
	Order Cycle	Every week: PO
	Order Type	Scheduled Agreement
Demand Patterns		
	Variability	1product/1-2 cable P/N, mostly 1 product/1 cable P/N MPC: 1 P/N, MRB: 2 P/N, MPA: 2 P/N
	Ability to Forecast	Difficult to forecast the supply requirement for suppliers
	Demand time frame	Weekly PO (acumalate daily requirement)
	Any Dependent Demand	No
	Substitution	None
	Demand History	Once the demand upside in a significant quantity in short lead time, supplier always have a problem to supply the flex cable
Supply Situation		
	Supplier Name	Mektec (Ayuthaya)
	Lead Time	1 day
	Reliability	Very high quality problem due to cable is a electrical part and supplier performance sometimes can't relied on
	Flexibility	Low flexibility caused from part quality problem
	Ability to Expedite	Not so smooth eventhough supplier is in Thailand
	Minimum Orders	Not available
	Discount (Volume, Freight)	Not available
	Availability	OK
	Alternate Part	Alternative cable in some model which will create the inventory control problem
	Receiving Inspection	Quality problem: occasionally (electrical part)
	Supplier and Transportation Lead Time	Depend on service level: Default is SL2
	Inventory Turnover	Not available
Cost Factors		
	Acceptable Stock Out	0%
	Carrying Costs	Undisclosed
	Expediting	Undisclosed
Nature of Product		
	Repairable (Rework or Reused, and Number of Time of Rework)	Reused depend on part condition
	Part Cost	$2.97
	Safety Stock	Vary depends on policy
	Scrap Ratio	0.03
Other Issues		
	History of Shortage	Shortage history came from quality problem. On hand inventory were rejected before release to production line
	History of Expediting	Expediting history were found occasionally. Most of them came from quality problem and supplier decommitment
	Customer Service Target	100%

Spacer

Element Check List

Customer Ordering Characteristics		
	Order Timing	Thursday wk x, Thai time
	Order Size	N/A: haven't decided yet
	Delay in Order Processing	Occasionally (maximum 1 day) came from SAP runtime problem and PO send to supplier process
	Order Cycle	Every week, weekly PO
	Order Type	Scheduled Agreement
Demand Patterns		
	Variability	using in some model only . 1 product/1spacer P/N (MRB)
	Ability to Forecast	
	Demand time frame	Weekly PO (acumalate daily requirement)
	Any Dependent Demand	No
	Substitution	None
	Demand History	Fluctuate and lumpy not only the total demand change but also the model mix. However it doesn't effect to washer demand since there is only one product using spacer.
Supply Situation		
	Supplier Name	NHK, Soode
	Lead Time	SLE= 32hrs, SL1= 60hrs, SL2= 96hrs , NFO= 30hrs
	Reliability	OK
	Flexibility	OK
	Ability to Expedite	OK
	Minimum Orders	Not available
	Discount (Volume, Freight)	Not available
	Availability	OK
	Alternate Part	No
	Receiving Inspection	Required: Sampling test
	Supplier and Transportation Lead Time	Depend on service level Default is SL2
	Inventory Turnover	
Cost Factors		
	Acceptable Stock Out	0%
	Carrying Costs	Undisclosed
	Expediting	Undisclosed
Nature of Product		
	Repairable (Rework or Reused, and Number of Time of Rework)	Reused depend on part condition
	Part Cost	$0.14
	Safety Stock	Vary depends on policy
	Scrap Ratio	0.03
Other Issues		
	History of Shortage	Yes from Quality problem
	History of Expediting	Not found
	Customer Service Target	100%

Washer

Element Check List

Customer Ordering Characteristics		
	Order Timing	Thursday wk x, Thai time
	Order Size	Not available, 10000 pcs/box
	Delay in Order Processing	Occasionally (maximum 1 day) came from SAP runtime problem and PO send to supplier process
	Order Cycle	Every week monthly PO
	Order Type	Scheduled Agreement
Demand Patterns		
	Variability	using in some model only , 1 product/1spacer P/N (MRB)
	Ability to Forecast	
	Demand time frame	Weekly PO (acumalate daily requirement)
	Any Dependent Demand	No
	Substitution	None
	Demand History	Fluctuate and lumpy not only the total demand change but also the model mix. However it doesn't effect to washer demand since there is only one product using washer
Supply Situation		
	Supplier Name	Minibea
	Lead Time	1 day
	Reliability	Yes
	Flexibility	Yes
	Ability to Expedite	Yes
	Minimum Orders	Not available
	Discount (Volume, Freight)	Not available
	Availability	Yes
	Alternate Part	Not available
	Receiving Inspection	Required; Sampling test
	Supplier and Transportation Lead Time	Depend on service level; Default is SL2
	Inventory Turnover	Not Available
Cost Factors		
	Acceptable Stock Out	0%
	Carrying Costs	Undisclosed
	Expediting	Undisclosed
Nature of Product		
	Repairable (Rework or Reused, and Number of Time of Rework)	Reused depend on part condition
	Part Cost	$0.12
	Safety Stock	Vary depends on policy
	Scrap Ratio	0.2
Other Issues		
	History of Shortage	No
	History of Expediting	No
	Customer Service Target	100%

APPENDIX B

Scrap Allowance Calculation

Actual Scrap Ratio from June 2004 - December 2004

	June	July	August	September	October	November	December
WASHER	0.3	0.2	0.2	0.3	0.2	0.1	0.2
SPACER	0.03	0.035	0.03	0.03	0.025	0.035	0.025
CARRIAGE	0.025	0.035	0.03	0.03	0.03	0.037	0.04
SCREW	0.2	0.22	0.32	0.5	0.5	0.4	0.26
HSA SCREW	0.2	0.22	0.32	0.5	0.5	0.4	0.26
FLEX CABLE	0.03	0.03	0.035	0.028	0.04	0.052	0.035
HGA UP	0.045	0.06	0.06	0.062	0.061	0.072	0.055
HGA DOWN	0.042	0.062	0.075	0.077	0.06	0.05	0.055
DAMPER	0.05	0.05	0.055	0.05	0.055	0.056	0.05
SUSPENSION UP	0.067	0.062	0.077	0.073	0.068	0.055	0.056
SUSPENSION DOWN	0.071	0.082	0.055	0.058	0.062	0.06	0.055
SLIDER UP	0.05	0.05	0.06	0.065	0.06	0.062	0.07
SLIDER DOWN	0.05	0.065	0.066	0.056	0.057	0.06	0.058

Actual Scrap Ratio from June 2005 - May 2005

	January	February	March	April	May
WASHER	0.2	0.2	0.4	0.15	0.15
SPACER	0.025	0.03	0.03	0.025	0.04
CARRIAGE	0.07	0.03	0.022	0.055	0.05
SCREW	0.3	0.3	0.25	0.25	0.35
HSA SCREW	0.3	0.3	0.25	0.25	0.35
FLEX CABLE	0.04	0.03	0.058	0.062	0.058
HGA UP	0.05	0.047	0.065	0.055	0.069
HGA DOWN	0.06	0.062	0.05	0.057	0.072
DAMPER	0.05	0.055	0.045	0.05	0.05
SUSPENSION UP	0.057	0.05	0.055	0.058	0.054
SUSPENSION DOWN	0.076	0.067	0.055	0.057	0.06
SLIDER UP	0.071	0.066	0.068	0.069	0.05
SLIDER DOWN	0.066	0.072	0.08	0.078	0.081

Scrap Ratio with Safety factor Calculation for WASHER

	Actual	Forecast	Deviation	Deviation Square
June	0.3	0.3	0	0
July	0.2	0.3	-0.1	0.01
August	0.2	0.3	-0.1	0.01
September	0.3	0.3	0	0
October	0.2	0.3	-0.1	0.01
November	0.1	0.3	-0.2	0.04
December	0.2	0.3	-0.1	0.01
January	0.2	0.3	-0.1	0.01
February	0.2	0.3	-0.1	0.01
March	0.4	0.3	0.1	0.01
April	0.15	0.3	-0.15	0.0225
May	0.15	0.3	-0.15	0.0225
				0.155

Calculation

Standard Deviation	σd	0.00704545
Z for 99% service levels	Z	2.33
Safety Factor	= Z x σd	0.01641591
Scrap ratio + Safety		**0.316416**

Scrap Ratio with Safety factor Calculation for SPACER

	Actual	Forecast	Deviation	Deviation Square
June	0.03	0.03	0	0
July	0.35	0.03	0.32	0.1024
August	0.03	0.03	0	0
September	0.03	0.03	0	0
October	0.025	0.03	-0.005	0.000025
November	0.035	0.03	0.005	0.000025
December	0.025	0.03	-0.005	0.000025
January	0.025	0.03	-0.005	0.000025
February	0.03	0.03	0	0
March	0.03	0.03	0	0
April	0.025	0.03	-0.005	0.000025
May	0.04	0.03	0.01	0.0001
				0.102625

Calculation

Standard Deviation	σd	0.004665
Z for 99% service levels	Z	2.33
Safety Factor	= Z x σd	0.010869
Scrap ratio + Safety		**0.040869**

Scrap Ratio with Safety factor Calculation for CARRIAGE

	Actual	Forecast	Deviation	Deviation Square
June	0.025	0.03	-0.005	0.000025
July	0.035	0.03	0.005	0.000025
August	0.03	0.03	0	0
September	0.03	0.03	0	0
October	0.03	0.03	0	0
November	0.037	0.03	0.007	0.000049
December	0.04	0.03	0.01	0.0001
January	0.07	0.03	0.04	0.0016
February	0.03	0.03	0	0
March	0.022	0.03	-0.008	0.000064
April	0.055	0.03	0.025	0.000625
May	0.05	0.03	0.02	0.0004
				0.002888

Calculation

Standard Deviation	σd	0.000131
Z for 99% service levels	Z	2.33
Safety Factor	= Z x σd	0.000306
Scrap ratio + Safety		**0.030306**

Scrap Ratio with Safety factor Calculation for SCREW

	Actual	Forecast	Deviation	Deviation Square
June	0.025	0.2	-0.175	0.030625
July	0.035	0.2	-0.165	0.027225
August	0.03	0.2	-0.17	0.0289
September	0.03	0.2	-0.17	0.0289
October	0.03	0.2	-0.17	0.0289
November	0.037	0.2	-0.163	0.026569
December	0.04	0.2	-0.16	0.0256
January	0.07	0.2	-0.13	0.0169
February	0.03	0.2	-0.17	0.0289
March	0.022	0.2	-0.178	0.031684
April	0.032	0.2	-0.168	0.028224
May	0.03	0.2	-0.17	0.0289
				0.331327

Calculation

Standard Deviation	σd	0.015060
Z for 99% service levels	Z	2.33
Safety Factor	= Z x σd	0.035091
Scrap ratio + Safety		**0.235091**

Scrap Ratio with Safety factor Calculation for HSA SCREW

	Actual	Forecast	Deviation	Deviation Square
June	0.2	0.2	0	0
July	0.22	0.2	0.02	0.0004
August	0.32	0.2	0.12	0.0144
September	0.5	0.2	0.3	0.09
October	0.5	0.2	0.3	0.09
November	0.4	0.2	0.2	0.04
December	0.26	0.2	0.06	0.0036
January	0.3	0.2	0.1	0.01
February	0.3	0.2	0.1	0.01
March	0.25	0.2	0.05	0.0025
April	0.25	0.2	0.05	0.0025
May	0.35	0.2	0.15	0.0225
				0.2859

Calculation

Standard Deviation	σd	0.012995
Z for 99% service levels	Z	2.33
Safety Factor	= Z x σd	0.030279
Scrap ratio + Safety		**0.230279**

Scrap Ratio with Safety factor Calculation for FLEX CABLE

	Actual	Forecast	Deviation	Deviation Square
June	0.03	0.03	0	0
July	0.03	0.03	0	0
August	0.035	0.03	0.005	0.000025
September	0.028	0.03	-0.002	0.0000040
October	0.04	0.03	0.01	0.0001
November	0.052	0.03	0.022	0.000484
December	0.035	0.03	0.005	0.000025
January	0.04	0.03	0.01	0.0001
February	0.03	0.03	0	0
March	0.058	0.03	0.028	0.000784
April	0.062	0.03	0.032	0.001024
May	0.058	0.03	0.028	0.000784
				0.00333

Calculation

Standard Deviation	σd	0.000151
Z for 99% service levels	Z	2.33
Safety Factor	= Z x σd	0.000353
Scrap ratio + Safety		**0.030353**

Scrap Ratio with Safety factor Calculation for HGA UP

	Actual	Forecast	Deviation	Deviation Square
June	0.045	0.05	-0.005	0.000025
July	0.06	0.05	0.01	0.000100
August	0.06	0.05	0.01	0.000100
September	0.062	0.05	0.012	0.000144
October	0.061	0.05	0.011	0.000121
November	0.072	0.05	0.022	0.000484
December	0.055	0.05	0.005	0.000025
January	0.05	0.05	0	0
February	0.047	0.05	-0.003	0.000009
March	0.065	0.05	0.015	0.000225
April	0.055	0.05	0.005	0.000025
May	0.069	0.05	0.019	0.000361
				0.001619

Calculation

Standard Deviation	σd	0.000074
Z for 99% service levels	Z	2.33
Safety Factor	= Z x σd	0.000171
Scrap ratio + Safety		**0.050171**

Scrap Ratio with Safety factor Calculation for HGA DOWN

	Actual	Forecast	Deviation	Deviation Square
June	0.042	0.05	-0.008	0.000064
July	0.062	0.05	0.012	0.000144
August	0.075	0.05	0.025	0.000625
September	0.077	0.05	0.027	0.000729
October	0.06	0.05	0.01	0.0001
November	0.05	0.05	0	0.0000
December	0.055	0.05	0.005	0.0000
January	0.06	0.05	0.01	0.0001
February	0.062	0.05	0.012	0.000144
March	0.05	0.05	0	0
April	0.057	0.05	0.007	0.000049
May	0.072	0.05	0.022	0.000484
				0.002464

Calculation

Standard Deviation	σd	0.000112
Z for 99% service levels	Z	2.33
Safety Factor	= Z x σd	0.000261
Scrap ratio + Safety		**0.050261**

Scrap Ratio with Safety factor Calculation for DAMPER

	Actual	Forecast	Deviation	Deviation Square
June	0.05	0.05	0	0
July	0.05	0.05	0	0
August	0.055	0.05	0.005	0.000025
September	0.05	0.05	0	0
October	0.055	0.05	0.005	0.000025
November	0.056	0.05	0.006	0.000036
December	0.05	0.05	0	0
January	0.05	0.05	0	0
February	0.055	0.05	0.005	0.000025
March	0.045	0.05	-0.005	0.000025
April	0.05	0.05	0	0
May	0.05	0.05	0	0
				0.000136

Calculation

Standard Deviation	σd	0.000006
Z for 99% service levels	Z	2.33
Safety Factor	= Z x σd	0.000014
Scrap ratio + Safety		**0.050014**

Scrap Ratio with Safety factor Calculation for SUSPENSION UP

	Actual	Forecast	Deviation	Deviation Square
June	0.067	0.05	0.017	0.0003
July	0.062	0.05	0.012	0.0001
August	0.077	0.05	0.027	0.000729
September	0.073	0.05	0.023	0.000529
October	0.068	0.05	0.018	0.000324
November	0.055	0.05	0.005	0.000025
December	0.056	0.05	0.006	0.000036
January	0.057	0.05	0.007	0.000049
February	0.05	0.05	0	0
March	0.055	0.05	0.005	0.000025
April	0.058	0.05	0.008	0.000064
May	0.054	0.05	0.004	0.000016
				0.00223

Calculation

Standard Deviation	σd	0.000101
Z for 99% service levels	Z	2.33
Safety Factor	= Z x σd	0.000236
Scrap ratio + Safety		**0.050236**

Scrap Ratio with Safety factor Calculation for SUSPENSION DOWN

	Actual	Forecast	Deviation	Deviation Square
June	0.071	0.05	0.021	0.000441
July	0.082	0.05	0.032	0.001024
August	0.055	0.05	0.005	0.000025
September	0.058	0.05	0.008	0.000064
October	0.062	0.05	0.012	0.000144
November	0.06	0.05	0.01	0.000100
December	0.055	0.05	0.005	0.000025
January	0.076	0.05	0.026	0.000676
February	0.067	0.05	0.017	0.000289
March	0.055	0.05	0.005	0.000025
April	0.057	0.05	0.007	0.000049
May	0.06	0.05	0.01	0.000100
				0.002962

Calculation

Standard Deviation	σd	0.000135
Z for 99% service levels	Z	2.33
Safety Factor	= Z x σd	0.000314
Scrap ratio + Safety		**0.050314**

Scrap Ratio with Safety factor Calculation for SLIDER UP

	Actual	Forecast	Deviation	Deviation Square
June	0.05	0.05	0	0
July	0.05	0.05	0	0
August	0.06	0.05	0.01	0.000100
September	0.065	0.05	0.015	0.000225
October	0.06	0.05	0.01	0.000100
November	0.062	0.05	0.012	0.000144
December	0.07	0.05	0.02	0.000400
January	0.071	0.05	0.021	0.000441
February	0.066	0.05	0.016	0.000256
March	0.068	0.05	0.018	0.000324
April	0.069	0.05	0.019	0.000361
May	0.05	0.05	0	0.000000
				0.002351

Calculation

Standard Deviation	σd	0.000107
Z for 99% service levels	Z	2.33
Safety Factor	= Z x σd	0.000249
Scrap ratio + Safety		**0.050249**

Scrap Ratio with Safety factor Calculation for SLIDER DOWN

	Actual	Forecast	Deviation	Deviation Square
June	0.05	0.05	0	0
July	0.065	0.05	0.015	0.000225
August	0.066	0.05	0.016	0.000256
September	0.056	0.05	0.006	0.000036
October	0.057	0.05	0.007	0.000049
November	0.06	0.05	0.01	0.000100
December	0.058	0.05	0.008	0.000064
January	0.066	0.05	0.016	0.000256
February	0.072	0.05	0.022	0.000484
March	0.08	0.05	0.03	0.000900
April	0.078	0.05	0.028	0.000784
May	0.081	0.05	0.031	0.000961
				0.004115

Calculation

Standard Deviation	σd	0.000187
Z for 99% service levels	Z	2.33
Safety Factor	= Z x σd	0.000436
Scrap ratio + Safety		**0.050436**

APPENDIX C

Example of MRP data

Example of Master Production Schedule (MPS)

			Prod Year	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005
			Prod Month	4	4	4	4	5	5	5	5	6	6	6
Genus	Family	Pn	Prod Week	14	15	16	17	18	19	20	21	22	23	24
CPMOR	HSA	000000A25020	Max base		329	1453	1940	2730	3083	3344	2711	3177	2835	3174
CPMOR	HSA	000000A25047	Max base	17	267									
CPMOR	HSA	000000A25048	Max base		333	866	719	469	489	487	613	919	746	812
CPMOR	HSA	000000A25049	Max base	307	577	1467	4754	6536	7313	7985	6315	6933	6814	6911
CPMOR	HSA	000000A27229	Max base	7783	10897	7781	11494	8780	12292	10544	13490	16625	23276	16624
CPMOR	HSA	000000A27230	Max base	3333	4666	3332	4493	3045	4259	3651	3092	3125	4375	3125
CPMOR	HSA	000000A27231	Max base	2500	3500	2500	3566	2610	3651	3129	3917	4790	6710	4792
CPMOR	HSA	000000A27232	Max base	2500	3500	2500	3695	2825	3955	3393	3882	4585	6416	4582
CPMOR	HSA	000000A27233	Max base	2500	3500	2500	3695	2825	3955	3393	3882	4585	6416	4582

Example of Supplier Lead time (days)

Item	Supplier	Supplier Lead time (days)
WASHER	Minibea	1
SPACER	NHK	1
	Soode	1
CARRIAGE	LTEC	1
	Totoku	3
SCREW	Katayama	3
HSA SCREW	Katayama	3
FLEX CABLE	Mektec	1
HGA UP	TDK	4
	HSPC	3
HGA DOWN	TDK	4
	HSPC	3
DAMPER	Minibea	1
SUSPENSION UP	NHK Japan	4
	SCC	4
SUSPENSION DOWN	NHK Japan	4
	SCC	4
SLIDER UP	ITP Japan	4
	GDL Mexico	5
SLIDER DOWN	ITP Japan	4
	GDL Mexico	5

Example of Scrap Ratio with Safety Factor

ITEM	Scrap Ratio with Safety Factor
WASHER	0.31642
SPACER	0.04087
CARRIAGE	0.03031
SCREW	0.23509
HSA SCREW	0.23028
FLEX CABLE	0.03035
HGA UP	0.05017
HGA DOWN	0.05026
DAMPER	0.05001
SUSPENSION UP	0.05024
SUSPENSION DOWN	0.05031
SLIDER UP	0.05025
SLIDER DOWN	0.05044

Example of BOM document from SAP

Report ID: YGMMMR56

Plant: TH01
Material: 13G1716 and others
Group:
Procurement type:
Alt BOM: 1
Valid date: 1/23/2005
Change number:
BOM Usage: 3
Language: Z1

Material Level 0 1 2 3 4 5 6 7 8 9 10 11 11+						Alt Gp	SG	E/C Number	Description		Valid Date	MP TY	MRP Con	MRP Grp	Sp Pr	Group	P	Ext Qty	Unit Cst
0	14R8838							DA1052	ACTUATOR A	MRL HSA 60G4HD	5/20/2004	PD	1	TH01		PMORAHDE	E	1	17 17
1		13G1714				04(02)0		DA1052	HEAD ASM D	HGA DN MRG W/D	5/20/2004	M0	33T	TH01		PMORAHSA	F	2	3 31
1		13G1713				03(02)0		DA1052	HEAD ASM U	HGA UP MRG W/D	5/20/2004	M0	33T	TH01		PMORAHSA	F	2	3 31
1		0A25114				04(01)100		DA1052	HEAD ASM D	HGA DN MRG-B W/D	5/20/2004	M0	33T	TH01		PMORAHSA	F	2	3 31
2				0A24798				DA1034	SLIDER	SLIDER TOP MRG-B	4/7/2004	PD	1	TH01		PMORAHGA	F	2	0
3					18P4527			DA1034	SLIDER	SLIDER TD LOW	4/7/2004	M0	1	TH01		MORASLD	F	2	0
2			*	08K0892				DA1034	DAMPER	SEAL	4/7/2004	PD	1	TH01		PMORAHGA	F	2	0 05
2			*	07N7778				DA1034	SUSPENSION	MRG ILS DOWN	4/7/2004	M0	1	PAPO		SMORAHGA	F	2	0
1		0A25113				03(01)100		DA1052	HEAD ASM U	HGA UP MRG-B W/D	5/20/2004	M0	33T	TH01		PMORAHSA	F	2	3 31
2				0A24797				DA1034	SLIDER	SLIDER BOT MRG-B	4/7/2004	PD	1	TH01		PMORAHGA	F	2	0
3					18P4528			DA1034	SLIDER	SLIDER BU LOW	4/7/2004	M0	1	TH01		MORASLD	F	2	0
2			*	08K0892				DA1034	DAMPER	SEAL	4/7/2004	PD	1	TH01		PMORAHGA	F	2	0 05
2			*	07N7777				DA1034	SUSPENSION	MRG ILS UP	4/7/2004	M0	1	PAPO		SMORAHGA	F	2	0
1		0A21128				04(03)0		DA1052	HEAD ASM D	MRG-LP HGA WITH	5/20/2004	M0	46T	TH01		PMORAHSA	F	2	3 31
2				13G1712				DA1013	SLIDER	SLIDER DN	1/28/2004	M0	1	PAPO		PMORAHGA	F	2	0
2			*	08K0892				DA1013	DAMPER	SEAL	1/28/2004	PD	1	TH01		PMORAHGA	F	2	0 05
2			*	07N7778				DA1013	SUSPENSION	MRG ILS DOWN	1/28/2004	M0	1	PAPO		SMORAHGA	F	2	0
1		0A21127				03(03)0		DA1052	HEAD ASM U	MRG-LP HGA WITH	5/20/2004	M0	46T	TH01		PMORAHSA	F	2	3 31
2				13G1711				DA1013	SLIDER	SLIDER UP	1/28/2004	M0	1	PAPO		PMORAHGA	F	2	0
2			*	08K0892				DA1013	DAMPER	SEAL	1/28/2004	PD	1	TH01		PMORAHGA	F	2	0 05
2			*	07N7777				DA1013	SUSPENSION	MRG ILS UP	1/28/2004	M0	1	PAPO		SMORAHGA	F	2	0
1		25L1457						10000H7147	WASHER	ACTR WASHER	8/30/2003	PD	37T	DNF1		LMORAHSA	F	1	0 12
1		25L1423						10000H7147	SPACER	ACTUATOR SPACR	8/30/2003	M0	26T	TH01		LMORAHSA	F	1	0 14
1		25L1422						10000H7147	SCREW	HSA SCREW	8/30/2003	PD	37T	DNF1		LMORAHSA	F	1	0 01
1		08K0211						10000H7147	CABLE	MRG-L FLEXASM	8/30/2003	M0	47T	TH01		LMORAHSA	F	1	2 97
1		08K0207						10000H7147	CARRIAGE A	COIL SUPPORT A	8/30/2003	M0	47T	TH01		LMORAHSA	F	1	0 67
1		07N9992						10000H7147	SCREW	SCREW M1	8/30/2003	PD	38T	DNF1		SMORAHSA	F	1	0 02

Example of BOM Table

14R8838 ACTUATOR A MRL HSA 60G4HD

Mat Level	Part No.		Alt Gp	Description	Qty
0	14R8838			ACTUATOR A MRL HSA 60G4HD	1
1	13G1714		04(02)0	HEAD ASM D HGA DN MRG W/D	2
2		13G1712		SLIDER SLIDER DN	2
2		07N7778		SUSPENSION MRG ILS DOWN	2
2		08K0892		DAMPER SEAL	2
1	13G1713		03(02)0	HEAD ASM U HGA UP MRG W/D	2
		13G1711		SLIDER SLIDER UP	2
		07N7777		SUSPENSION MRG ILS UP	2
		08K0892		DAMPER SEAL	2
1	0A25114		04(01)100	HEAD ASM D HGA DN MRG-B W/D	2
2		0A24798		SLIDER SLIDER TOP MRG-B	2
2	*	08K0892		DAMPER SEAL	2
2	*	07N7778		SUSPENSION MRG ILS DOWN	2
1	0A25113		03(01)100	HEAD ASM U HGA UP MRG-B W/D	2
2		0A24797		SLIDER SLIDER BOT MRG-B	2
2	*	08K0892		DAMPER SEAL	2
2	*	07N7777		SUSPENSION MRG ILS UP	2
1	0A21128		04(03)0	HEAD ASM D MRG-LP HGA WITH	2
2		13G1712		SLIDER SLIDER DN	2
2	*	08K0892		DAMPER SEAL	2
2	*	07N7778		SUSPENSION MRG ILS DOWN	2
1	0A21127		03(03)0	HEAD ASM U MRG-LP HGA WITH	2
2		13G1711		SLIDER SLIDER UP	2
2	*	08K0892		DAMPER SEAL	2
2	*	07N7777		SUSPENSION MRG ILS UP	2
1	25L1457			WASHER ACTR WASHER	1
1	25L1423			SPACER ACTUATOR SPACR	1
1	25L1422			SCREW HSA SCREW	1
1	08K0211			CABLE MRG-L FLEXASM	1
1	08K0207			CARRIAGE A COIL SUPPORT A	1
1	07N9992			SCREW SCREW M1	1

Example of Inventory data and Scheduled Receipt

Report ID: YCPP

Page: 1

YPK1: Unassigned Inventory

Date: 04/06/2005

Transaction: YPK1

Time: 16:57:36

Plant TH01

Material	InvTyp	Unit	Quantity	St. Loc	Document #	Vendor	TTR Vendor	Avail Dt	Delivery Dt	Quality Ind
07N8491	PO/TO	ST	29	MDC2	91292410	0 72810	81	20030117	20030116	
07N8491	PO/TO	ST	58	MDC2	91269010	0 72810	81	20021228	20021227	
07N8491	PO/TO	ST	12	MDC2	91268910	0 72810	81	20021228	20021227	
07N8491	RES	ST	-58	CISO	126641471		TH01	20021114		
07N8491	RES	ST	-12	CISO	126641461		TH01	20021114		
07N8491	VC	ST	67	****						
Total inventory	for 07N84	91		96						
07N9078	BRC	ST	3	ENG3	15457974 26		TH01	20050420		
07N9078	BRC	ST	3	ENG3	15457974 22		TH01	20050416		
07N9078	BRC	ST	3	ENG3	15457974 25		TH01	20050512		
07N9078	BRC	ST	3	ENG3	15457974 24		TH01	20050504		
07N9078	BRC	ST	3	ENG3	15457974 23		TH01	20050426		
07N9078	OH	ST	147,565	****						
Total inventory	for 07N90	78	14	7,580						
07N9085	PR/TR	ST	1	MDC1	6128684 10		NVEN	20030628	20030627	
07N9085	VC	ST	182	****						
Total inventory	for 07N90	85		183						

Example of Supplier Sourcing Percentage

Item	Supplier	Percentage
WASHER	Minibea	100%
SPACER	NHK	50%
	Soode	50%
CARRIAGE	LTEC	70%
	Totoku	30%
SCREW	Katayama	100%
HSA SCREW	Katayama	100%
FLEX CABLE	Mektec	100%
HGA UP	TDK	60%
	HSPC	40%
HGA DOWN	TDK	60%
	HSPC	40%
DAMPER	Minibea	100%
SUSPENSION UP	NHK Japan	70%
	SCC	30%
SUSPENSION DOWN	NHK Japan	70%
	SCC	30%
SLIDER UP	ITP Japan	50%
	GDL Mexico	50%
SLIDER DOWN	ITP Japan	50%
	GDL Mexico	50%

Example of Production Lead time

ITEM	Production Leadtime
HSA	1
WASHER	N/A
SPACER	N/A
CARRIAGE	N/A
SCREW	N/A
HSA SCREW	N/A
FLEX CABLE	N/A
HGA UP	2
HGA DOWN	2
DAMPER	N/A
SUSPENSION UP	N/A
SUSPENSION DOWN	N/A
SLIDER UP	N/A
SLIDER DOWN	N/A

Example of HGA Capacity Information

Capacity Information for HGA Production Line

unit: KDGR

	Day																					
	7/12	7/13	7/14	7/15	7/16	7/18	7/19	7/20	7/21	7/22	7/23	7/25	7/26	7/27	7/28	7/29	7/30	8/1	8/2	8/3	8/4	8/5
working days																						
Capacity/Line	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19
No. of Line	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Line Capacity	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95
Standard hour/ unit																						
Capacity/Team	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6
No. of Team	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Team Capacity	76.8	76.8	76.8	76.8	76.8	76.8	76.8	76.8	76.8	76.8	76.8	76.8	76.8	76.8	76.8	76.8	76.8	76.8	76.8	76.8	76.8	76.8
Quasi Up	38.8	38.8	38.8	38.8	38.8	38.8	38.8	38.8	38.8	38.8	38.8	38.8	38.8	38.8	38.8	38.8	38.8	38.8	38.8	38.8	38.8	38.8
Quasi Down	38.8	38.8	38.8	38.8	38.8	38.8	38.8	38.8	38.8	38.8	38.8	38.8	38.8	38.8	38.8	38.8	38.8	38.8	38.8	38.8	38.8	38.8
Total Quasi	77.6	77.6	77.6	77.6	77.6	77.6	77.6	77.6	77.6	77.6	77.6	77.6	77.6	77.6	77.6	77.6	77.6	77.6	77.6	77.6	77.6	77.6
ABS	75.8	75.8	75.8	75.8	75.8	75.8	75.8	75.8	75.8	75.8	75.8	75.8	75.8	75.8	75.8	75.8	75.8	75.8	75.8	75.8	75.8	75.8
Final Inspection	76.4	76.4	76.4	76.4	76.4	76.4	76.4	76.4	76.4	76.4	76.4	76.4	76.4	76.4	76.4	76.4	76.4	76.4	76.4	76.4	76.4	76.4

APPENDIX D

Example of MRP System

Example of Procedure Worksheet

Material Requirement Planning for HSA

1. To start MRP, input the parameters in parameter worksheet
2. Input BOM usage
3. Input Supplier Information
4. Input Demand
5. Input Capacity
6. Automatic MRP Calculation Process
7. PR summary and Print out
8. Work Order Summary and Print out

Example of Calendar Worksheet

Working Day	Wk	Jan St	Su	Mo	Tu	We	Th	Fr
4	1	1	2	3	4	5	6	7
6	2	8	9	10	11	12	13	14
6	3	15	16	17	18	19	20	21
6	4	22	23	24	25	26	27	28
	Jan 1	New Year						

Working Day	Wk	Feb St	Su	Mo	Tu	We	Th	Fr
6	5	29	30	31	1	2	3	4
6	6	5	6	7	8	9	10	11
6	7	12	13	14	15	16	17	18
5	8	19	20	21	22	23	24	25
	Feb 23	Makhan Bucha day						

Working Day	Wk	Mar St	Su	Mo	Tu	We	Th	Fr
6	9	26	27	28	1	2	3	4
6	10	5	6	7	8	9	10	11
6	11	12	13	14	15	16	17	18
6	12	19	20	21	22	23	24	25
6	13	26	27	28	29	30	31	1

Working Day	Wk	April St	Su	Mo	Tu	We	Th	Fr
								1
6	14	2	3	4	5	5	7	8
3	15	9	10	11	12	13	14	15
5	16	16	17	18	19	20	21	22
6	17	23	24	25	26	27	28	29
	Apr 16	Substitution of Chakri day						
	Apr 13-15	Songkran day						

Example of Parameter Worksheet

Item	Lead Time	Scrap	Usage	Production Leadtime	Beginning Inventory
HSA	1	0.1	1	1	1
WASHER	1	0.3	1	N/A	2
SPACER	5	0.3	1	N/A	2
CARRIAGE	1	0.3	1	N/A	1
SCREW	7	0.3	1	N/A	2
HSA SCREW	1	0.3	1	N/A	1
FLEX CABLE	1	0.3	1	N/A	1
HGA UP	1	0.3	1	2	2
HGA DOWN	1	0.3	1	2	3
DAMPER	1	0.3	0	N/A	2
SUSPENSION UP	4	0.3	1	N/A	4
SUSPENSION DOWN	4	0.3	1	N/A	3
SLIDER UP	4	0.3	1	N/A	1
SLIDER DOWN	4	0.3	1	N/A	1

MRP Start Date	7/12/05
Week start	32
Month start	10

Example of BOM Worksheet

	WASHER	SPACER	CARRIAGE	SCREW	HSA SCREW	FLEX CABLE	HGA UP	HGA DOWN	DAMPER
Low level code	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**2**
13G1737	1	1	1	1	1	1	1	1	1
13G1738	1	1	1	1	1	1	1	1	0
14R8838	1	1	1	1	1	1	1	1	2
13G1740	1	1	1	1	1	1	1	1	4

Example of Supplier Percentage Worksheet

Item	Supplier	Percentage	Supplier Lead time (days)
WASHER	Minibea	100%	1
SPACER	NHK	50%	1
	Soode	50%	1
CARRIAGE	LTEC	70%	1
	Totoku	30%	3
SCREW	Katayama	100%	3
HSA SCREW	Katayama	100%	3
FLEX CABLE	Mektec	100%	1
HGA UP	TDK	60%	4
	HSPC	40%	3
HGA DOWN	TDK	60%	4
	HSPC	40%	3
DAMPER	Minibea	100%	1
SUSPENSION UP	NHK Japan	70%	4
	SCC	30%	4
SUSPENSION DOWN	NHK Japan	70%	4
	SCC	30%	4
SLIDER UP	ITP Japan	50%	4
	GDL Mexico	50%	5
SLIDER DOWN	ITP Japan	50%	4
	GDL Mexico	50%	5

Example of Demand Worksheet

Demand Summary of MPA and MRB

		Day																			
		7/12	7/13	7/14	7/15	7/16	7/18	7/19	7/20	7/21	7/22	7/23	7/25	7/26	7/27	7/28	7/29	7/30	8/1	8/2	8/3
MPA	Total MPA	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
MRB	13G1737	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
	13G1738	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
	14R8838	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
	13G1740	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
	Total	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
	Ratio																				
	Total MPA	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
	13G1737	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
	13G1738	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
	14R8838	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
	13G1740	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
	Total	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

Example of Capacity Worksheet

unit: KDGR

	Day																
	7/12	7/13	7/14	7/15	7/16	7/18	7/19	7/20	7/21	7/22	7/23	7/25	7/26	7/27	7/28	7/29	7/30
working days																	
Capacity/Line	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19
No. of Line	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Line Capacity	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95
Standard hour/ unit																	
Capacity/Team	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6
No. of Team	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Team Capacity	76.8	76.8	76.8	76.8	76.8	76.8	76.8	76.8	76.8	76.8	76.8	76.8	76.8	76.8	76.8	76.8	76.8
Quasi Up	38.8	38.8	38.8	38.8	38.8	38.8	38.8	38.8	38.8	38.8	38.8	38.8	38.8	38.8	38.8	38.8	38.8
Quasi Down	38.8	38.8	38.8	38.8	38.8	38.8	38.8	38.8	38.8	38.8	38.8	38.8	38.8	38.8	38.8	38.8	38.8
Total Quasi	77.6	77.6	77.6	77.6	77.6	77.6	77.6	77.6	77.6	77.6	77.6	77.6	77.6	77.6	77.6	77.6	77.6
ABS	75.8	75.8	75.8	75.8	75.8	75.8	75.8	75.8	75.8	75.8	75.8	75.8	75.8	75.8	75.8	75.8	75.8
Final Inspection	76.44	76.44	76.44	76.44	76.44	76.44	76.44	76.44	76.44	76.44	76.44	76.44	76.44	76.44	76.44	76.44	76.44
Gating Capacity	75.8	75.8	75.8	75.8	75.8	75.8	75.8	75.8	75.8	75.8	75.8	75.8	75.8	75.8	75.8	75.8	75.8
HGA UP	37.9	37.9	37.9	37.9	37.9	37.9	37.9	37.9	37.9	37.9	37.9	37.9	37.9	37.9	37.9	37.9	37.9
HGA DOWN	37.9	37.9	37.9	37.9	37.9	37.9	37.9	37.9	37.9	37.9	37.9	37.9	37.9	37.9	37.9	37.9	37.9
Available capacity for 14R8838																	
HGA UP	7.58	7.58	7.58	7.58	7.58	7.58	7.58	7.58	7.58	7.58	7.58	7.58	7.58	7.58	7.58	7.58	7.58
HGA DOWN	7.58	7.58	7.58	7.58	7.58	7.58	7.58	7.58	7.58	7.58	7.58	7.58	7.58	7.58	7.58	7.58	7.58

Example of Calculation Worksheet

					Day									
					7/12	7/13	7/14	7/15	7/16	7/18	7/19	7/20	7/21	7/22
	[illegible]	14R8838			3	3	3	3	3	3	3	3	3	3
	UNIT: KUNITS													
					Day									
HSA					7/12	7/13	7/14	7/15	7/16	7/18	7/19	7/20	7/21	7/22
	Technique	POQ	Gross Requirement		3.33	3.33	3.33	3.33	3.33	3.33	3.33	3.33	3.33	3.33
	Order Qty	N/A	Scheduled Receipts				4							
	Alloc Qty	N/A	Projected Available	1	0	0	0.67	0	0	0	0	0	0	0
	Safety Stock	0	Net Requirements		2.33	3.33	0	2.67	3.33	3.33	3.33	3.33	3.33	3.33
	Low Level Code	0	Planned Order Receipts		2.33	3.33	0	2.67	3.33	3.33	3.33	3.33	3.33	3.33
			Planned Order Released		3.33	0	2.67	3.33	3.33	3.33	3.33	3.33	3.33	3.33
	Scrap Ratio	0.1												
	Usage	1												
					Day									
WASHER					7/12	7/13	7/14	7/15	7/16	7/18	7/19	7/20	7/21	7/22
	Technique	POQ	Gross Requirement		4.76	0	3.81	4.76	4.76	4.76	4.76	4.76	4.76	4.76
	Order Qty	N/A	Scheduled Receipts				4							
	Alloc Qty	N/A	Projected Available	2	0	0	0.19	0	0	0	0	0	0	0
	Safety Stock	0	Net Requirements		2.76	0	0	4.57	4.76	4.76	4.76	4.76	4.76	4.76
	Low Level Code	1	Planned Order Receipts		2.76		4.57		9.52		9.52		9.52	
	Scrap Ratio	0.3												
	Usage	1												
					Day									
SPACER					7/12	7/13	7/14	7/15	7/16	7/18	7/19	7/20	7/21	7/22
	Technique	POQ	Gross Requirement		4.76	0	3.81	4.76	4.76	4.76	4.76	4.76	4.76	4.76
	Order Qty		Scheduled Receipts				4							
	Alloc Qty		Projected Available	2	0	0	0.19	0	0	0	0	0	0	0
	Safety Stock	10	Net Requirements		2.76	0	0	4.57	4.76	4.76	4.76	4.76	4.76	4.76
	Low Level Code	1	Planned Order Receipts		2.76		4.57		9.52		9.52		9.52	
	Scrap Ratio	0.3												
	Usage	1												

Example of Sourcing Calculation Worksheet

	Supplier LT	Week												
		8/1	8/2	8/3	8/4	8/5	32	33	34	35	36	37	38	39
WASHER		0.00	9.52	0.00	17.99	0.00	66.14	79.37	33.51	79.37	79.37	79.37	79.37	79.37
	1	9.52	0.00	17.99	0.00	26.46	39.68	79.37	33.51	79.37	79.37	79.37	79.37	79.37
		8/1	8/2	8/3	8/4	8/5	32	33	34	35	36	37	38	39
SPACER		0.00	9.52	0.00	17.99	0.00	66.14	79.37	33.51	79.37	79.37	79.37	79.37	79.37
	1	4.76	0.00	8.99	0.00	13.23	19.84	39.68	16.75	39.68	39.68	39.68	39.68	39.68
	1	4.76	0.00	8.99	0.00	13.23	19.84	39.68	16.75	39.68	39.68	39.68	39.68	39.68
		8/1	8/2	8/3	8/4	8/5	32	33	34	35	36	37	38	39
CARRIAGE		4.76	4.76	4.76	4.76	13.23	66.14	79.37	36.51	79.37	79.37	79.37	79.37	79.37
	1	3.33	3.33	3.33	9.26	9.26	37.04	55.56	25.56	55.56	55.56	55.56	55.56	55.56
	3	1.43	3.97	3.97	3.97	3.97	7.94	23.81	10.95	23.81	23.81	23.81	23.81	23.81
		8/1	8/2	8/3	8/4	8/5	32	33	34	35	36	37	38	39
SCREW		0.00	9.52	0.00	17.99	0.00	66.14	79.37	36.51	79.37	79.37	79.37	79.37	79.37
	3	17.99	0.00	13.23	13.23	13.23	26.46	79.37	36.51	79.37	79.37	79.37	79.37	79.37
		8/1	8/2	8/3	8/4	8/5	32	33	34	35	36	37	38	39
HSA SCREW		0.00	9.52	0.00	17.99	0.00	66.14	79.37	36.51	79.37	79.37	79.37	79.37	79.37
	3	17.99	0.00	13.23	13.23	13.23	26.46	79.37	36.51	79.37	79.37	79.37	79.37	79.37
		8/1	8/2	8/3	8/4	8/5	32	33	34	35	36	37	38	39
FLEX CABLE		4.76	4.76	4.76	4.76	13.23	66.14	79.37	36.51	79.37	79.37	79.37	79.37	79.37
	1	4.76	4.76	4.76	13.23	13.23	52.91	79.37	36.51	79.37	79.37	79.37	79.37	79.37
		8/1	8/2	8/3	8/4	8/5	32	33	34	35	36	37	38	39
HGA UP		0.00	0.00	0.00	0.00	5.65	0.00	12.61	0.00	12.61	12.61	12.61	14.39	14.39
	4	3.39	0.00	0.00	0.00	0.00	0.00	7.57	0.00	7.57	7.57	7.57	8.63	8.63
	3	0.00	2.26	0.00	0.00	0.00	0.00	5.05	0.00	5.05	5.05	5.05	5.76	5.76
		8/1	8/2	8/3	8/4	8/5	32	33	34	35	36	37	38	39
HGA DOWN		0.00	0.00	0.00	0.00	5.65	0.00	12.61	0.00	12.61	12.61	12.61	14.39	14.39
	4	3.39	0.00	0.00	0.00	0.00	0.00	7.57	0.00	7.57	7.57	7.57	8.63	8.63
	3	0.00	2.26	0.00	0.00	0.00	0.00	5.05	0.00	5.05	5.05	5.05	5.76	5.76

Example of PR Summary Worksheet

PR SUMMARY REPORT

		WASHER	SPACER		CARRIAGE		SCREW
		Minibea	NHK	Soode	LTEC	Totoku	Katayama
	7/12	0.00	0.00	0.00	0.00	1.37	0.00
	7/13	4.57	2.29	2.29	0.00	1.43	9.52
	7/14	0.00	0.00	0.00	3.20	1.43	0.00
	7/15	9.52	4.76	4.76	3.33	1.43	9.52
	7/16	0.00	0.00	0.00	3.33	1.43	0.00
	7/18	9.52	4.76	4.76	3.33	1.43	9.52
	7/19	0.00	0.00	0.00	3.33	1.43	0.00
	7/20	9.52	4.76	4.76	3.33	1.43	9.52
	7/21	0.00	0.00	0.00	3.33	1.43	0.00
	7/22	9.52	4.76	4.76	3.33	1.43	9.52
	7/23	0.00	0.00	0.00	3.33	1.43	0.00
	7/25	9.52	4.76	4.76	3.33	1.43	9.52
	7/26	0.00	0.00	0.00	3.33	1.43	0.00
	7/27	9.52	4.76	4.76	3.33	1.43	9.52
	7/28	0.00	0.00	0.00	3.33	1.43	0.00
	7/29	9.52	4.76	4.76	3.33	1.43	9.52
	7/30	0.00	0.00	0.00	3.33	1.43	0.00
	8/1	9.52	4.76	4.76	3.33	1.43	17.99
	8/2	0.00	0.00	0.00	3.33	3.97	0.00
	8/3	17.99	8.99	8.99	3.33	3.97	13.23
	8/4	0.00	0.00	0.00	9.26	3.97	13.23
	8/5	26.46	13.23	13.23	9.26	3.97	13.23

Example of Work Order Summary Worksheet

BUILD SUMMARY REPORT

		HGA UP	HGA DOWN
	7/12	0.00	0.00
	7/13	4.57	4.57
	7/14	4.76	4.76
	7/15	4.76	4.76
	7/16	4.76	4.76
	7/18	4.76	4.76
	7/19	4.76	4.76
	7/20	4.76	4.76
	7/21	4.76	4.76
	7/22	4.76	4.76
	7/23	4.76	4.76
	7/25	4.76	4.76
	7/26	4.76	4.76
	7/27	4.76	4.76
	7/28	4.76	4.76
	7/29	4.76	4.76
	7/30	4.76	4.76
	8/1	4.76	4.76
	8/2	4.76	4.76
	8/3	7.58	7.58
	8/4	11.02	11.02
	8/5	11.02	11.02
week	32	44.09	44.09
	33	66.75	66.75
	34	36.51	36.51
	35	66.75	66.75
	36	66.75	66.75
	37	66.75	66.75
	38	64.97	64.97
	39	64.97	64.97
month	10	174.47	174.47
	11	182.05	182.05
	12	219.98	219.98
	1	157.09	157.09
	2	157.09	157.09
	3	157.09	157.09
	4	157.09	157.09
	5	157.09	157.09
	6	157.09	157.09
	Total	**2111.75**	**2111.75**

APPENDIX E

Evaluation Result

Number of Part Supply Shortage (times)

using Existing Material Management System

Part Item/Wk No.	22	23	24	25	26	Total
Required shift	18	18	18	18	18	90
WASHER	0	0	0	0	0	0
SPACER	0	0	0	0	1	1
CARRIAGE	0	0	2	0	1	3
SCREW	0	0	0	0	0	0
HSA SCREW	0	0	0	3	4	7
FLEX CABLE	0	0	0	6	2	8
HGA UP	2	2	8	2	3	17
HGA DOWN	0	5	5	4	2	16
DAMPER	0	0	0	0	0	0
SUSPENSION UP	3	4	3	5	2	17
SUSPENSION DOWN	3	2	2	4	5	16
SLIDER UP	2	2	4	2	7	17
SLIDER DOWN	1	2	1	5	7	16

Part Item/Wk No.	27	28	29	30	Total
Required shift	18	18	18	18	72
WASHER	0	0	0	0	0
SPACER	0	0	0	0	0
CARRIAGE	3	0	0	0	3
SCREW	0	0	0	0	0
HSA SCREW	0	0	0	0	0
FLEX CABLE	4	0	1	2	7
HGA UP	3	2	4	1	10
HGA DOWN	4	4	3	2	13
DAMPER	0	0	0	0	0
SUSPENSION UP	5	2	1	3	11
SUSPENSION DOWN	2	2	1	3	8
SLIDER UP	2	0	0	2	4
SLIDER DOWN	1	3	0	1	5

Number of Part Supply Shortage (times)

using Developed Material Management System

Part Item/Wk No.	22	23	24	25	26	Total
Required shift	18	18	18	18	18	90
WASHER	0	0	0	0	0	0
SPACER	0	0	0	0	0	0
CARRIAGE	0	0	0	0	0	0
SCREW	0	0	0	0	0	0
HSA SCREW	0	0	0	0	0	0
FLEX CABLE	0	0	0	0	0	0
HGA UP	2	2	0	0	0	4
HGA DOWN	0	5	0	0	0	5
DAMPER	0	0	0	0	0	0
SUSPENSION UP	3	2	0	0	0	5
SUSPENSION DOWN	3	2	0	0	0	5
SLIDER UP	2	2	0	0	0	4
SLIDER DOWN	1	2	0	0	0	3

Part Item/Wk No.	27	28	29	30	Total
Required shift	18	18	18	18	72
WASHER	0	0	0	0	0
SPACER	0	0	0	0	0
CARRIAGE	0	0	0	0	0
SCREW	0	0	0	0	0
HSA SCREW	0	0	0	0	0
FLEX CABLE	0	0	0	0	0
HGA UP	0	1	0	0	1
HGA DOWN	0	1	0	0	1
DAMPER	0	0	0	0	0
SUSPENSION UP	0	0	3	1	4
SUSPENSION DOWN	0	0	2	1	3
SLIDER UP	0	0	0	2	2
SLIDER DOWN	0	0	2	1	3

Number of HSA Shortage using Existing Material Management System (times)

Part Item/Wk No.	22	23	24	25	26	Total
Required time	12	12	12	12	12	60
HSA	0	2	3	4	5	14
On Time Delivery	100%	83%	75%	67%	58%	77%

Part Item/Wk No.	27	28	29	30	Total
Required time	12	12	12	12	48
HSA	1	2	1	2	6
On Time Delivery	92%	83%	92%	83%	88%

Remark: Main Asm. Work for only two shift and six days

Number of HSA Shortage using Developed Material Management System (times)

Part Item/Wk No.	22	23	24	25	26	Total
Required time	12	12	12	12	12	60
HSA	0	0	0	0	0	0
On Time Delivery	100%	100%	100%	100%	100%	100%

Part Item/Wk No.	27	28	29	30	Total
Required time	12	12	12	12	48
HSA	0	0	0	0	0
On Time Delivery	100%	100%	100%	100%	100%

Remark: Main Asm. Work for only two shift and six days

Production Resource Utilization by using Existing Material Management System (Hrs)

Production Resource Utilization = Actual time for HSA production line used / Available time for HSA production line

Part Item/Wk No.	5/28	5/29	5/30	5/31	6/1	6/2	6/3	6/4	6/5	6/6	6/7	6/8	6/9	6/10
Required time	21	21	21	21	21	21	21	21	21	21	21	21	21	21
HSA	21	0	19	19	10	12	18	21	0	18	21	17	18	16

Part Item/Wk No.	6/11	6/12	6/13	6/14	6/15	6/16	6/17	6/18	6/19	6/20	6/21	6/22	6/23	6/24
Required time	21	21	21	21	21	21	21	21	21	21	21	21	21	21
HSA	21	0	21	17	16	12	16	17	0	19	18	16	21	16

Part Item/Wk No.	6/25	6/26	6/27	6/28	6/29	6/30	7/1	7/2	7/3	7/4	7/5	7/6	7/7	7/8
Required time	21	21	21	21	21	21	21	21	21	21	21	21	21	21
HSA	18	0	16	14	14	15	21	20	0	18	18	16	19	21

Part Item/Wk No.	7/9	7/10	7/11	7/12	7/13	7/14	7/15	7/16	7/17	7/18	7/19	7/20	7/21	7/22
Required time	21	21	21	21	21	21	21	21	21	21	21	21	21	21
HSA	21	0	18	19	17	21	21	21	0	21	21	18	18	21

Part Item/Wk No.	7/23	7/24	7/25	7/26	7/27	7/28	7/29
Required time	21	21	21	21	21	21	21
HSA	21	0	21	17	19	18	17

Production Resource Utilization by using Developed Material Management System (Hrs)

Production Resource Utilization = Actual time for HSA production line used / Available time for HSA production line

Part Item/Wk No.	5/28	5/29	5/30	5/31	6/1	6/2	6/3	6/4	6/5	6/6	6/7	6/8	6/9	6/10
Required time	21	21	21	21	21	21	21	21	21	21	21	21	21	21
HSA	21	0	19	19	10	12	18	21	0	18	21	18	20	18

Part Item/Wk No.	6/11	6/12	6/13	6/14	6/15	6/16	6/17	6/18	6/19	6/20	6/21	6/22	6/23	6/24
Required time	21	21	21	21	21	21	21	21	21	21	21	21	21	21
HSA	21	0	21	19	19	20	21	20	0	19	20	20	21	18

Part Item/Wk No.	6/25	6/26	6/27	6/28	6/29	6/30	7/1	7/2	7/3	7/4	7/5	7/6	7/7	7/8
Required time	21	21	21	21	21	21	21	21	21	21	21	21	21	21
HSA	20	0	19	20	21	20	21	20	0	20	20	21	21	21

Part Item/Wk No.	7/9	7/10	7/11	7/12	7/13	7/14	7/15	7/16	7/17	7/18	7/19	7/20	7/21	7/22
Required time	21	21	21	21	21	21	21	21	21	21	21	21	21	21
HSA	21	0	20	20	19	21	21	21	0	21	17	18	18	21

Part Item/Wk No.	7/23	7/24	7/25	7/26	7/27	7/28	7/29
Required time	21	21	21	21	21	21	21
HSA	21	0	21	20	21	18	19

Total Inventory Costs using Existing Material Management System (Kunits)

Total Inventory Costs in June	Existing System
WASHER	6
SPACER	6
CARRIAGE	962.88
SCREW	5.33
HSA SCREW	7
FLEX CABLE	1614.6
HGA UP	2063.02
HGA DOWN	2063.02
DAMPER	1.8
SUSPENSION UP	523.4
SUSPENSION DOWN	571.4
SLIDER UP	553.68
SLIDER DOWN	609.92
Total Inventory Costs (K$)	8988.05

Total Inventory Costs in July	Existing System
WASHER	3.60
SPACER	3.60
CARRIAGE	490.88
SCREW	3.07
HSA SCREW	3.12
FLEX CABLE	741.52
HGA UP	957.80
HGA DOWN	975.88
DAMPER	0.62
SUSPENSION UP	258.32
SUSPENSION DOWN	259.92
SLIDER UP	254.32
SLIDER DOWN	256.00
Total Inventory Costs (K$)	4208.65

Total Inventory Costs using Developed Material Management System (Kunits)

Total Inventory Costs in June	Developed System
WASHER	2.08
SPACER	2.19
CARRIAGE	1018.58
SCREW	2.43
HSA SCREW	3.00
FLEX CABLE	1620.58
HGA UP	1255.89
HGA DOWN	1162.94
DAMPER	1.00
SUSPENSION UP	401.44
SUSPENSION DOWN	433.44
SLIDER UP	449.68
SLIDER DOWN	438.60
Total Inventory Costs (K$)	6791.85

Total Inventory Costs in July	Developed System
WASHER	1.42
SPACER	1.43
CARRIAGE	511.27
SCREW	1.40
HSA SCREW	1.41
FLEX CABLE	746.30
HGA UP	496.52
HGA DOWN	496.75
DAMPER	0.81
SUSPENSION UP	321.64
SUSPENSION DOWN	321.64
SLIDER UP	322.52
SLIDER DOWN	322.56
Total Inventory Costs (K$)	3545.66

BIOGRAPHY

Monticha Sangvoranit was born on April 16, 1975 in Nakorn Ratchasima, Thailand. She obtained her Bachelor's degree in Industrial Engineering from Khonkaen University in 1997. She had started working at IBM Storage Products (Thailand) Limited since 1997 – 2004. Then, she studied Master of Engineering in Engineering Management and Master of Science in Engineering Business Management at The Regional Center for Manufacturing Systems Engineering, Chulalongkorn University.