Aligning Learning Outcomes, Subject Content, and Assessments

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Learning Goals and Objectives
ALIGN
Teaching & Learning Activities
Feedback & Assessment

Program-Level Learning Outcomes

Course Learning Outcomes/Unit Learning Outcomes/Assessment Map		
CLO 1	**Discipline Knowledges**	Apply advanced discipline knowledge, concepts and practices in managing engineering systems and assets.
CLO 2	**Problem solving, decision making and Higher order thinking skils**	Critically analyse and evaluate complex engineering management problems to achieve, research informed solutions.
CLO 3		Apply systematic approaches to plan, design, execute and manage an engineering management project.
CLO 4	**Professional Communication**	Communicate complex information effectively and succinctly, presenting high level reports, arguments and justifications in oral, written and visual forms to professional and non-specialist audiences.
CLO 5	**Self and Team**	Organise and manage time, tasks and projects independently, and collaboratively demonstrating the values and principles that shape engineering management decision making and professional accountability.

1. **Discipline Knowledge and Skill Base**

   1.1 Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline

   1.2 Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline

   1.3 In-depth understanding of specialist bodies of knowledge within the engineering discipline

   1.4 Discernment of knowledge development and research directions within the engineering discipline

   1.5 Knowledge of contextual factors impacting the engineering discipline

   1.6 Understanding of the scope, principles, norms, accountabilities and bounds of contemporary engineering practice in the specific discipline.

2. **Engineering Application Ability**

   2.1 Application of established engineering methods to complex engineering problem solving.

   2.2 Fluent application of engineering techniques, tools and resources.

   2.3 Application of systematic engineering synthesis and design processes

   2.4 Application of systematic approaches to the conduct and management of engineering projects.

Unit Code	Unit Learning Outcomes	Course Learning Outcomes					Assessment	%	Group or Ind.	Auth Asses s	5 ULOs	arning O
		1	2	3	4	5						1
UNIT 1	1. Identify the factors that lead to the development and implementation of ERP systems.						**Problem Solving Task**	20	I		2,3,4,5	
	2. Critically reflect upon theoretical approaches and analyse their application to achieve effective use of Enterprise Systems to support operations and management practice;						**Project (Applied)**	40	G	X	2,3,4,6	
	3. Justify and interpret theoretical propositions and related bodies of knowledge to critically evaluate the resolution of business problems and make recommendations/recommend actions in contemporary Enterprise Systems;						**Exam**	40	I		1,2,3,4	
	4. Describe how an integrated information system can support effective and efficient business processes											
	5. Critically apply cross-disciplinary knowledge with creativity in decision making supporting the development, implementation and use of Enterprise Systems;											
	6. Plan and execute a substantial evidence-based project linked to Enterprise Resource Planning Systems to generate and evaluate complex ideas and concepts at abstract and practical levels.											

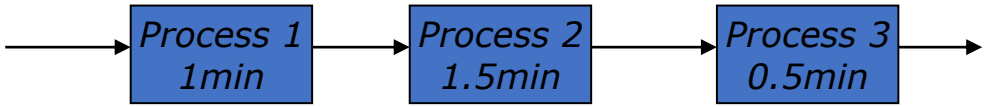
Lean Manufacturing

Learning Outcomes

- *Identify critical process wastes in manufacturing and service organisations using Lean tools such as value stream mapping (VSM)*
- *Use appropriate techniques to eliminate/minimize wastes in a business process.*
- *Demonstrate and report on work measurements and the setting of time standards using effective Lean techniques.*
- *Develop manufacturing cells and plant layouts using a systematic approach.*
- *Apply Lean tools (e.g. VSM) in a simulated organisational setting to identify and minimize process waste*

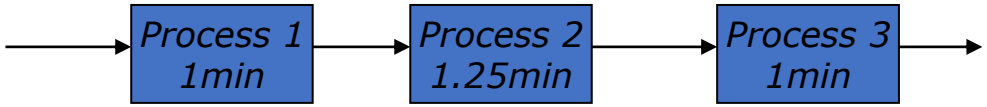
Processing time

Consider a product is manufactured through a three step process



System 1

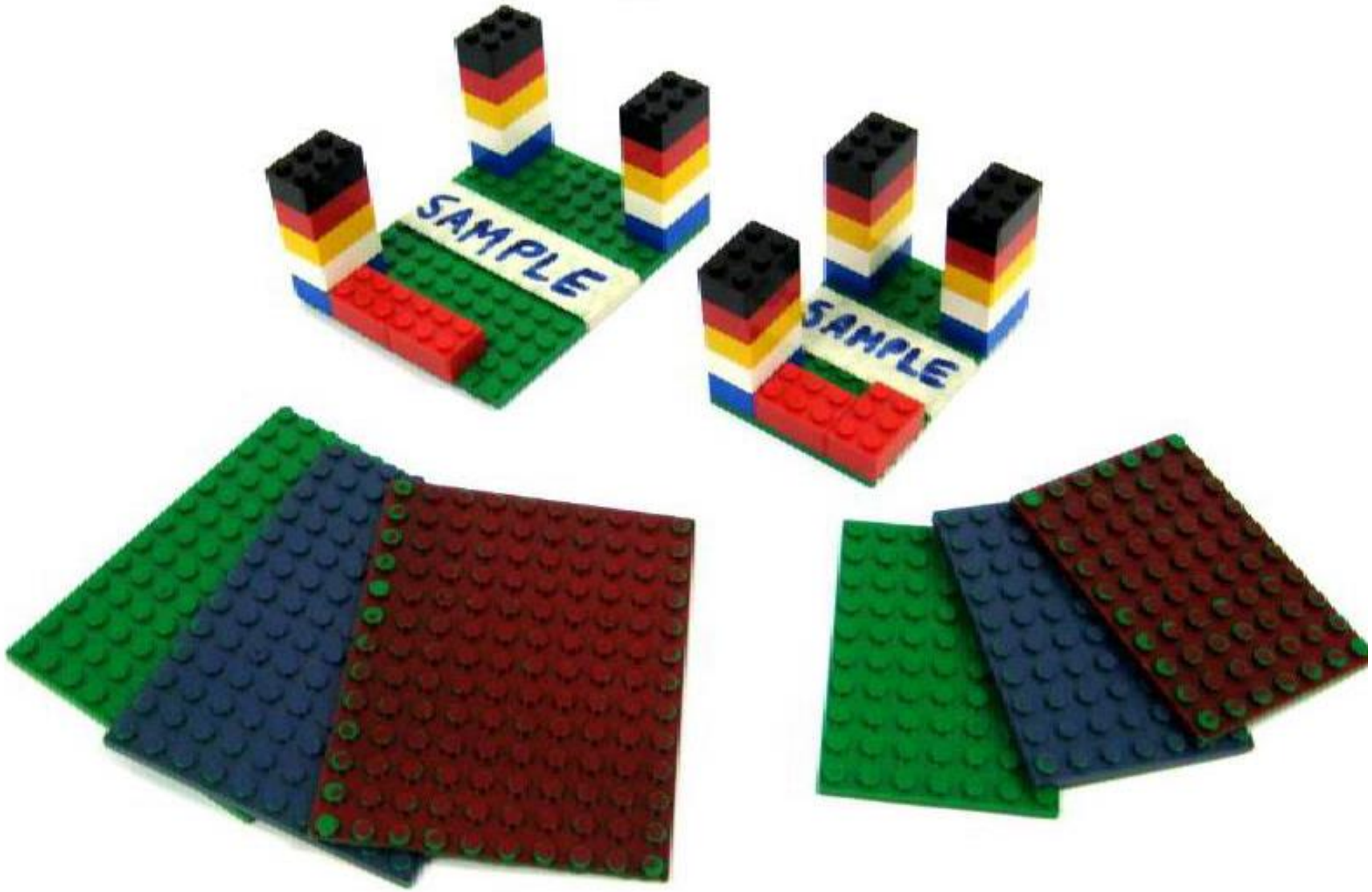
Time to make 10 products?



System 2

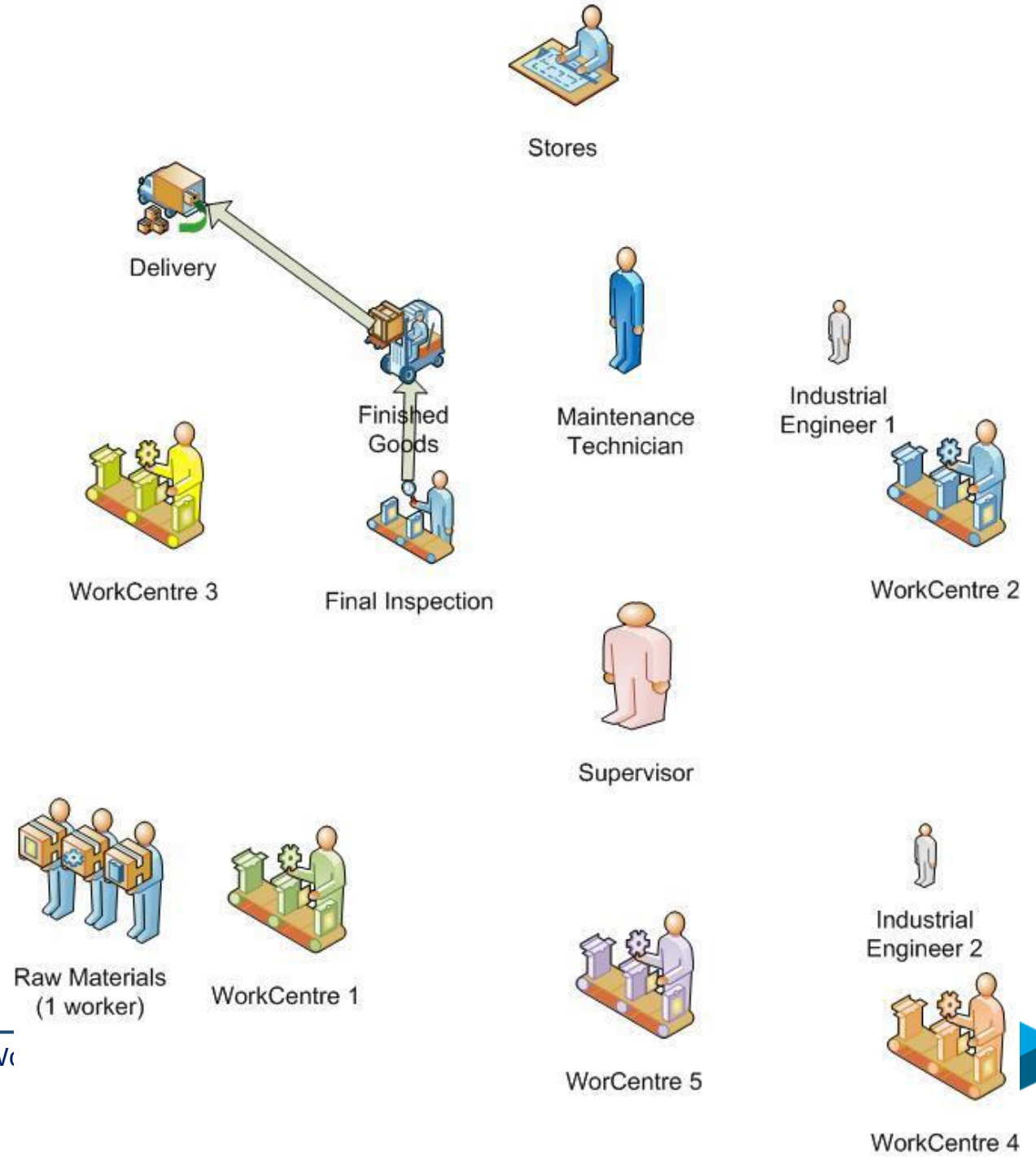
Time to make 10 products?

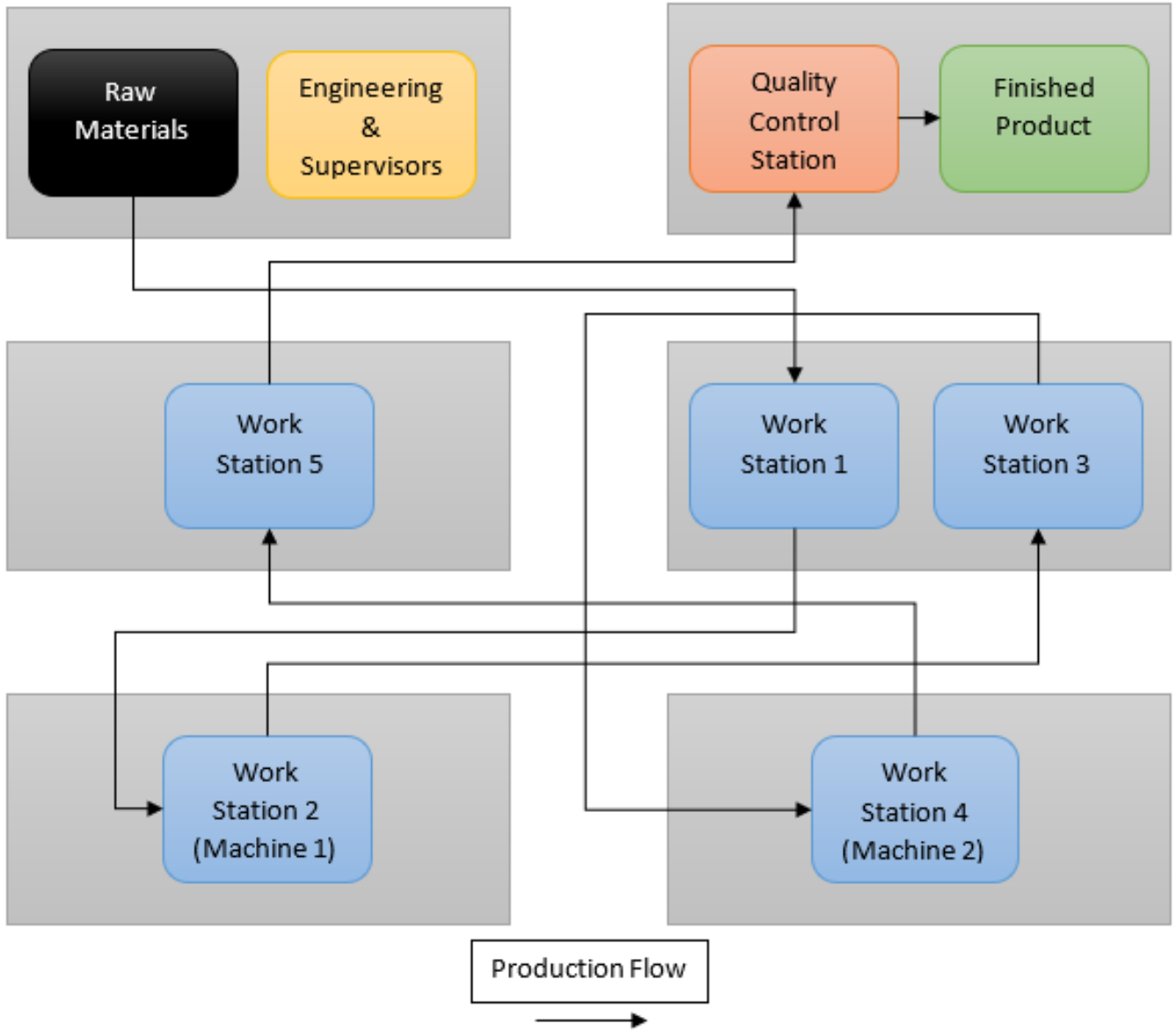
MANUFACTURING SIMULATION



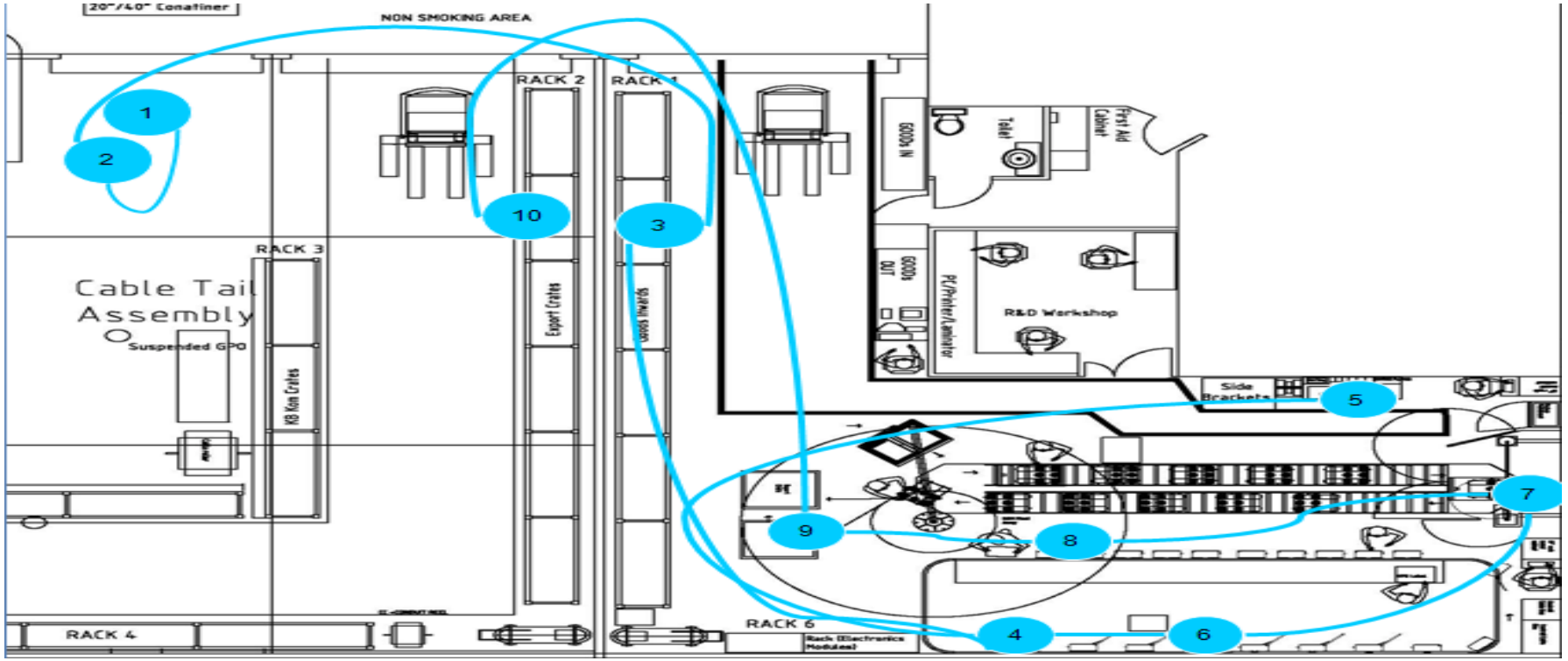
2 Sizes (Large & Small)

3 Colours (Green, Blue & Red Base Plates)





Practical Example[1]



1 Karim, A., & Arif-Uz-Zaman, K. (2013). A methodology for effective implementation of lean strategies and its performance evaluation in manufacturing organizations. Business Process Management Journal, 19(1), 169-196.

Equipment worthy of the people operating it! Work Centre 2

WC2: Setup for Large Parts

Work Centre 2 has a size driven change-over. Locating beam must be repositioned to match the size of the base plate of the parts being processed.

All change-overs & repairs are to be conducted by the maintenance fitter.

WC2: Setup for Small Parts

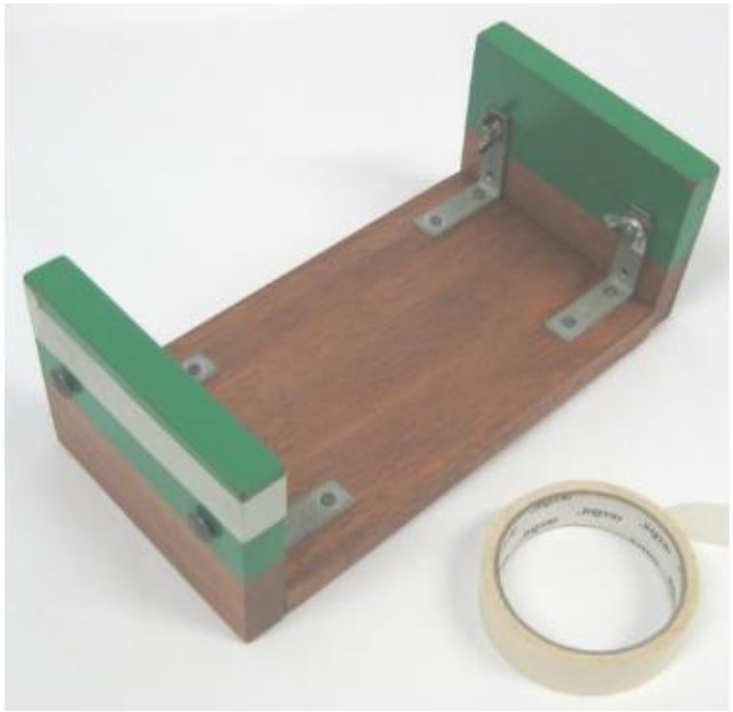
Replacement Spare

Equipment worthy of the people operating it! Work Centre 4

WC4: Setup for **Green** Parts

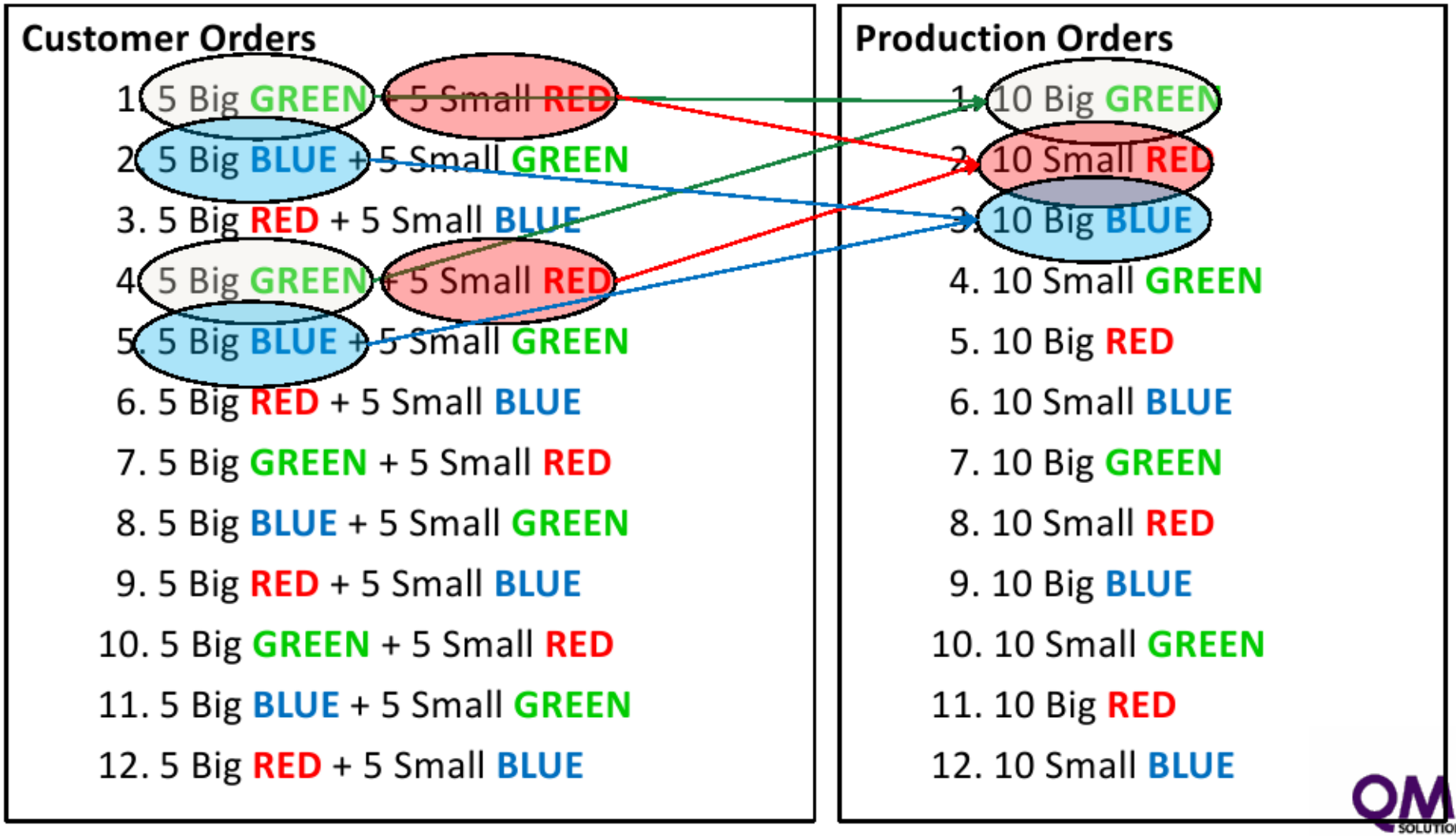
WC4: Tools for **Blue** Parts and **Red** Parts

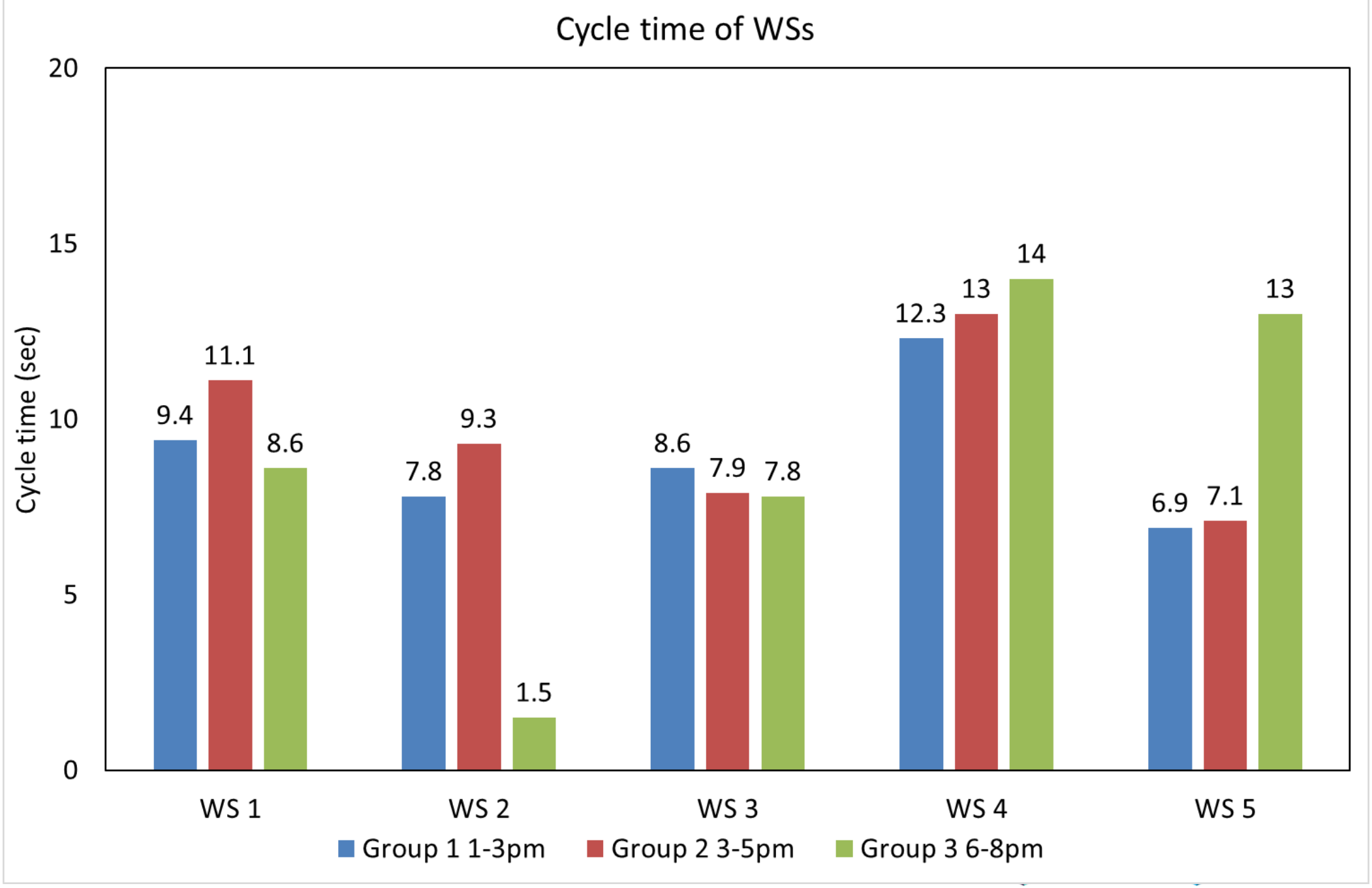
Work Centre 4 has a material driven change-over. Tooling must be changed to match the colour of the base plate of the parts being processed.



Repairs: Tooling must be strapped on one side. All change-overs & repairs must be conducted by the maintenance fitter.

Market Demand & Production Plan




Cycle time of WSs
Cycle time (sec)
20
15
10
5
0
9.4
11.1
8.6
7.8
9.3
1.5
8.6
7.9
7.8
12.3
13
14
6.9
7.1
13
WS 1
WS 2
WS 3
WS 4
WS 5
Group 1 1-3pm
Group 2 3-5pm
Group 3 6-8pm

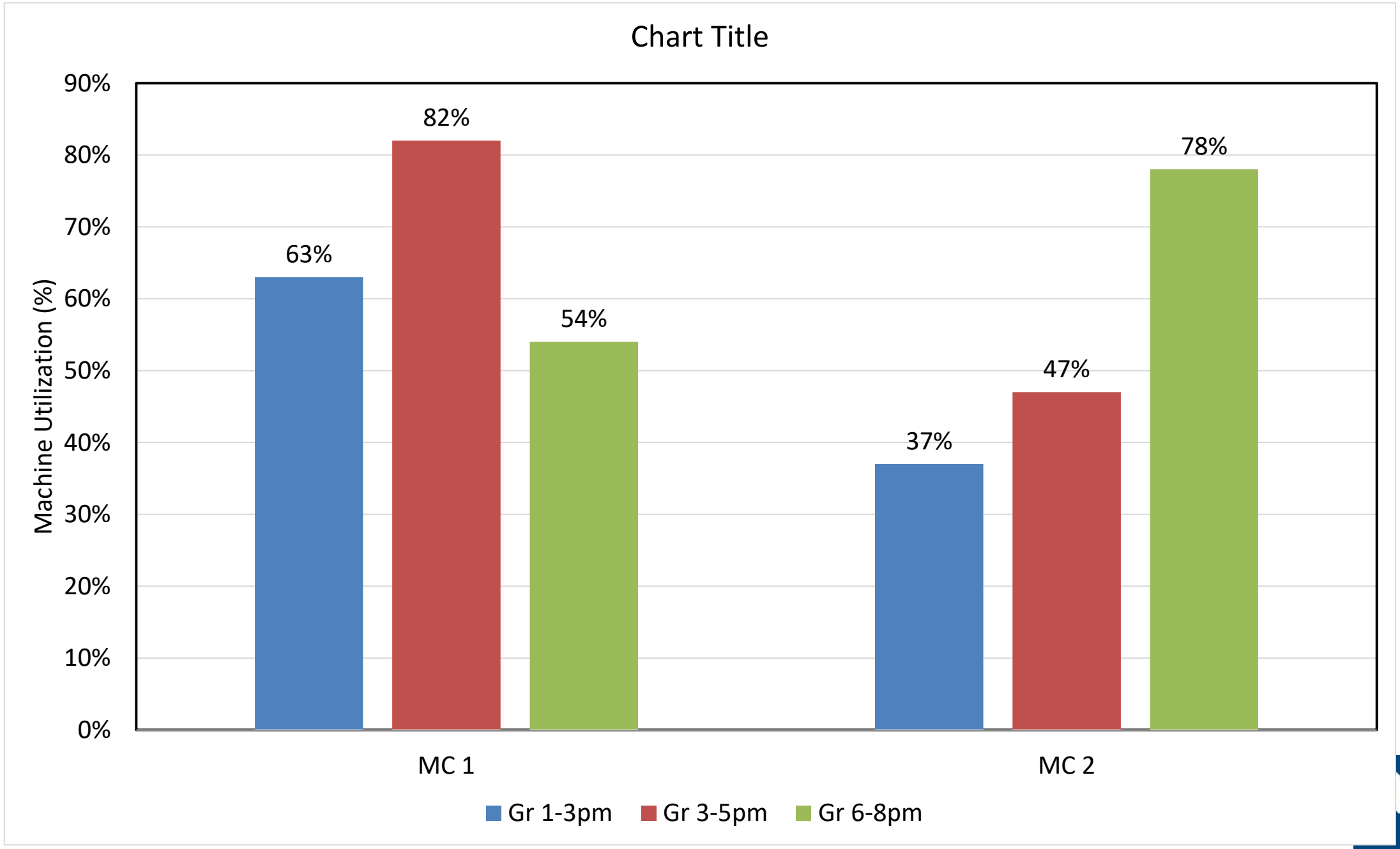


Chart Title
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Machine Utilization (%)
63%
82%
54%
37%
47%
78%
MC 1
MC 2
Gr 1-3pm
Gr 3-5pm
Gr 6-8pm

Observations

Wastes in the process

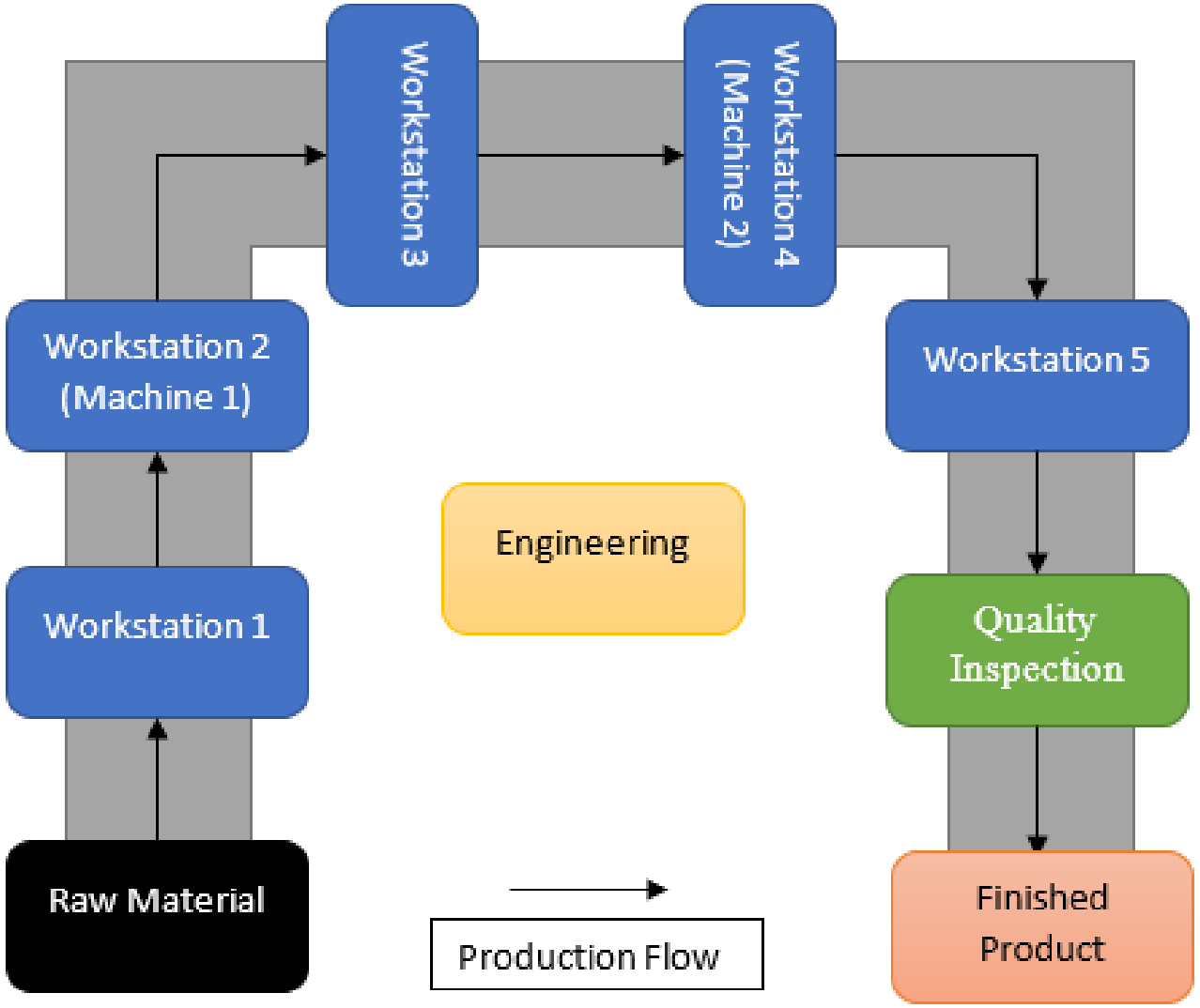
- *Frequent changes in product design resulted in frequent changes in machine set up.*
- *Waste- Long set up time*
- *Layout- not a well planned and systematic layout-*
- *Waste- Transportation*
- *Idle time for later processes when manufacturing starts*
- *Bottleneck inWS4*
- *Defects*
- *Defects identified at the end*
- *WIP*

People related wastes:

- *All WSs are idle while WS1 is busy- no team work*
- *Material handler and maintenance engineer had large workload*
- *Paper works involved in getting the parts*
- *WS2 and 4 workers are idle while maintenance works are done*
- *Idle time for many staff- job not justified*

Suggestions for improvement

- *U-shaped layout*
- *Follow the sequence of customer order and 5 in a batch*
- *Use Kanban in all workstations*
- *2 workers in WS 4*
- *Use universal Jigs for WS 2 and WS4 (no use of screws)*
- *Quality check at WSs, not at the end 9particularly at WS1)*
- *Implementation of 5S/visual workplace- photo of samples will be displayed in WS1, and WS4 and two correct sample of products (one small and one big) will be placed in the desk of Quality Control. The component in component store will be properly marked.*
- *The maintenance Engineer will not need to fill out the form, he just need to sign when he takes the material.*
- *No Material handler required- he/she will be employed in WS4*
- *Supervisor will not only announce the breaks, he/she will help in overall process*



Financial Measurements		Run 1		Run 2		Run 3	
1. Net Profit	Per Unit	Qty	Value	Qty	Value	Qty	Value
- Sales	$60	0	0	55	3300	112	6720
- Material Cost	$20	0	0	55	-1100	112	-2240
- Scrapped Blocks	$1	0	0	0	0	7	-7
			0		2200		4473
- Wages			0		-800		-800
- Interest	10%		-23		-20		-19
- Net Profit/(Loss)			-23		1380		3654

2. Stock on Hand	Qty	Value	Qty	Value	Qty	Value
- Raw Material	60	1200	35	700	0	0
- Process 1 WIP	10	200	15	300	0	0
- Process 2 WIP	40	800	5	100	0	0
- Process 3 WIP	10	200	5	100	0	0
- Process 4 WIP	10	200	0	0	0	0
- Process 5 WIP	0	0	5	100	0	0
- Final Inspection	10	200	0	0	0	0
- Packing	0	0	55	1100	112	2240
- Total	140	2800	120	2400	112	2240

3. Unit cost of sales [World Class = $30.00]			
- Total Cost	-23	-1920	-3066
- Units Sold	0	55	112
- Unit cost	0.00	34.91	27.37

Simulation 1

Simulation 2 and 3

Manufacturing Simulation

For each of the statements below, please indicate the extent of your agreement by ticking or encircling the appropriate box (5=Strongly Agree, 4=Agree, 3=Neutral, 2=Disagree, 1=Strongly disagree)

		Strongly Agree		neutral		Strongly Disagree
1.	Simulation has improved my understanding of the practical aspects of Lean Manufacturing	5	4	3	2	1
2.	I now got an experience how to identify the manufacturing process inefficiencies	5	4	3	2	1
3.	The problems we studied in the simulation project are realistic and reflected typical real practical situations	5	4	3	2	1
4.	I will be more confident in identifying process problems and suggesting necessary improvements.	5	4	3	2	1
5.	I think simulation project was an innovative way of introducing real life problems in classroom setting.	5	4	3	2	1

Azharul Karim

		Strongly Agree		neutral		Strongly Disagree
1.	Dr Karim's lectures, explanations and simulations helped my understanding	5	4	3	2	1
2.	Dr Karim's increased my engagement in learning	5	4	3	2	1
3.	Dr Karim is well organised	5	4	3	2	1

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A new method of integrating project-based and work-integrated learning in postgraduate engineering study

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Thank you