

phillip rowe

by Phillip Rowe

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1. Task 1

1.1 Taguchi DOE

DOE, which is used in Six Sigma, is a tool for selecting the set of parameters on which the experiment is performed (D, 2010). An example of this would be if an experiment was done on cooling a pipe by passing water through it, then there would be multiple different control parameters such as pipe material, pipe diameter and pipe length. These control parameters will also have various values/levels. DOE will enable the user to select the parameters and their values by their highest effectiveness and most economical value. This method uses orthogonal arrays which massively reduce the number of experiments which need to be performed which will then reduce the experiment cost. An orthogonal array is a predefined matrices of control parameters and a variety of experiments. The array must be based upon the number of control parameters and their levels. There are many different arrays In Taguchis method such as L4,L8,L9,L12,L16 up to L50. The more control parameters there are, the higher the number is after the L.

1.2 L9 Orthogonal array

Following below in figure 1 is the workings out for the optimum and predicted outcome.

Task 1b

$$\sum T = 182 \dots 77$$

$$T = \frac{182}{9} = 20.22 \quad \text{average distortion}$$

$$\overline{A1} = (20 + 12 + 10) / 3 = 14$$

$$\overline{A2} = (48 + 28 + 20) / 3 = 32$$

$$\overline{A3} = (20 + 16 + 8) / 3 = 14.667$$

$$\overline{B1} = (20 + 48 + 20) / 3 = 29.3$$

$$\overline{B2} = (12 + 28 + 16) / 3 = 18.667$$

$$\overline{B3} = (10 + 20 + 8) / 3 = 12.667$$

$$\overline{C1} = (20 + 20 + 16) / 3 = 18.667$$

$$\overline{C2} = (12 + 48 + 8) / 3 = 22.667$$

$$\overline{C3} = (10 + 28 + 20) / 3 = 19.3$$

$$\overline{D1} = (20 + 28 + 8) / 3 = 18.667$$

$$\overline{D2} = (12 + 20 + 20) / 3 = 17.33$$

$$\overline{D3} = (10 + 48 + 16) / 3 = 24.667$$

	Diff	Rank
A	18	1
B	16.633	2
C	4	4
D	7.333	3

Optimum Settings = A1, B3, C1, D2

$$\text{outcome} = \frac{14 + 12.667 + 18.667 + 17.3}{4} = 15.6585$$

Figure 1- Optimum values and predicted outcomes

1.3 Additional information

All of the additional information has been considered.

The optimum value for A was A1, however there was very little difference as seen in the above task. With the cost difference for material cost considered A3 may be the most optimum setting as it has a must lower material cost. So, the new optimum setting for A would be A3.

The optimum value for B was B3 and the process temperature is highest when B3 is selected. The second closest optimum value initially was B2, however there is only a 25°C so knowledge of the process would have to be taken into consideration but B3 would stay as the optimum.

The optimum value for C was C1, however there was not much difference between C1 and C3. Looking at the process time, C3 is 0.5 hours quicker than C1 so with that considered and the savings which would come with it, C3 would be the optimum value now.

The optimum value for D was D2 with very little difference between D2 and D1. D1 uses double the percentage of additive compared to D2, with this considered and the cost savings which could occur as long as the quality of the product is not sacrificed, D1 would be the new optimum value.

The new optimum settings would be A3, B3, C3, D1.

The new outcome would be $= (14.667 + 12.667 + 19.3 + 18.667) / 4 = 16.325$

Task 2 SWOT, PESTLE and Porters Five Force

SWOT, PESTLE and Porters Five Forces are all used as tools in order to carry out an analysis of a business. All these tools look at the business from a difference perspective so using all 3 would make for a good analysis of any business.

SWOT stands for 'Strengths, Weaknesses, Opportunities and Threats'. This is a method of analysis of the environment and the company's standing in it. (times, 2021) By using a SWOT analysis, it helps the person carrying it out better understand the company and what aspects of the company can be improved. There can be numerous weaknesses in a company such as poor marketing techniques, poor investment and pay issues. Whilst the SWOT highlights issues, it can also help improve these issues or even factor them out. It can also see things that may not have been thought of before such as new innovation ideas or market advantages that aren't yet being used by others. The SWOT can also determine where the business is most likely to be vulnerable from threats of competitors and help the

company avoid losing custom due to poor customer satisfaction. It can also highlight any legal issues which may arise with local governments such as carbon taxes and energy tariffs.

PESTLE stands for "Political, Economic, Social, Technological, Legal and Environmental" and is used for business and strategic planning, marketing planning, organizational change, business and product development and research reports (Reed, 2021)). Pestle analysis looks at the wider issues within the company which the SWOT analysis may not pick up on. Pestle considers real world influences more than what the competitors of the business are doing. For example, the political aspect of this would look into things like Brexit which could affect trade prices, clog transport lines and ultimately be a logistical nightmare. It is important to pay attention to these things as they can be a major influence on business performance. The economic section would look at things like the GDP of the country and interest rates in the country. This can influence how much you would have to pay the workers but also how much the product may cost the business to make. The social aspect may look at things like buying habits, ethical issues and consumer role models. For example, if the company is a major physical clothing retailer but the location of the shop is where most people shop online, this can influence the company to possibly not opening a shop and moving things online. The technological factors are things like emerging technologies, research and innovation and also competitor technology developments. For example, in a steel industry, there are new electrical arc furnaces which can do the job of the of the standard blast furnaces but do not need the raw materials as they work off scrap, stuff like this can present a market advantage if the company is quick to move to the newest technology. Finally the legal and environmental issues can be things such as employment law and tax regulations.

Porters 5 forces is a competitive position analysis. This theory is based on the concept that there are five forces that determine the competitive intensity and attractiveness of a market. Porter's five forces help to identify where power lies in a business situation. This is useful both in understanding the strength of an organisation's current competitive position, and the strength of a position that an organisation may look to move into (CGMA, 2013). An example of some of the things this tool may look at is start up investments, material accessibility and cost and finally how competitive the market is.

Task 3

Section (a)

The Kano Model (pronounced “kah-no”) is an approach to prioritizing features on a product roadmap based on the degree to which they are likely to satisfy customers. (Kano, 2021) There are 3 main factors to this model and these are basic, performance and delight.

Basic

This factor outlines the basic needs of which a product will need in order for it to be competitive. An example of this would be with a car, the car must have headlights as the customer expects these and takes them for granted. If something a customer takes for granted is missed, this could lead to dissatisfaction because the product did not work as they expected it to. This is a very good factor to consider as it can outline the absolute basic specification for a product in order to avoid customer dissatisfaction.

Performance

The performance features would be the features of the product which would increase the satisfaction for the customer as investment is put into them. An example of this would be increasing the size of a file storage facility on an online app. With this example it can be said that there is a linear correlation between how much is invested and the satisfaction which is given to customers. Performance features could also be featuring that the customer desires which may be the difference between them choosing your product or your competitors. An example of this could be if two cars had the same specification, but one car was 0.5 seconds faster to 60mph than the other, then this could be a performance feature that will be a deciding factor to a customer making a purchase.

The performance factor in my eyes is possibly the most crucial of the 3 factors. The reason for this would be that by including something that separates your product from the competitors, it would drive more customers towards your product rather than others. Any feature which is linear so what is invested will proportionally should as what you get out is more than worth it.

Excitement

The excitement features can make a disproportionate increase from a customer delight as investment is put into them. Now these features are not included, may not be missed by the customer but the stigma and word of mouth excitement will not be passed around. Failing to invest in an excitement feature would miss out on creating dramatic customer happiness. These features can be seen as the USP of a product but also the surprise, unique innovations of a product which will be included and can generate a massive attractive to a product because it develops a buzz with the customers. This buzz can then have a ripple effect and it can be partially used as a marketing tool, the more customers that are happy and excited about their newly purchased product, the more likely others are to follow suit and buy the same product.

This factor is important because it will generate extreme customer satisfaction if the proper investment is made into it. This factor can create that stigma around the product to essentially create a free marketing tool for the product.

Task 3 section (b)

There are 3 main reasons as to why a company should use the quality function deployment, these are:

- The first reason why QFD should be used by a company would be that it is a very powerful tool which can prioritize. It also will combine many different matrices into a single form house structure which makes it very easy to interoperate.
- Another benefit of the quality function deployment is that it is a customer driven process which can be used for planning products and services, so timelines can be set in order to help achieve deadlines.
- Finally, the last reason a company should use Quality Function Deployment is that it is originally started with the voice of the customer, this would then become the basis for setting any requirements. This would mean that the customer satisfaction would be high as the customer had the original voice when setting the specification requirements. This can also help avoid pointless features being included in a product and save time and money.

Following below in figure 2 is the template for a simple house of quality.

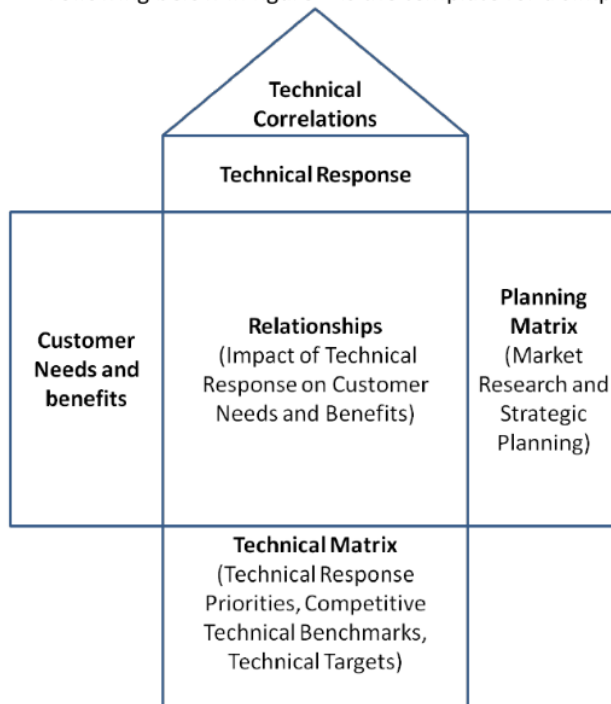


Figure 2- House of quality

Looking at figure 2 and starting with the box on the left which is customer needs and benefits, this would be where the customer demands are written. In this box should be things like a specification of what is required but not list how good that requirement needs to be. An example of this could be a computer, in the box would be the important things like high processing speed and large memory storage, but the actual speed and the size of the memory storage would not be defined here. These items would then also be ranked using a scale so say between 1-10 in order to rank them in order of importance. The technical response would be where the actual design requirements are listed. These things need to be something which can be measured and be related to the customer requirements. An example of this would be if the customer requirement was to say large memory storage, then the technical requirement can be 128GB storage. The technical correlations are where the technical information and requirements are assessed. There a number of correlations such as positive correlation, negative correlation, no-correlation, strong positive correlation and a strong negative correlation. An example of this would be that there is a strong correlation between having a high-speed processor and the heat generated. The relationships section is where the technical data is directly mapped into the customers needs in order to create a solid link. This will then show the correlation between the data and the customer needs. The technical matrix is where the priorities are set based on factors such as competitors, bench marking and technical targets. Finally, the planning section is where the market research about the product is done and the strategic planning of the planning is outlined.

Task 4

The data has been taken from the table below and a table of results has been formulated as seen in figure 3

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

Table of results

Figure 3-

Calculate the averages and the ranges for each group of samples:

20.11	20.13	20.12	20.06	20.22	20.13	20.21	19.96	20.13	20.2	
20.12	20.04	20	20.14	20	20.04	20.02	19.97	20.14	20	
19.97	20.1	20.15	20.23	20.15	20.11	19.97	20.21	20.1	20.5	
20.05	20	20.11	20.11	20.1	20	20.05	19.9	20	20.11	
19.88	20.2	19.9	20.12	19.9	20.22	19.88	19.9	20.12	19.99	
20.026	20.094	20.056	20.132	20.074	20.1	20.026	19.988	20.098	20.16	xbar
0.24	0.2	0.25	0.17	0.32	0.22	0.33	0.31	0.14	0.51	ranges

The mean can be calculated from the results – Mean = 20.0754

From this the mean range can also be calculated – Mean range = 0.269

By using the information calculated the Range UCL and LCL can be calculated –

R UCL = 0.56867

R LCL = 0

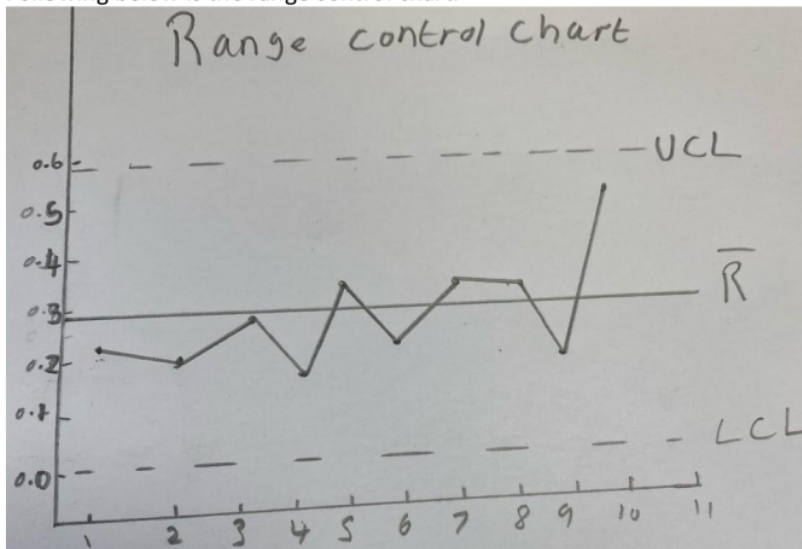
Calculate the UCL and LCL for the averages using the information gathered from the control chart factors table:

Using the information calculated the UCL and LCL averages can be calculated.

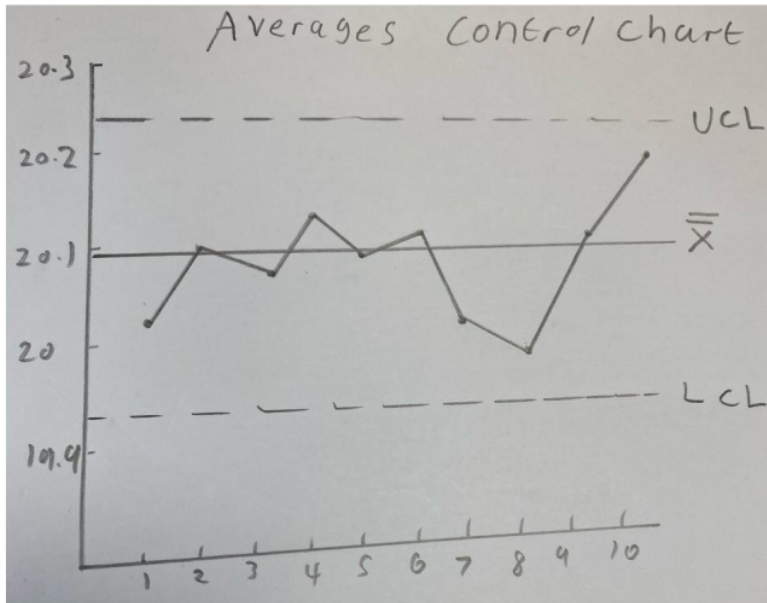
X UCL = 20.2306

X LCL = 19.9202

Following below is the range control chart.



Following below is the average control chart:



4.2 Special causes

There are many special causes which should be carried out, these could be things such as material inconsistency, machine parts worn and also the factor of human operator error. In order to make educated choices, data taken needs to be reproduceable and have as little variables as possible. A wider range of data should be taken in order to increase the reliability of the data, this will also produce a good range in order to rule out anomalies. When the data has been produced, better control charts can be used to interpreted the data. From the charts positive or negative trends will be able to be seen and also any anomalies such as data spikes will be able to be seen, these spikes mean that the collected data may not be fit for purpose and unstable.

4.3 Cp, Cpk and suitability of the process

First of all $\bar{X}$ and $(\bar{x} - \bar{x})^2$ will be calculated, this is shown below in figure 4.

Sample	data	$x_i - \bar{x}$	$(x_i - \bar{x})^2$
1	20.11	0.0346	0.00119716
2	20.12	0.0446	0.00198916
3	19.97	-0.1054	0.01110916
4	20.05	-0.0254	0.00064516
5	19.88	-0.1954	0.03818116
6	20.13	0.0546	0.00298116
7	20.04	-0.0354	0.00125316
8	20.1	0.0246	0.00060516
9	20	-0.0754	0.00568516
10	20.2	0.1246	0.01552516
11	20.12	0.0446	0.00198916
12	20	-0.0754	0.00568516
13	20.15	0.0746	0.00556516
14	20.11	0.0346	0.00119716
15	19.9	-0.1754	0.03076516
16	20.06	-0.0154	0.00023716
17	20.14	0.0646	0.00417316
18	20.23	0.1546	0.02390116
19	20.11	0.0346	0.00119716
20	20.12	0.0446	0.00198916

Figure 4 - $\bar{X}$ bar

From this data, the sum of $(x - \bar{x})^2$ can be calculated as 0.652042

The standard deviation can also be worked out to be – SD = 0.115355882

3x and 2x of the standard deviation can be calculated as: 3SD = 0.346067647 and 2SD = 0.230711765

Now the upper and lower warning and control limits were calculated as:

+3SD = 20.35 -3SD = 19.65

+2SD = 20.23 -2SD = 19.77

The process range can be calculated as = 0.69

From this CP can now be calculated as – CP = 0.722

Now the USL and CPKU can be calculated as: USL = 0.17 CPKU = 0.506

Finally LSL and CPKL can be calculated as: USL = 0.3254 and CPKL = 0.941
Calculate LSL and CPKL:

In order to determine the suitability of the process, CP must be looked at. So if Cp is greater than one then the actual spread of the data would be less than the tolerance however, when Cp is less than one then that would indicate that the spread of the actual data is more than the tolerance. If we were to take a look at Cpk, then if it is more than 1 then this would indicate that the data isn't near the centre of the specification. An ideal process would have a value of Cp to be greater than one and Cpk would need to be around 1.3. The value of Cp in this case is 0.722 and the lowest value of Cpk is 0.506, this would indicate that the process is not suitable.

Task 5

Bruce W Tuckman published his theory in 1965 which consisted of the 5 stages of team working. The 5 stages are forming, storming, norming, performing and adjourning. As shown below in figure 5 Each item can be plotted on a graph.

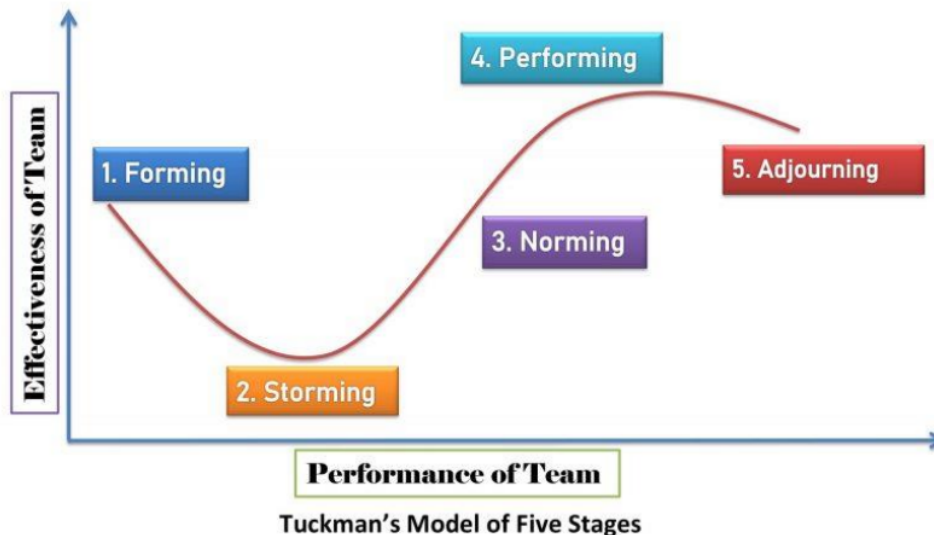


Figure 5 - Tuckmans model of five stages

The first forming stage is where each of the team members will come together and establish an interpersonal relationship with each other. They all become familiar with each other and the task assigned. The ground rules are then also established. The second phase is storming. This is where intragroup conflict will be generated. This is due to each member of the group still sees themselves as individuals rather than a member of one team. During this phase they may resist the formation of the group as they are trying to express their individuality. The third stage is the norming stage. During this stage the group is starting to form and the individualism is starting to be factored out. During this phase the members of the group are starting to openly give their opinions and inputs. The group then starts to accept each other

as team mates for who they are, this then factors out the conflicts as they are avoided due to each member of the group working in harmony. The fourth stage is performing. This is when a period where the team produces a strong collaboration where each team member takes their role and each member supports one another. This will enhance the performance and create effective task completion. Any issues which arise are resolved in a civil and constructive manner in order to get the task completed. The final adjourning stage is the reflection period where the team can look back at how the task went and some adjustments can be made in order to improve the flow of the task if it was done again.

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FINAL GRADE

GENERAL COMMENTS

Instructor

67/100

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GRADING FORM: NEW CSG-RUBRIC

PHILLIP ROWE

1. ENGAGEMENT WITH LITERATURE

-  Reading, referencing, academic conventions and academic honesty. A good level of research and referencing has been undertaken to support the report, more use of the MOODLE resource could have been made.

05

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 very good understanding of the business tools. Examples and interpretation of the tools have been used in the explanation.

14

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.

14

4. PRACTICAL APPLICATION



Analytical tasks, you should be able to apply the methods and techniques that you have learned. The calculation undertaken are correct and to a good standard.

31

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