St. Jude Children's Research Hospital

St. Jude Children's Research Hospital
ALSAC • Danny Thomas, Founder

Group 6

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Presentation Outline

- Topic Background
- Objective
- Overview of Previous Work
  - COPQ
  - Fault Tree Analysis
  - Gauge R&R
  - QFD
  - DOE
  - Supply Chain
  - SPC
  - DMAIC/DFSS
  - Acceptance Sampling
- Quality Companion and VSM
- Conclusion

St. Jude's Hospital

- Founded in 1962
- Founder and entertainer : Danny Thomas
- "No child should die in the dawn of life"
- A nonprofit medical corporation
- A pediatric treatment and research facility
- Children's catastrophic diseases

Objective

Objective:

Use Quality Engineering methodology and concepts in relation to St. Jude's Children's Hospital and its operations.

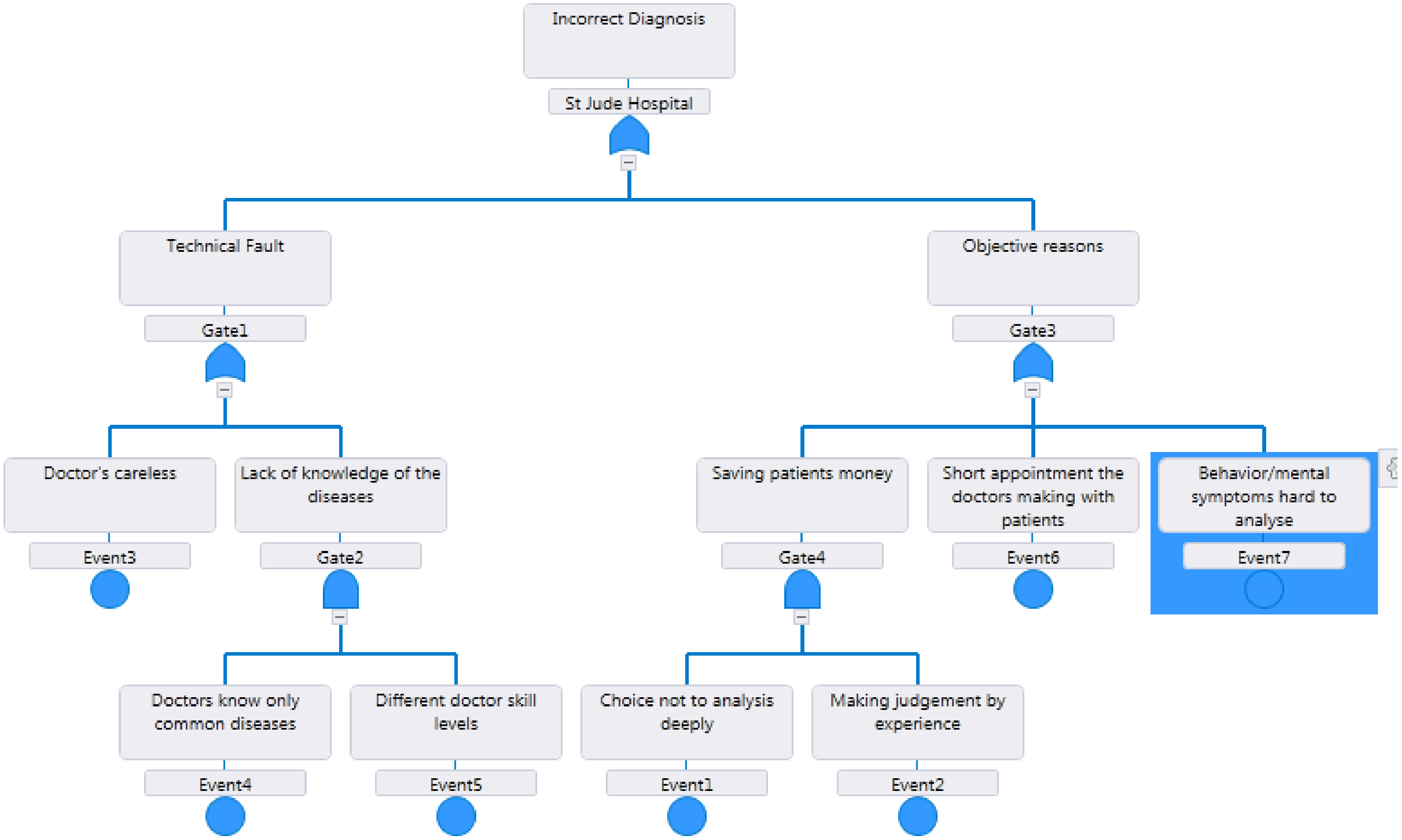
Focused on Patient and Family Logistics

Overview of Previous Work

COPQ

COPQ	ITEM
External Cost	Premature Discharges
	Incorrect Diagnosis
	Delayed Follow-up Appointments
	Any issue with HR
Internal Cost	Research Multi-function
	Overstock
	Over-hiring
	Unnecessary Equipment treatment
	Excess capacity
	Non-restricted public spending
	Inefficiency in clinical diagnosis

FTA



Incorrect Diagnosis
St Jude Hospital
Technical Fault
Gate1
Objective reasons
Gate3
Doctor's careless
Event3
Lack of knowledge of the diseases
Gate2
Saving patients money
Gate4
Short appointment the doctors making with patients
Event6
Behavior/mental symptoms hard to analyse
Event7
Doctors know only common diseases
Event4
Different doctor skill levels
Event5
Choice not to analysis deeply
Event1
Making judgement by experience
Event2

Gage R&R

- ***Definition:***

  measure the amounts of variability induced in measurement by the measurement system itself, and compare the result to the total system.

- ***Gage R&R System:*** Repeatability; Reproducibility; Stability;

- ***ANOVA:***

  7 columns

  3 operators

  90 group of members

Ratio of Gage R&R

Goes over 10%

Not accept

Source	StdDev (SD)	Study Var (6 × SD)	%Study Var (%SV)
Total Gage R&R	0.30237	1.81423	27.86
Repeatability	0.19993	1.19960	18.42
Reproducibility	0.22684	1.36103	20.90
Operator	0.22684	1.36103	20.90
Part-To-Part	1.04233	6.25396	96.04
Total Variation	1.08530	6.51180	100.00

Number of Distinct Categories = 4

QFD

- ***Definition:***

A planning tool used to fulfill customer expectations

A tool used to translate customer requirements to engineering specifications

Is a link between customers-design engineers-competitors-manufacturing

- ***Purpose***

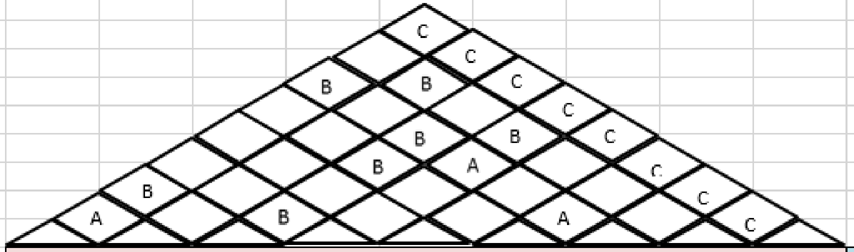
-improve quality

-increase organization capabilities

-to make the organization more competitive

- develop products that better fulfills users’ needs

QFD



				Technical Description									Competitive Assessment			
Improving Direction				↑	↑	↑	↑	↑	↑	↑	↑	↑				
Customer Needs	Technical Requirements	Customer Important Rating (1-5)	Percent of impoetance (%)	Scrupulous inspection to equipment	24 hours security guard	Management of dangeous items	Medicines standard	Housing standard	Food standard	Sullpy chain supervisxe	Information management	Engergy-efficiency	Scores	NewYork-Presbyterian Morgan Stanley Child	Upstate Golisano Children's Hospital	St. Jude Children Hospital
Must have	Nutrient and diverse foods	5	18.51						Θ	Θ		O	105	5	3	4
	Capability for providing house	5	18.51		O	O		Θ		O	Δ	O	110	3	4	5
	Comfortable rooms	4	14.81	O	O	O		Θ	Θ	Δ		Δ	116	4	4	4
Satisfier	Simple check-in	3	11.11							Δ	Θ	Δ	33	5	3	3
	Convenient calling system	3	11.11	O	O			Δ			Θ		48	4	3	4
	Transportation service	3	11.11	O	O	Δ				O	Δ	Δ	36	4	4	3
	Lab supervise	2	7.4	Θ	O	O	O			O	O	O	54	5	3	3
Delighter	Online-oppointment	1	3.7								Θ		9	4	4	2
	Onsite-pharmacy	1	3.7			Δ	Θ			O			13	3	3	4
Technical Difficulty Number				3	4	3	3	4	4	5	4	4		37	31	32
Importance of Technical Requirement				48	51	36	15	84	81	85	77	46				
Percent of the Technical Requirement(%)				9.17	9.75	6.88	2.86	16.06	15.48	16.25	14.72	8.8				

Legend

Item	Symbol	Meaning
Importance	5	Must have
	4	Must have
	3	Satisfier
	2	Satisfier
	1	Delighter
Relationship	Θ	9
	O	3
	Δ	1
		0
Correlation	A	Extremely Positive
	B	Positive
	C	Negative
	D	Extremely Negative

Design of Experiments

Output (Response):

Number of Housing Related Complaints

Input (Factors):

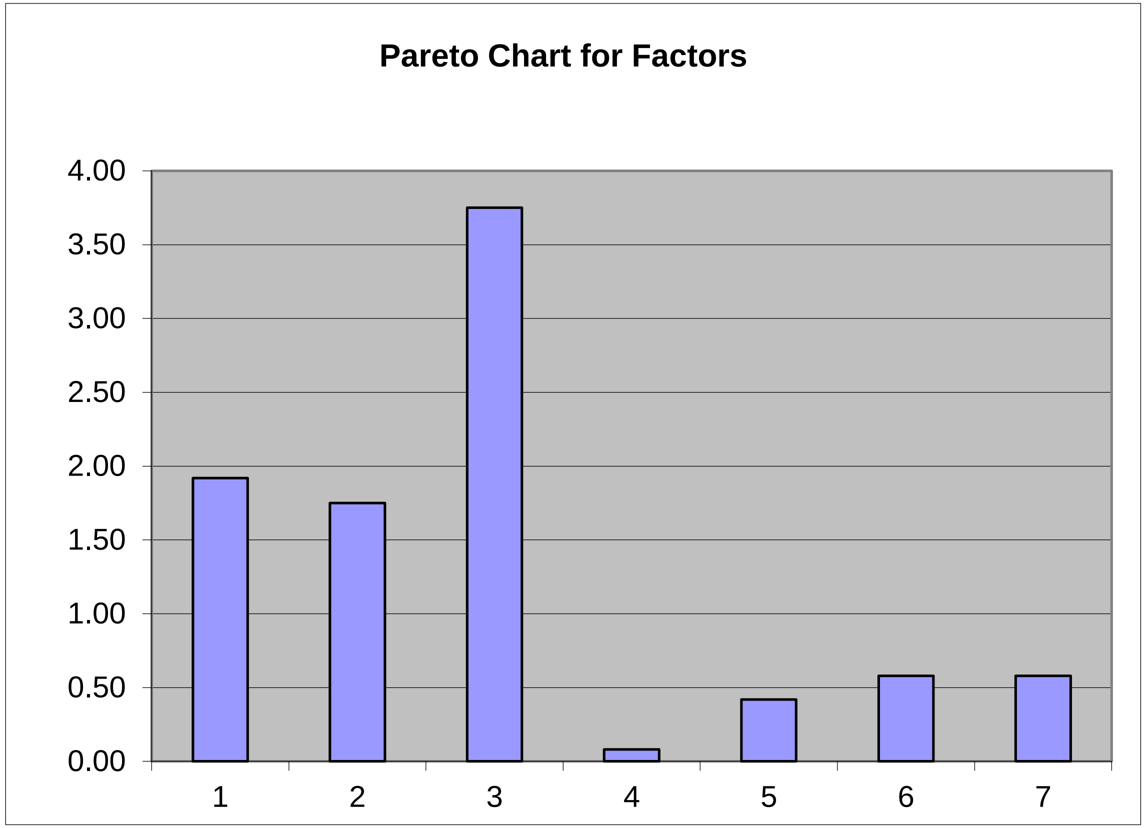
Factor A: **Length of Stay**
Low(-): 4 weeks
High(+): 12 weeks

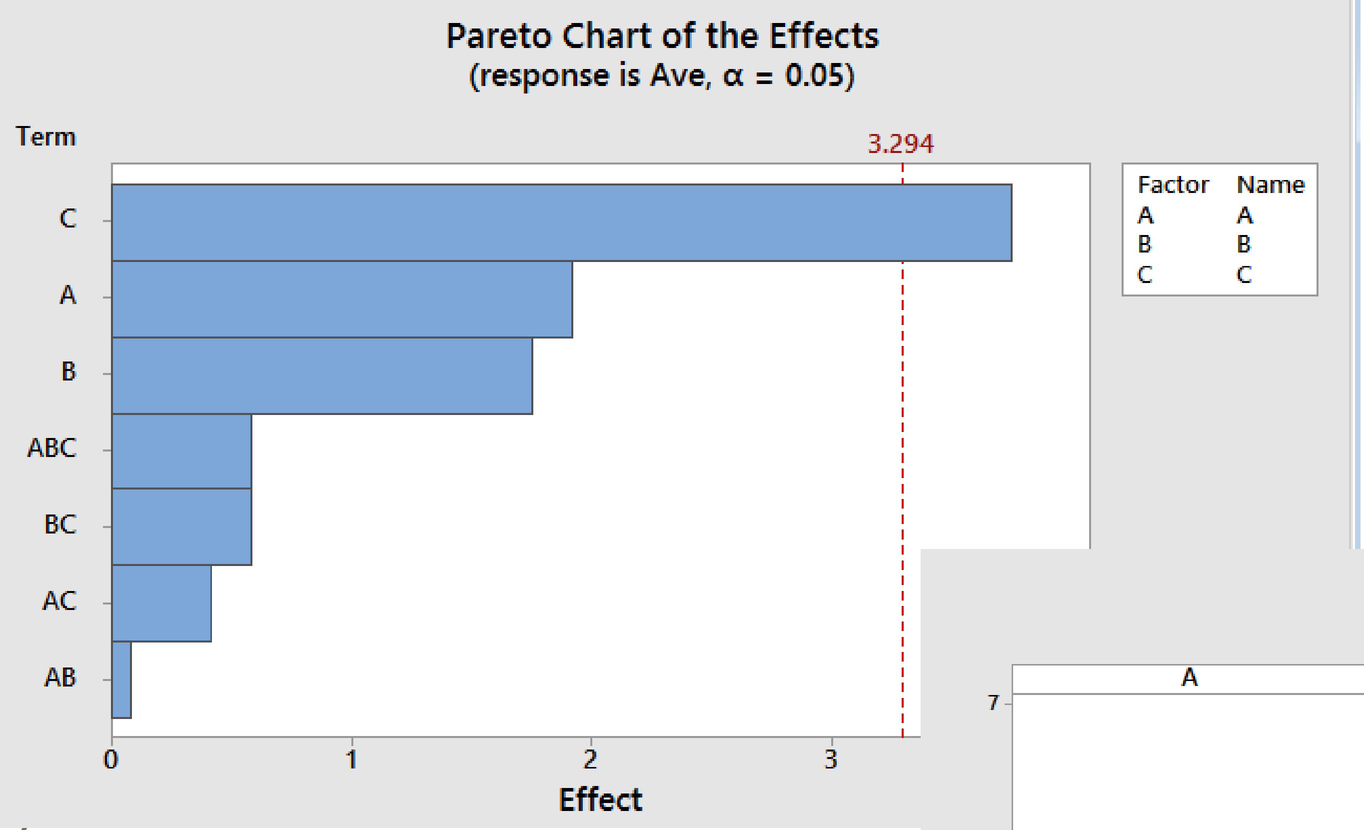
Factor B: **Size of Family**
Low(-): 2 family members
High(+): 4 family members

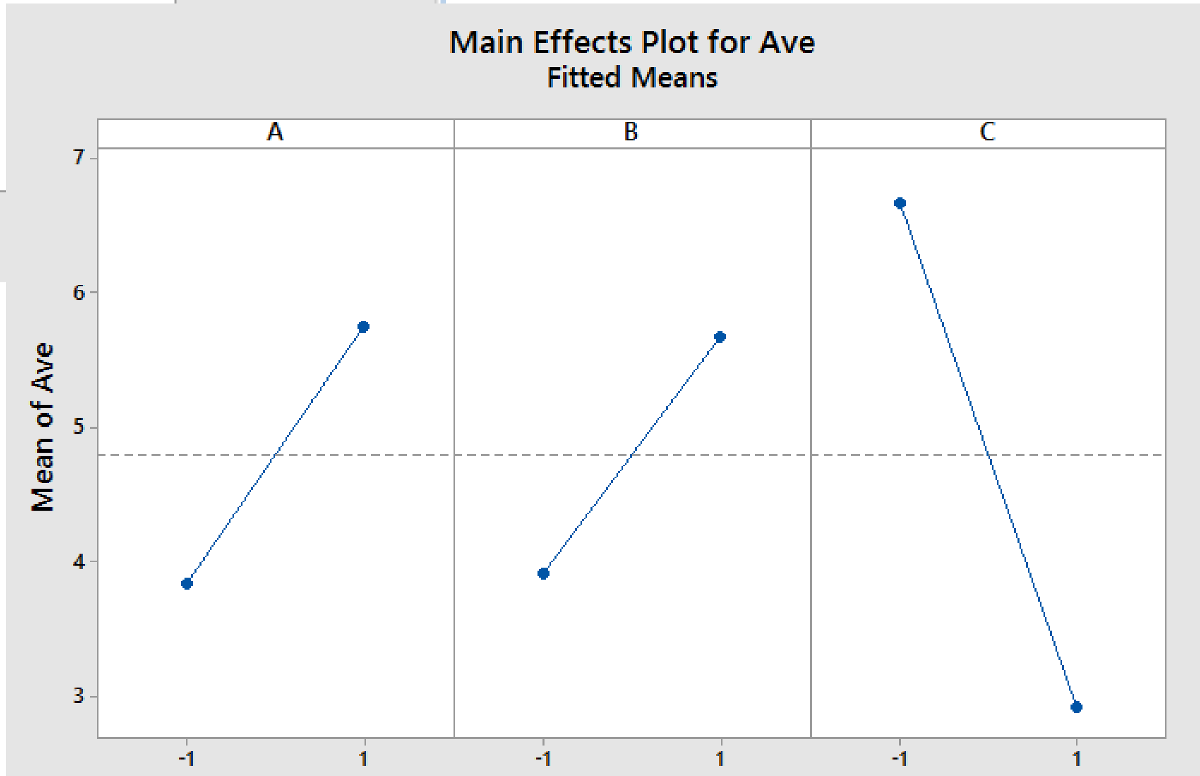
Factor C: **Number of Beds**
Low(-): 1
High(+): 3

Run	A	B	C
1	-1	-1	-1
2	1	-1	-1
3	-1	1	-1
4	1	1	-1
5	-1	-1	1
6	1	-1	1
7	-1	1	1
8	1	1	1

	A	B	C	AB	AC	BC	ABC
SumY+	23.00	22.67	11.67	19.33	18.33	18.00	18.00
SumY-	15.33	15.67	26.67	19.00	20.00	20.33	20.33
AvgY+	5.75	5.67	2.92	4.83	4.58	4.50	4.50
AvgY-	3.83	3.92	6.67	4.75	5.00	5.08	5.08
Effect	**1.92**	**1.75**	**-3.75**	**0.08**	**-0.42**	**-0.58**	**-0.58**







A: Length of Stay
B: Size of Family
C: Number of Beds

Supply Chain

Item	Cabinet Maker	Assembler	Furniture Store
Production/Sale	13	14	12
Inventory Max	9	10	8
Cost of Inventory	1	2	5
Cost of Overflow	3	4	10
Cost of Shortage	7	6	7
Random/Selection	Judgement	Judgement	Distribution J

Demand<= Production

Demand<=Production/Sale												
Week		**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Furniture Store	Customer Needs		12	12	12	12	12	12	12	12	12	12
	Inventory	8	0	0	0	0	0	0	0	0	0	0
	Net requirements		4	12	12	12	12	12	12	12	12	12
	Cost of inventory	40	0	0	0	0	0	0	0	0	0	0
	Cost of overflow		0	0	0	0	0	0	0	0	0	0
	Cost of shortage		0	0	0	0	0	0	0	0	0	0
	Total cost	40										
Assembler	Gross requirements		4	12	12	12	12	12	12	12	12	12
	Inventory	10	6	0	0	0	0	0	0	0	0	0
	Net requirements		0	6	12	12	12	12	12	12	12	12
	Cost of inventory	20	12	0	0	0	0	0	0	0	0	0
	Cost of overflow		0	0	8	8	8	8	8	8	8	8
	Cost of shortage		0	0	0	0	0	0	0	0	0	0
	Total cost	96										
Cabinet Maker	Gross requirements		0	6	12	12	12	12	12	12	12	12
	Inventory	9	9	3	0	0	0	0	0	0	0	0
	Net requirements		0	0	9	12	12	12	12	12	12	12
	Cost of inventory	9	9	9	0	0	0	0	0	0	0	0
	Cost of overflow		0	0	0	3	3	3	3	3	3	3
	Cost of shortage		0	0	0	0	0	0	0	0	0	0
	Total cost	48										
Total cost of the whole system		184										

Demand>= Production

Demand>=Production/Sale												
Week		**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Furniture Store	Forecast demand		14	14	14	14	14	14	14	14	14	14
	Inventory	8	0	0	0	0	0	0	0	0	0	0
	Net requirements		6	14	14	14	14	14	14	14	14	14
	Cost of inventory	40	0	0	0	0	0	0	0	0	0	0
	Cost of overflow		0	0	0	0	0	0	0	0	0	0
	Cost of shortage		0	14	14	14	14	14	14	14	14	14
	Total cost	166										
Assembler	Gross requirements		6	14	14	14	14	14	14	14	14	14
	Inventory	10	4	0	0	0	0	0	0	0	0	0
	Net requirements		0	10	14	14	14	14	14	14	14	14
	Cost of inventory	20	8	0	0	0	0	0	0	0	0	0
	Cost of overflow		0	0	0	0	0	0	0	0	0	0
	Cost of shortage		0	0	0	0	0	0	0	0	0	0
	Total cost	28										
Cabinet Maker	Gross requirements		0	10	14	14	14	14	14	14	14	14
	Inventory	9	9	0	0	0	0	0	0	0	0	0
	Net requirements		0	1	14	14	14	14	14	14	14	14
	Cost of inventory	9	9	0	0	0	0	0	0	0	0	0
	Cost of overflow		0	0	0	0	0	0	0	0	0	0
	Cost of shortage		0	0	7	7	7	7	7	7	7	7
	Total cost	74										
Total cost of the whole system		268										

SPC

- ***Definition:***

    Detect when a stable process departs from stability

    'Quality Control' (QC)

- ***X-bar Chart:***

Assess whether a production process is under control or not

Three parallel lines

Center : target line for the Process Mean

Above : Upper Control Limit (UCL)

Below : Lower Control Limit (LCL)

Under control : averages fall randomly within the LCL and UCL limits.

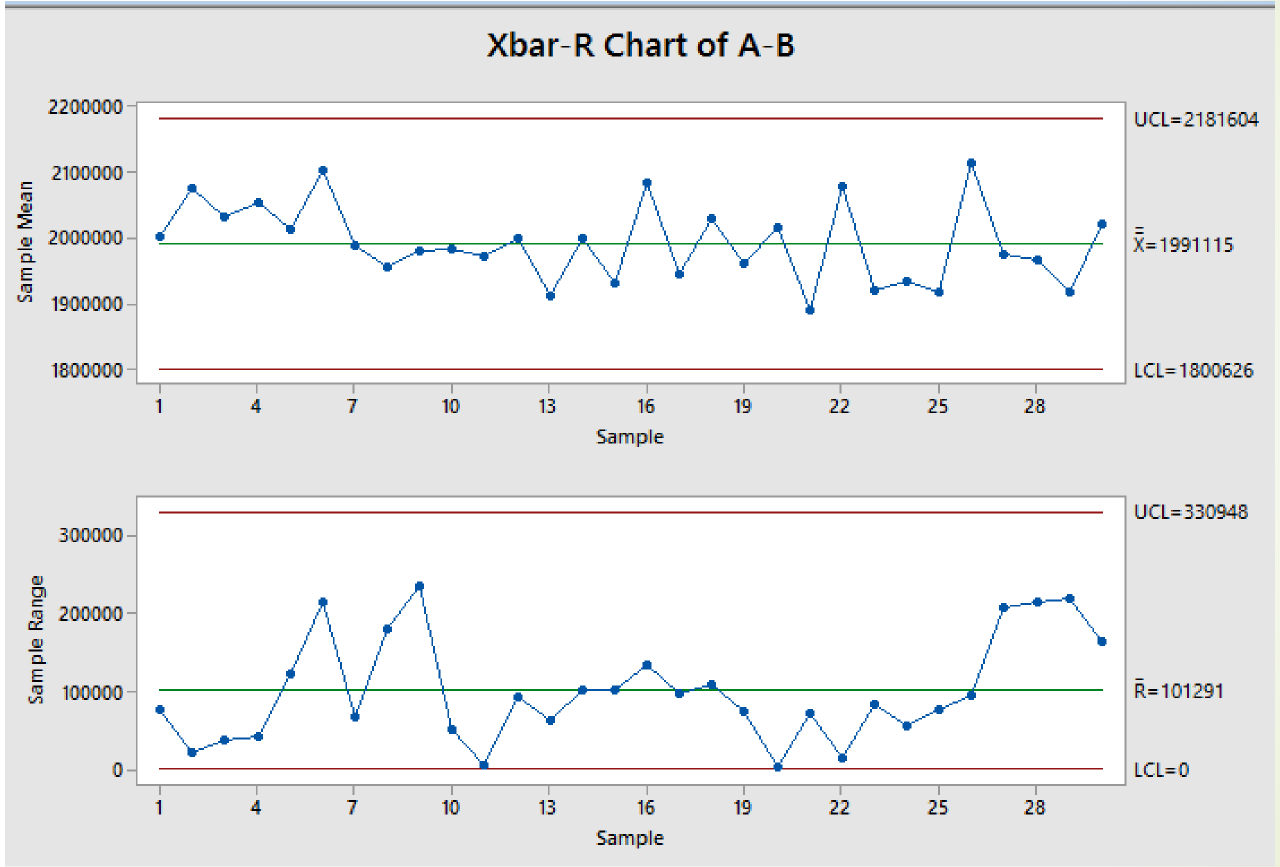
Out of control : a shift "δ" in the mean

SPC

- ***Old X-bar chart***

All measurements are under Control.
However, there is the drift between Chart mean value and setting Mean value.

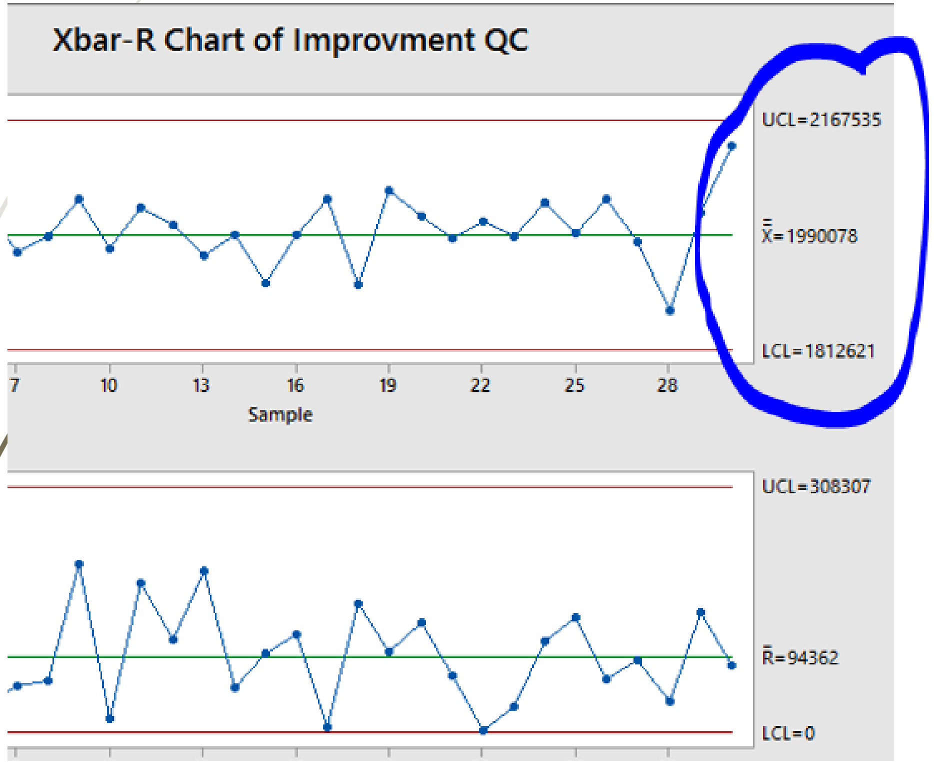
Chart: 1,991,115
Setting: 1,990,078



SPC

New Chart

Set UCL and LCL with sample A, Generate chart with sample B



K1	1,990,078
K3	94362
	And
K2	1.12800

There is no drift between two mean values

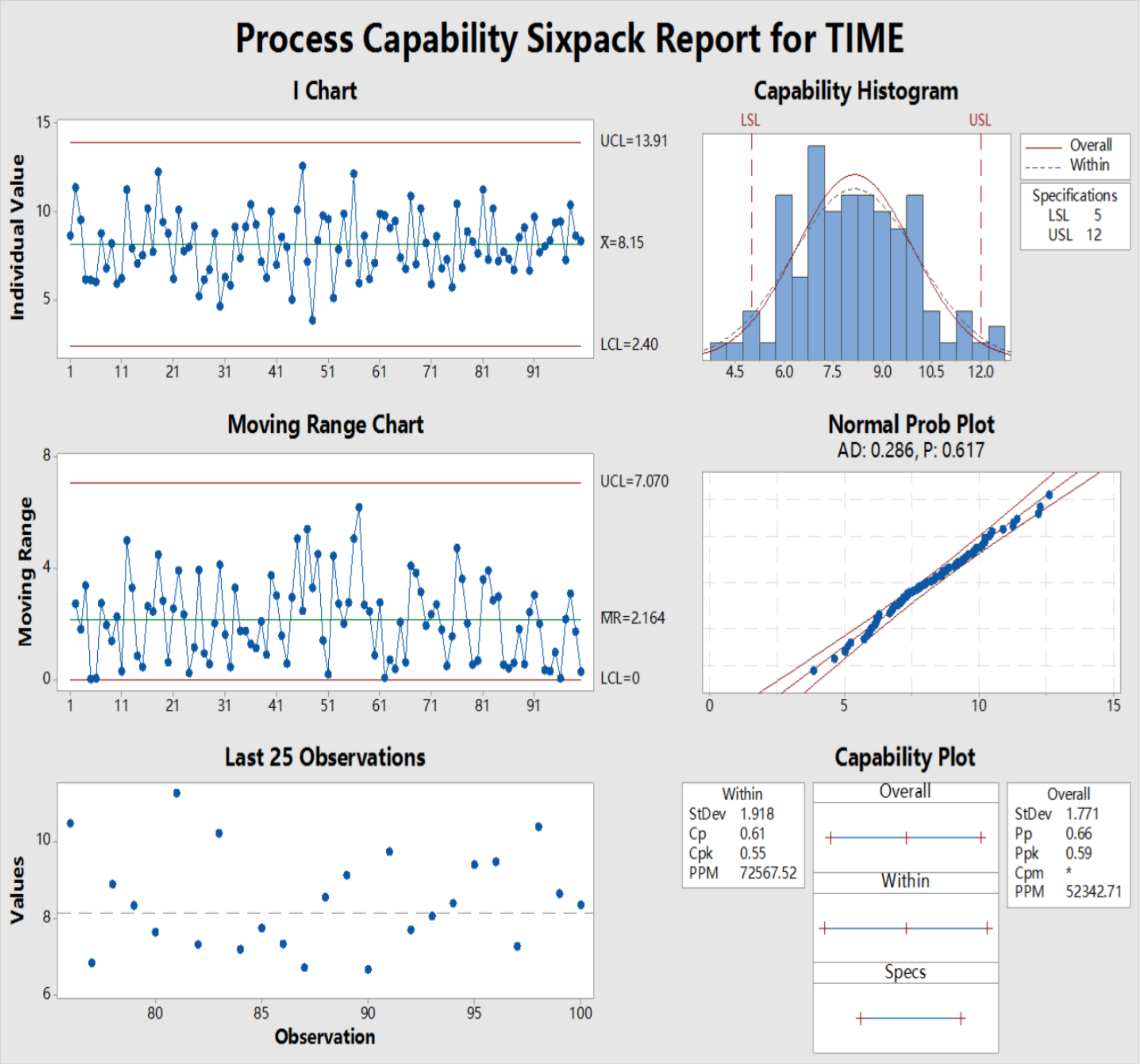
DMAIC/DFSS

- Six Sigma Approach is a set of administrative, statistical concepts and techniques for process improvement
- Six Sigma seeks to improve the quality of process outputs
- Six Sigma focus on minimizing variability in processes and eliminating the cause of defects
- Six Sigma has five phases :
  1. Define
  2. Measure
  3. Analyze
  4. Improve
  5. Control

- **To achieve the efficiency-cost aim, we use the divided six sigma improvement, which are Define, Measure, Analyze, Improve and Control.**

Phase	Step	Tools
Define	1.Identify Potential Project 2.Selection of Initial Projects 3.Problems and Mission Statement for Project 4.Select and Launch the Project	Strategic alignment and goal deployment Cost of Poor Quality analysis Project selection and chartering Project management SIPOC VOC
Measure	1.Verify the project need 2.Document the process 3.Plan for data collection 4.Validate the measurement system 5.Measure the process capability	Process mapping Process FMEA Data collection planning MSA Graphs and charts Stratification Process Capability sigma Calculation Pareto chart Fish bone
Analyze	1.Data collection 2.Data Analysis 3.Analysis of theory and relationships	Data collection planning Power and sample size Confidence intervals Hypothesis testing protocol T-test, ANOVA, Normality test
Improve	1.Evaluate alternatives 2.Doe to optimize 3.Process solution 4.Assess effectiveness 5.Resistance to change 6.Implementation plan	DOE Benchmarking Lean event Mistake proofing Process mapping Process FMEA
Control	1.Establish controls 2.Validate means 3.Process capability 4.Monitor process	Process control plan 5S Statistical process control Standard operating procedures Self-control analysis

Then we did the capability analysis



From the capability sixpack, LSL=$180m, USL=$220m.

The lowest daily expense is acceptable, however, the highest daily expense should be improved.

After analyzing this situation, the daily expense higher than $200m is mainly due to the seasonal equipment maintenance and periodic update.

As a result, we conclude that the daily expense of St. Jude Children's Research Hospital is stable and acceptable.

Acceptance Sampling

- **Definition:**

  Developing inspection plans that enable you to accept or reject a particular lot of incoming material based on the data from a representative sample.

- **OC Curve:**

  Depicting the discriminatory power of an acceptance sampling plan. The OC curve plots the probabilities of accepting a lot versus the fraction defective.

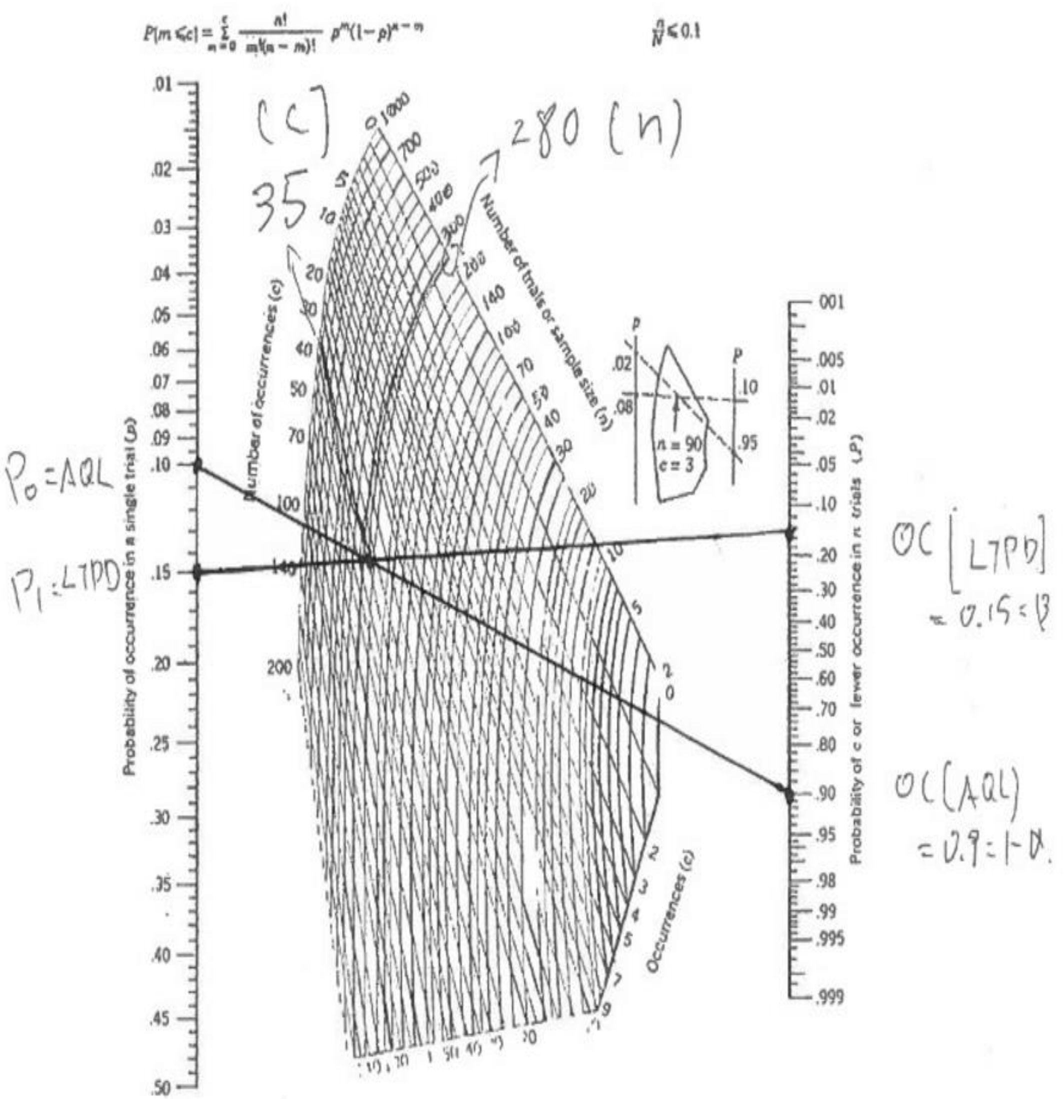
Acceptance Sampling

Method:

Excel, Minitab and Nomograph

N=280

C=35



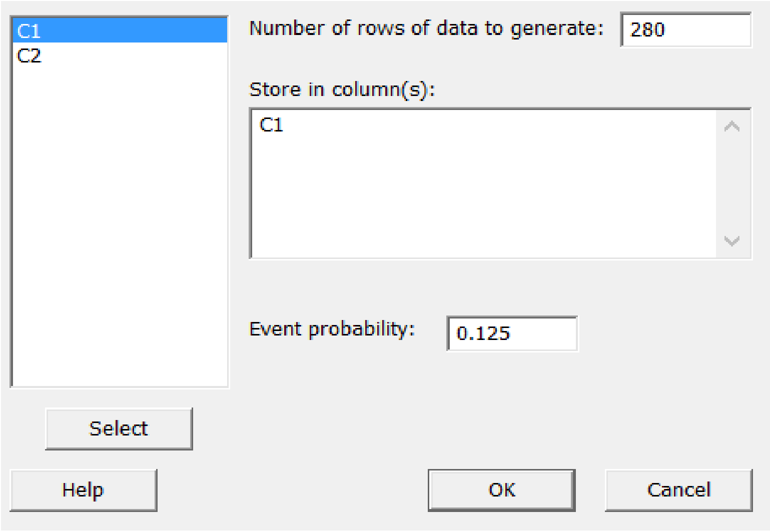
Acceptance Sampling

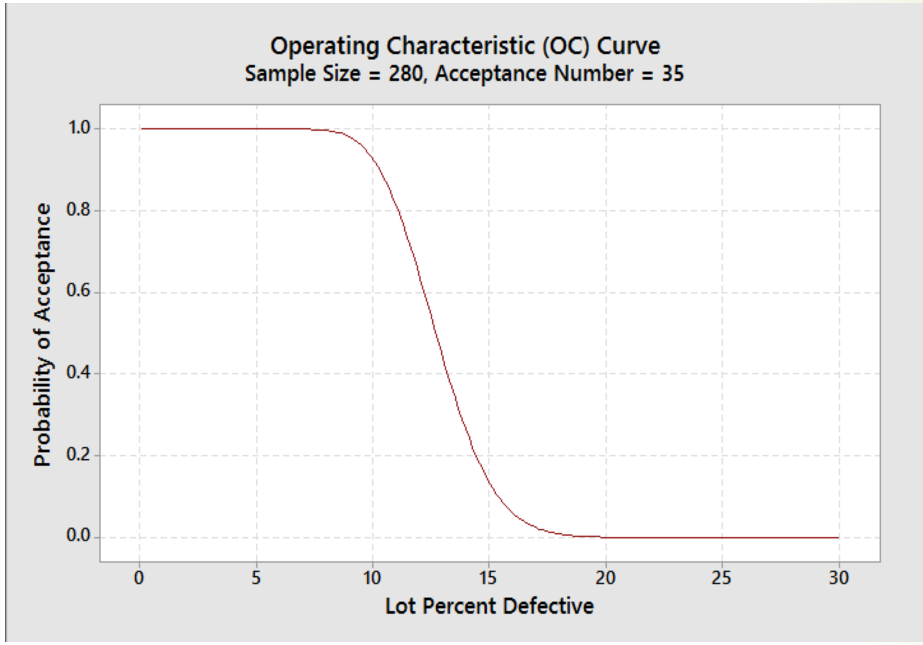
Minitab

AQL=0.1

LTPD=0.15

Average: 0.125





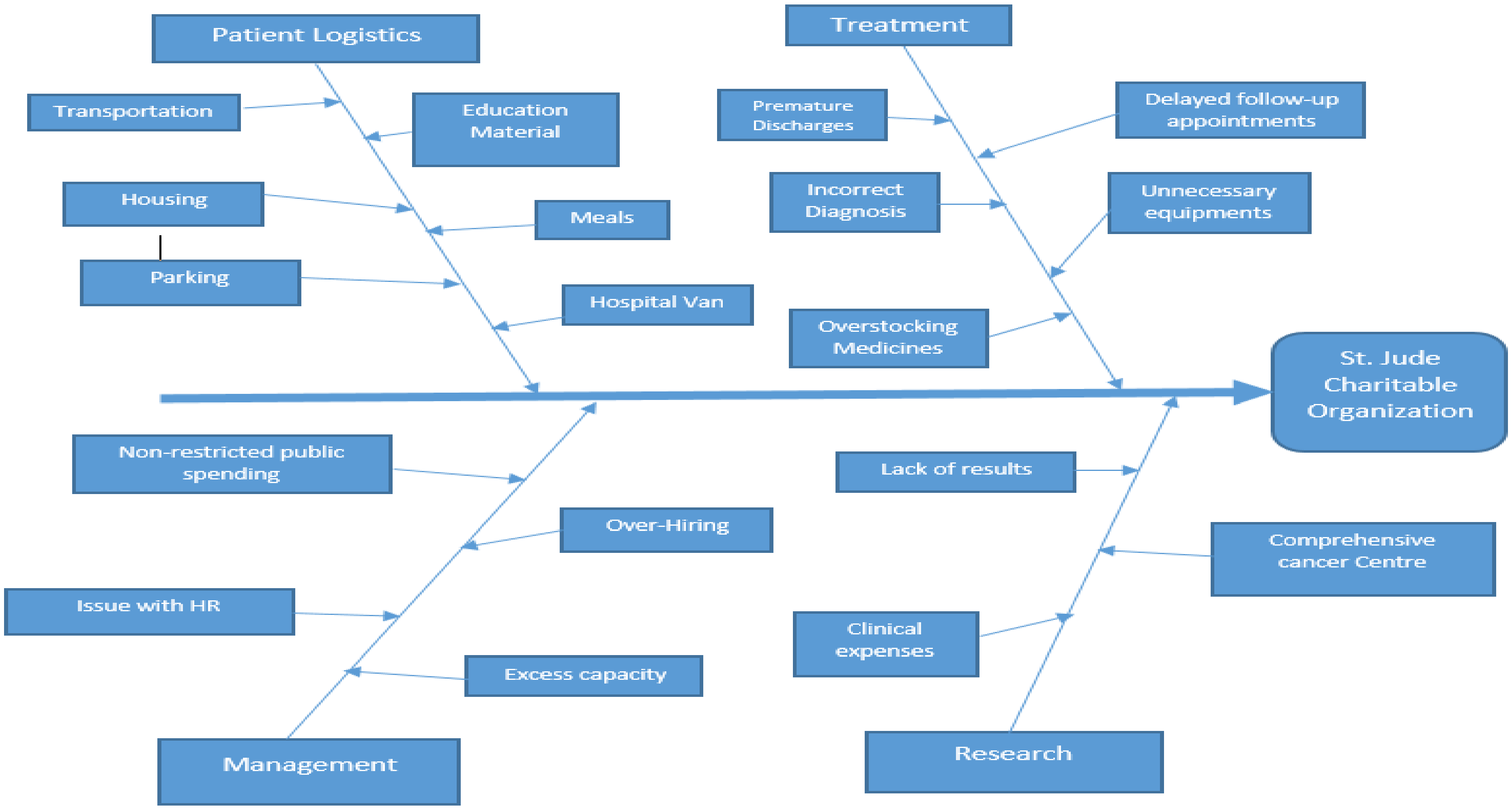
Data Display

K1 34.0000

K1<35. Accept

Quality Companion-VSM

Organization Chart

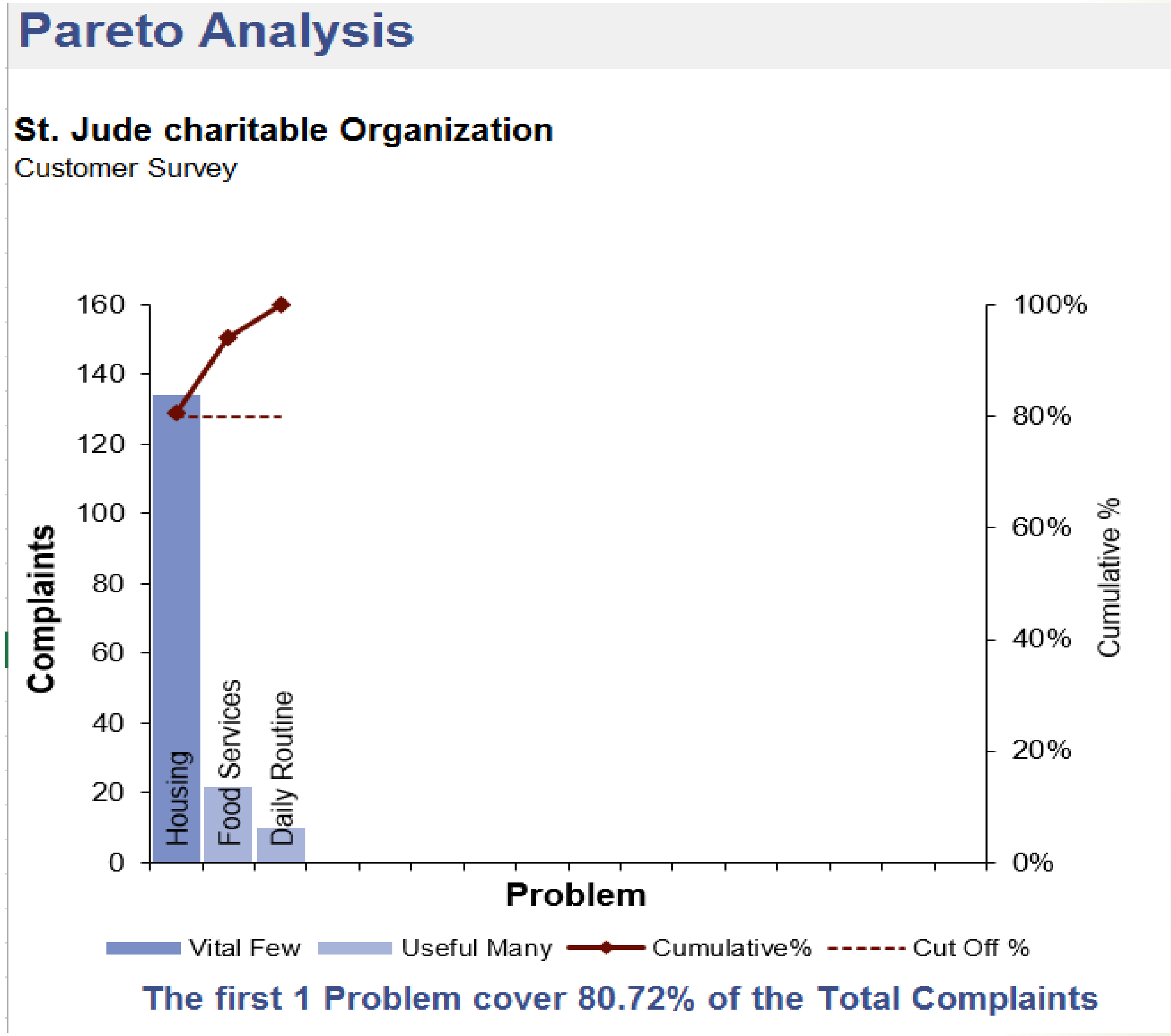


Identify Potential Project

- The logistic management of the hospital related to all aspects of the medical services. Such as, medical system support, medicine, equipment, electrical, air-conditioning, parking lot etc. Therefore, the logistic cost-management in a hospital is worthy to supervise and improve.
- Whereas, the logistic cost combines every aspects of St. Jude Children Hospital. Here we pick out THREE main aspects to supervise and improve. These three aspects are the dominant factors that effect the performance of the logistic. Hence, we need to supervise and improve their efficiency-cost.
- 1. Food service
- 2. Parent housing
- 3. Daily routines

Pareto Analysis

- In the Patient logistics department, we created a survey for the overall satisfaction of the patients in terms of food services, Housing Accommodation, Daily routines. From this survey we found out that maximum no. of complaints were due to the housing accommodation where parents of patients are stationed off the hospital building in the nearby campus



Quality Companion-Uses

- Organize your project
- Streamline how you will approach your improvement project
- Saves Time and Reduces errors
- Easy to Share, Review and Archive your work
- Helps in planning, design, organization, brainstorming and reporting
- On-demand guidance (Built-in Coaches)
- Easy to manage
- Makes quality improvement efficient

Purpose of Value Stream Mapping & Analysis

- Definition:
    - VSM is a lean manufacturing technique used to analyze and design the flow of materials and information required to bring product or service to a consumer.

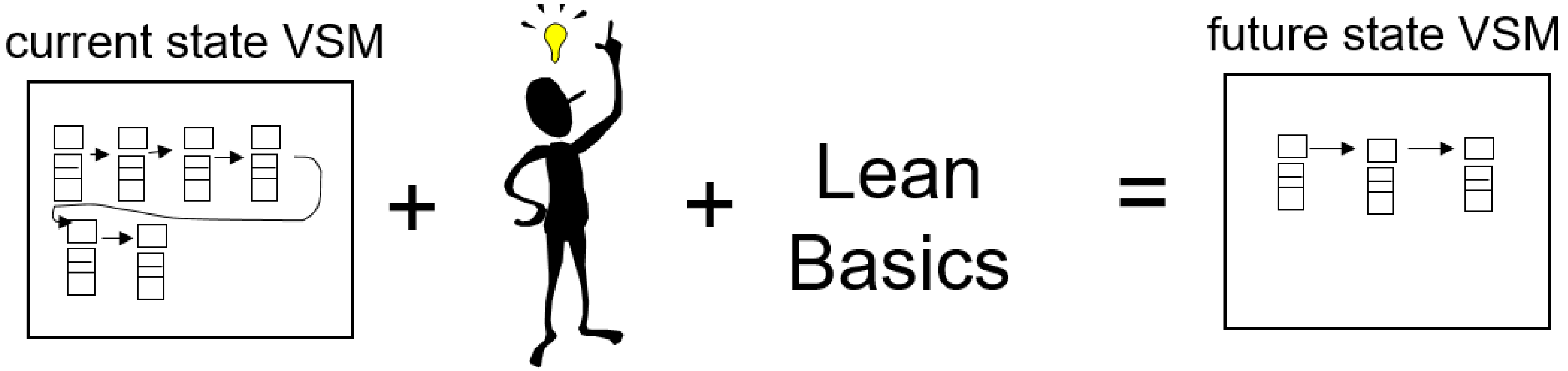
- Purpose:
  - Develop a common understanding of the current process
    - The relationship of process steps
    - A true picture of the process
  - Create a baseline to measure improvements against
  - Define a vision of the future process
  - Establish common leadership objectives
  - Identify opportunities for improvement
  - Design an implementation plan for improvements

Value of Value Stream Map

- The Value Stream Map provides visibility of the entire process
  - The process may cross functional boundaries
  - Without the map, you may focus on the wrong areas to try to improve

Analyzing the Value Stream

- Planning tool to optimize results of eliminating waste.



Value Stream Process Steps

1. Prepare
2. Gather Data & Develop Current State
3. Develop Future State & Action Plan
4. Execute to Plan
5. Align

Value Stream Process

Step 1 - Prepare

- Gathering Preparatory Information
  - **Document the Case for Change:**

    Measure the time taken for each of the processes right from putting patient information to checking out & document them

Define the Scope (start and end of process):

- When the patient's family approaches the hospital's desk for admitting the patient, putting all the information needed.
- When the patient's family checks out from the hospital, collecting all the medical documents & medicines.

Value Stream Process

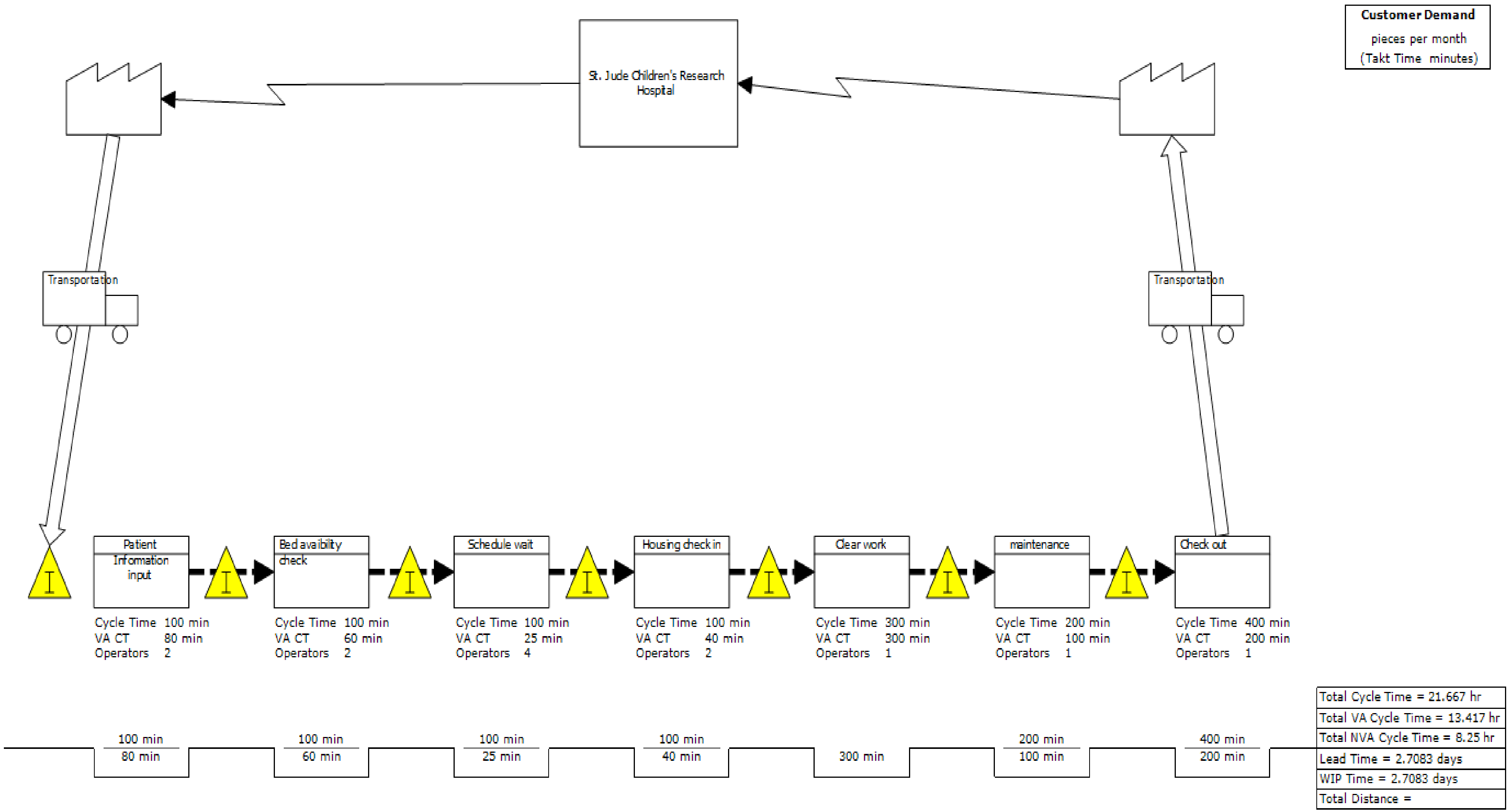
Step 2 - Gather Data (Develop Current State)

- Observe and gather data
  - Gather data for each step in the flow

Actual lead time	Output	Work
Actual cycle time	On time delivery	Staffing
Defect rate	Quality	Variations in process

- Map the flow of items
- Map the flow of information
- Add data and issues

Current State VSM



Value Stream Process

Step 3 – Future State & Action Plans

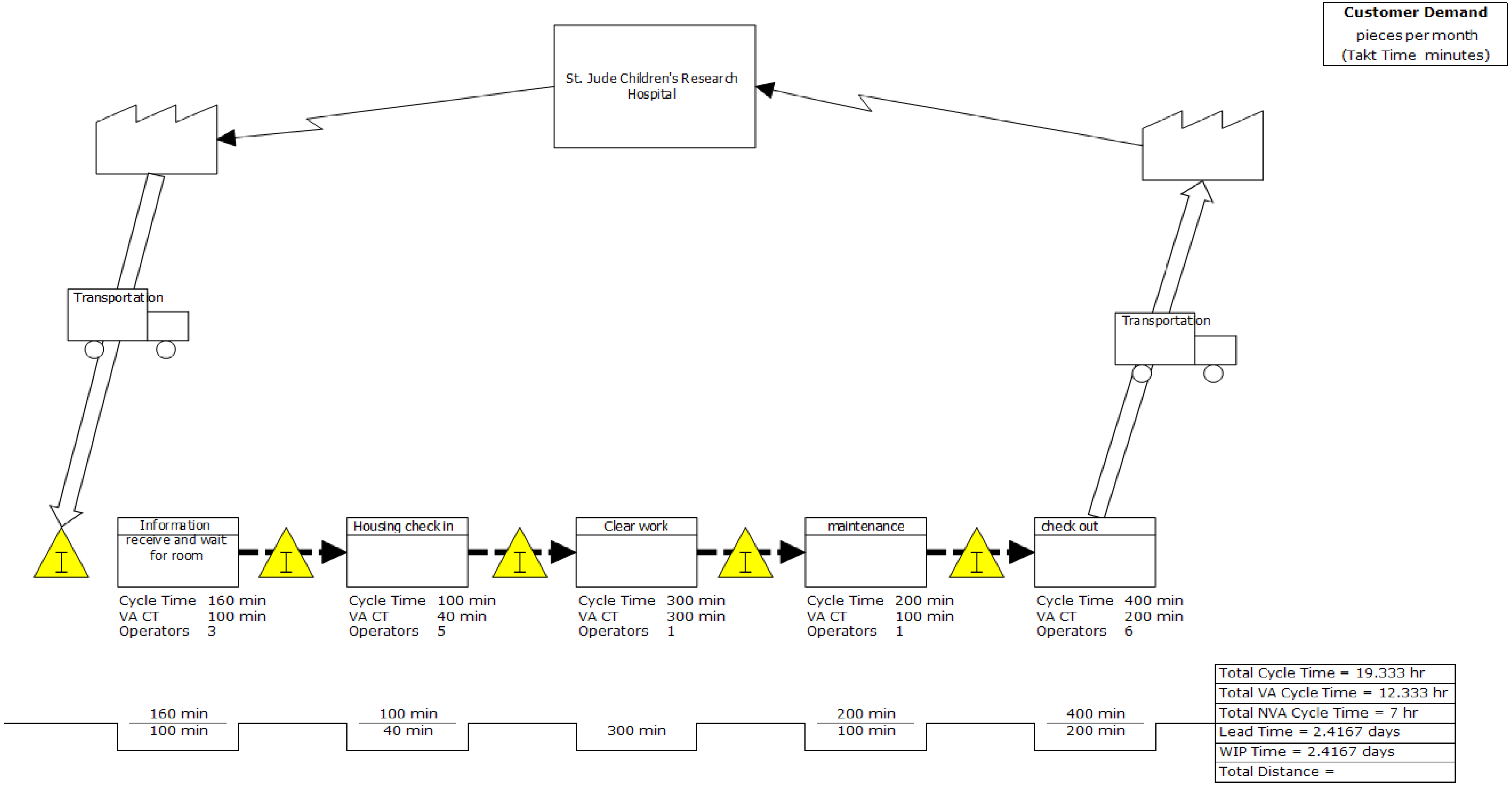
- Discuss the ideal state
- Develop the future state map
- Develop action plans

Types of Lean Events

- Lean tools are used to identify, measure and eliminate waste which adds no value.
- Value increases customer satisfaction.
- Some Lean tools used are:
  - Takt Time
  - Continuous flow
  - First In First Out

$$\textbf{takt time} = \frac{\boldsymbol{available\ time(in\ a\ day)}}{\boldsymbol{average\ daily\ demand}}$$

Future State VSM



Value Stream Process

- Conclusion

	System Lead Time	Process Lead Time	Total
Current VSM	21.667 Hr	64.99 Hr	86.657 Hr
Future VSM	19.33 Hr	58 Hr	77.33 Hr
Time Saved	2.337 Hr	6.99 Hr	9.327 Hr

Conclusion

- Throughout the activities in this course, we have all learned much about the operations of St. Jude Children's Hospital and the methods used in Productivity and Quality Engineering.

- Through the use of the methods discussed and their respective results, it was concluded that St. Jude Children's Hospital can make changes to their Logistics department to ensure price savings and higher patient satisfaction.