1910607-A2-Engineering Management

by Carl Jones

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Name:	Carl Jones
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1.0 Executive Summary

This assignment provides a detailed investigation into total engineering management systems

Task 1 discusses Taguchi Design of Experiments (DOE) and an exercise explains each stage to achieve optimum input settings to produce the best output

Task 2 critically analysis SWOT, PESTLE, and porter`s five forces strategic development techniques

Task 3 Discuss the Kano Model and comment on each of it factors, create a simple House of Quality diagram, and describe the rows.

Task 4 carry out a machine and process capability assessment and calculate the relevant figures

Task 5 Make a detailed critical analysis of Tuckman`s five stages of team progression

Carry out a conclusion for all sections

Task 1 (a)

The Taguchi Design of experiments (DOE) is a process performance tool that can create the optimum settings for producing the best output. There are several design steps involved in the experiment

1) Selection of the input variables
   Variables that effect the process output need to be selected. To do this an understanding of the whole process from start to finish is required.
2) Selection of the number of level settings for each input variable
   Level settings are selected on how much the input variable can affect the output. If the performance of the parameter is linear then 2 setting levels maybe selected, if the performance is nonlinear due to a lot of varying factors, then 3 or higher levels may be selected. Only analysis of the resulting data can determine if the level settings we right from assumptions made.
3) Selection of an orthogonal array
   The orthogonal array is a table of results that is selected on the number of experiments that is required to be run.
4) Assign the independent variables to each column
   The input variables need to be assigned to each vertical column of the chosen array. This is very essential as the interaction of each input variable could have large effects on the output.
5) Conduct the experiment
   Run the experiment as the array and recorded all the outcomes
6) Analyse the data
   From the data the different levels can be summed up for each level output result. This can than be collected in a table which then the lowest values of input parameters can be ranked
7) Inference
   From the data it will be apparent which level of inputs will create the optimum output. But to run at optimum there may be greater cost implications. At this stage it can be decided that the near optimum parameter settings can be selected and run to see the new effects on output.

Good work

(b) Determine the optimum parameter levels and predict the outcome from the below L9 orthogonal array produced from an experiment.

L9	A	B	C	D	Deterioration
1	1	1	1	1	20
2	1	2	2	2	12
3	1	3	3	3	10
4	2	1	2	3	48
5	2	2	3	1	28
6	2	3	1	2	20
7	3	1	3	2	20
8	3	2	1	3	16
9	3	3	2	1	8

Four parameters were tested at three levels each.

Calculate the average distortion

$$\sum T = 182$$

T = 182/9 = 20.22

A – Material type

L9	A	B	C	D	Deterioration
1	1				20
2	1				12
3	1				10
4	2				48
5	2				28
6	2				20
7	3				20
8	3				16
9	3				8

A1 = (20+12+10)/3 =14

A2 = (48+28+20)/3 = 32

A3 = (20+16+8)/3 = 14.67

B – Process temperature

L9	A	B	C	D	Deterioration
1		1			20
2		2			12
3		3			10
4		1			48
5		2			28
6		3			20
7		1			20
8		2			16
9		3			8

B1 = (20+48+20)/3 =29.33

B2 = (12+28+16)/3 =18.67

B3 = (10+20+8)/3 = 12.67

C – Processing time

L9	A	B	C	D	Deterioration
1			1		20
2			2		12
3			3		10
4			2		48
5			3		28
6			1		20
7			3		20
8			1		16
9			2		8

C1 = (20+20+16)/3 = 18.67

C2 = (12+48+8)/3 =22.67

C3 = (10+28+20)/3 =19.33

D – Type of additive

L9	A	B	C	D	Deterioration
1				1	20
2				2	12
3				3	10
4				3	48
5				1	28
6				2	20
7				2	20
8				3	16
9				1	8

D1 = (20+28+8)/3 = 18.67

D2 = (12+20+20)/3 = 17.33

D3 = (10+48+16)/3 = 24.67

Levels	A	B	C	D
1	14	29.33	18.67	18.67
2	32	18.67	22.67	17.33
3	14.67	12.67	19.33	24.67
Diff	18	16.63	4	7.33
Rank	1	2	4	3

not quite correct, remove highest and evaluate difference from the remaining

For optimum setting select the lowest values for all settings from table above

A1, B3, C1, D2

The predicted outcome

(14+12.67+18.67+17.33)/4 = 15.67

C) An additional table of information was provided

	Level	1	2	3
A	Material Cost(£/load)	2500	2400	2200
B	Process temperature	600	625	650
C	Process time (hrs)	2	1.75	1.5
D	Percentage additive	2%	4%	6%

The information in this table can affect the decisions made for the optimum settings. Each setting in this table can be rank as in previous table from 1-3 smallest to largest.

The optimum setting produced was A1, B3, C1, D2, from the table above A1 has the greatest cost and for this reason it may not be beneficial to run production with greater cost if it can be substituted for a cheaper option which will not have a big effect on the output of the product.

A3, B3, C1, D2 – (14.67+12.67+18.67.17.33)/4 = 15.835

All options for optimum settings need to be assessed as cost drivers will have a big influence on choosing off optimum settings.

Whilst C1 appears to be optimum, C3 gives a process difference of 0.67% but a 25% reduction in process time

Task 2

Three of the most used strategic development techniques used by companies and business are SWOT, Pestle and Porter`s five forces analysis.

SWOT analysis uses a matrix table, and a company or business will then try to create a list under four main headings. SWOT focuses on identifying the internal strengths and weaknesses within the company and identifies external opportunities out there and what kind of threats exist that could affect the direction of the company.

yes SWOT looks at factors that a company has some control over

Pestle analysis is a technique used to access markets factors for a company at a given time frame.

Pestle stands for

1. Political
2. Economic
3. Social
4. Technology
5. Legal
6. Environmental

These factors are influences outside of the company and business control but can be used as a guide.

Porter`s five forces analysis is based on the existing competition already withing the industry or business, the five forces are broken down into the following areas

1. Threat of new entrants
2. Bargaining power of suppliers
3. Bargaining power of customers
4. Threat from substitutes
5. Rivalry among current players

This analysis is market driven and takes an offensive and defensive style of action to create and maintain a competitor in current markets.

Advantages and disadvantages of the analysis tools

SWOT Analysis	
Advantages	Disadvantages
Allows the company or business to under their internal goals and objectives	Prone to ambiguity – SWOT does not have the mechanism for ranking how the all the list of factors can affect the company/business (Samson, 2017)
Gives a company or business an understanding of where and how they currently stand	Tendency to be subjective – data collected can be questionable as it depends on the company knowledge held by the individual. Tendency to identify favourable factors (Samson, 2017)

SWOT analysis is easy to carry out and doesn`t need technical skills or training, just an understanding of the company / business Expandability and integration – it is a data driven analysis which is based on informed decisions and opinions	

Pestle Analysis	
Advantages	Disadvantages
With 6 simple heading it is easy to understands and information can be gathering from credible sources, such as Government polices	Due to the ever-changing world the 6 factors can change very rapidly
Can help a company take advantages of current opportunities which could be very profitable due to current external influences i.e., tax or interest rate changes	There are cost implications involved in carrying out a PESTLE analysis as it involves time and labour. For smaller companies, the cost may outweigh the benefits of the analysis
Allow a company/ business to prepare for any external factors that could cause an unexpected threat due to action out of their control.	

Porter`s five forces Analysis	
Advantages	Disadvantages
Allow a company/business to assess the already established competition within the mark and can give the edge on how to price	The model does not take into consideration any other external and internal factors which have a bearing on the company/ business
Help in planning against threat of substitution and of new entrant. Choose the best market with more barriers in place to stop new companies entering	Porter`s Five forces analysis is based the assumption of a perfect industry.
Bargaining power with dealing with buyers and suppliers.	Not useful for all industries alike and may not bring the desired results.

From analysing the advantages and disadvantages of the above strategic tools available, a company/ business can only be successful if it implements more than 1 tool and integrate the analysed information.

Task 3 (a)

Kano Model was created by Dr Noriak Kano and published in 1984, the model is based on product development and customer satisfaction.

The Kano model works by assigning three types of properties to product and services

1) Threshold Attributes
2) Performance Attributes
3) Excitement Attributes

Threshold attributes are what a customer expects from a product or service and should be the minimum requirement for satisfaction

Performance Attribute is what draws the customers in, this area of satisfaction has the biggest gains if customers are fulfilled

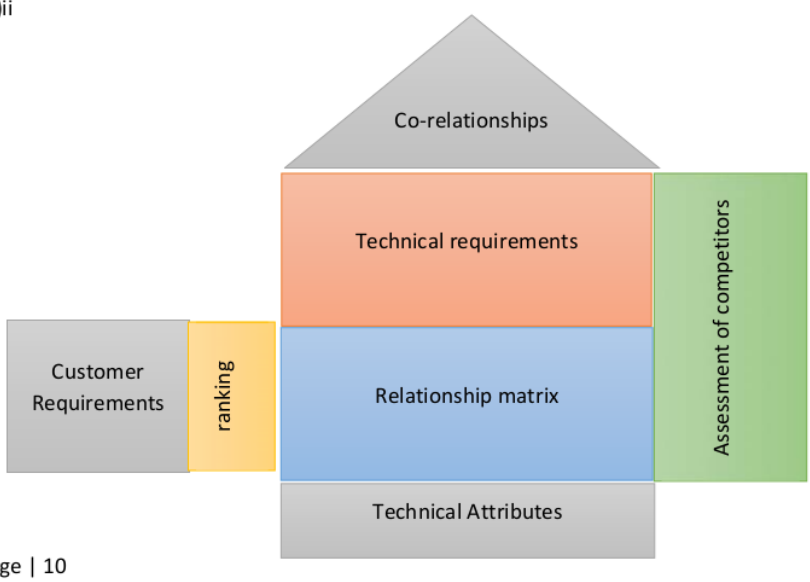
Excitement Attribute is something that customers did not expect but by having it has increased the delight

(b)i *QFD is about voice of the customer*

A company should implement QFD as it aims to satisfy the needs of the customer that buys the product, this can lead to becoming a preferred name or brand and end up being very profitable

Creating the house can help the company create performance specifications and develop quality measuring systems that will produce a product that meets customer requirements and helps the business to gain a competitive advantage

(b)ii



Technical Evaluation

Basic sketch of a House of Quality

A simple House of Quality can be built up of 6 steps that help to design a product using customers wants and needs. Three simple questions can be asked, “who?”, “What?” and “how?”

Steps

Customer requirements, identify with the customers, what do they need and what do they want currently.

Technical requirements, the already wants by the customer how are they satisfied.

Co-relationship, this is where the required How`s are identified to satisfy the needs of the customer

Ranking, this is an important step as rating the wants of the customer correctly can give the best outcome

Relationship matrix identifies the relationship between the customer requirements and technical requirements. This matrix is a scoring system which will highlight the importance of the How`s dependant of how large the number is.

Assessment of competitors is where products the product is compared whit what is already out there and rated.

Technical Attributes are skills that are required or can be taught to develop the best outcome, these can also be ranked

Technical evaluation can be assigned to individuals

Task 4

A CNC machine was set to machine components to a length of 20mm and ten samples of five were taken every half hour from the last made. The following results were obtained:

Sample No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
X1	20.11	20.13	20.12	20.06	20.22	20.13	20.21	19.96	20.13	20.2
X2	20.12	20.04	20	20.14	20	20.04	20.02	19.97	20.14	20

X3	19.97	20.1	20.15	20.23	20.15	20.11	19.97	20.21	20.1	20.5
X4	20.05	20	20.11	20.11	20.1	20	20.05	19.9	20	20.11
X5	19.88	20.2	19.9	20.12	19.9	20.22	19.88	19.9	20.12	19.99

(a)Plot the sample results on the average and range control chart and calculate the upper and lower control limits.

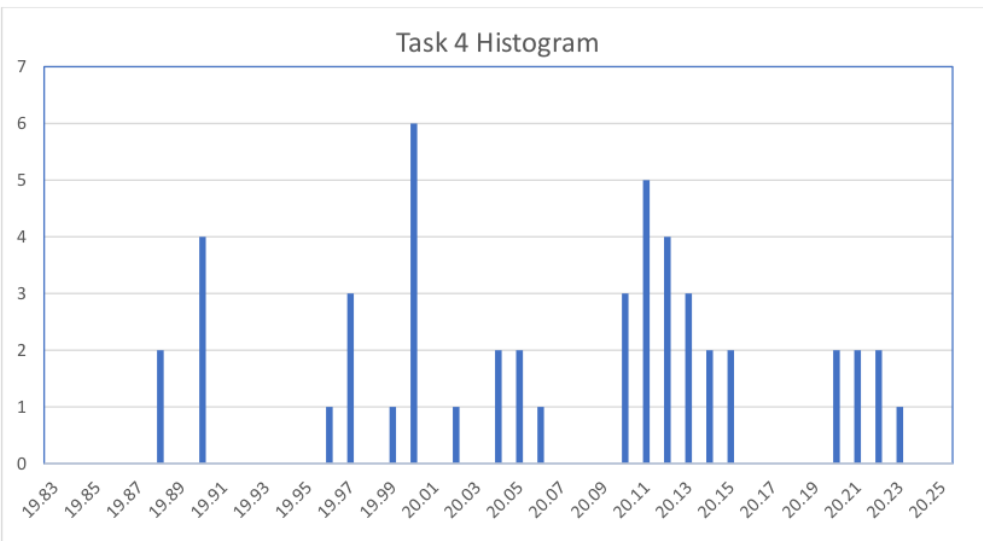
Using the information from the above table the mean value was calculated using the total of all the values divided by 50

Mean Value = 20.08

The standard deviation was calculated with the special function on the calculator. All the values were entered as a table form

SD = 0.1153

The data from the table was then tallied up and the results plotted on a histogram



Control charts are plotted as line graphs to better see trends

Upper control limit = UCL= mean + 3*SD
= 20.08 +3*0.1153
= 20.42

Lower Control Limit = LCL = mean -3*SD
= 20.08 +3*0.1153
= 19.73

To determine whether a process is in a state of statistical control the values are within +/- 3sigma of the mean and there are no special causes affecting the process

There are 7 tests for in control

The specification for the component is given as 20 ± 0.25mm. Determine Cp and Cpk and discuss the suitability of the process.

USL = 20.00 +0.25 = 20.25mm

LSL = 20.00 -0.25 = 19.75mm

CP = USL – LSL/6Θ

CP = 20.25-19.75/6*0.1153 =1.481

CpKU = USL-mean/3Θ

CpKu = 20.25-20.08/3*0.1153 =0.491

CpKL = mean – LSL/3Θ

CpKL = 20.08-19.75/3*0.1153 =0.953

Task 5

Tuckman's Five stages of team`s progression consists of the following

Stage 1 Forming

This is where the team meet for the first time and share information about themselves. Individual roles and responsibilities are unclear.

Stage 2 Storming

This is the development stage where team members now compete over ideas and try to establish themselves the position, they want in the team

Stage 3 Norming

The team now begin to work together understanding that they all need to achieve one common goal.

Stage 4 Performing

The team now has roles and works together and functions at a high level, focusing on development, decision making and problem solving.

Stage 5 Adjourning

The team has achieved the required goal and celebrates the success

Too brief

Conclusion

The assignment achieved all the goals set out by the tasks and has been very useful in introducing all aspects of engineering management.

After completing the assignment on management techniques, I have a better understanding of how to develop management strategies. Research into SWOT, PESTEL and Porter`s proved the useful ness of these strategies in developing a successful business plan. It also highlighted that a business must use more than 1 strategy to achieve goals.

Carrying out and example of Taguchi Design of Experiments (DOE) showed how useful this is in producing a successful product output.

House of quality sketch and research showed the benefits of doing this for developing new products

All these great engineering tools lend themselves to achieving company success in customer satisfaction and profitability.

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GRADEMARK REPORT

FINAL GRADE

62/100

GENERAL COMMENTS

Instructor

PAGE 1

PAGE 2

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PAGE 4

Text Comment. Good work

PAGE 5

PAGE 6

PAGE 7

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GRADING FORM: NEW CSG-RUBRIC

CARL JONES	62

1. ENGAGEMENT WITH LITERATURE

Reading, referencing, academic conventions and academic honesty. A satisfactory level of research but no evidence of the referenced work being used in the discussion, more use of the MOODLE resource could have been made.

04

2. KNOWLEDGE AND UNDERSTANDING

In answering the tasks, you should demonstrate coherent and detailed knowledge and a systematic understanding of the subject area The report demonstrates a satisfactory understanding of the business tools. The full evaluation of process charts to determine if a process is in control was missed.

12

3. COGNITIVE AND INTELLECTUAL

Descriptive tasks will be assessed against this generic criterion. The report has a reasonable description of the business tools and processes in context. The evaluation of teams by Tuckman lacked depth

13

4. PRACTICAL APPLICATION

Analytical tasks, you should be able to apply the methods and techniques that you have learned. Most of the calculations undertaken are correct and to a good standard. Errors made in the ranking of factors in the DOE task and the evaluation of optimum factors missed and salient point. The process chart was plotted as a histogram which makes evaluating trends difficult.

30

5. TRANSFERABLE SKILLS

Standard of presentation and organisation of your work: The report presented is to a very good standard. The use of graphics and sub paragraphs to highlight each point would have been good.

03