

University of Wales Trinity Saint David
School of Engineering



Mechanical and Manufacturing
Engineering

Engineering Applications

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Table of Contents

1	Introduction.....	iii
2	Health & Safety with Risk Assessments	iii
2.1	Health and safety for lathe machines.....	iii
3	Engineers Role In Society	v
3.1	Sustainability in design	v
3.2	Sustainability in production practices	vi
3.3	Sustainability in operations and maintenance.....	vi
3.4	Sustainability in product end life	vi
4	Team Structure	vii
5	Personal development plan.....	ix
6	Conclusion.....	x
7	References.....	x

1 Introduction

This report will look into health and safety related to an activity that was partaken in the university. It will also look at what an engineer's role is in society related to sustainability and environmental issues in the mechanical and manufacturing field. Teamwork is also a crucial part of engineering. For teamwork to work team structure should be present, which will be looked at in more detail in this report. The last topic that this report will cover will be the personal development plan.

2 Health & Safety with Risk Assessments

This chapter will look into the health and safety of a machining activity that was undertaken in the university. This machining activity is using a lathe to remove material form a steel rode. Below is an image of a lathe.

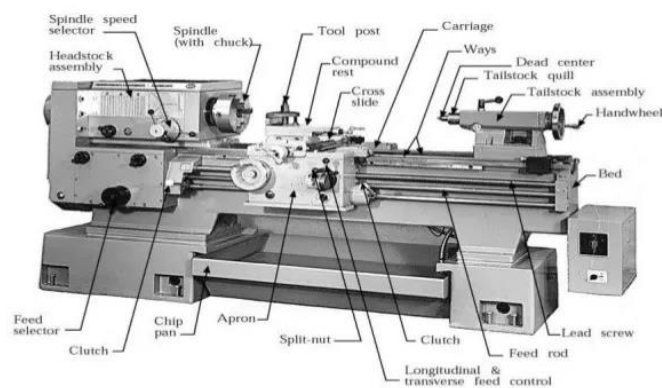


Figure 1: Image of a lathe.

A lathe is a machine that rotates on its axis to perform various operations such as cutting, sanding, knurling, drilling, or deformation, facing, turning, with tools that are applied to the workpiece to create an object with symmetry about an axis of rotation. They were originally designed to machine metals. Lathes are considered to be very dangerous if the health and safety protocols and personal protective equipment are not followed and used (Pramudya, Andesta and Hidayat, 2022).

2.1 Health and safety for lathe machines

The operation of lathes can be extremely dangerous as there are a lot of moving parts that are uncovered in order for the user to work on their workpiece. Although lathes are dangerous there are some health and safety regulations that have been put in place to make the use of lathes safer.

Below are the most common safety regulations that have been put in place to make lathes safer to use:

1. The use of Personal Protective Equipment (PPE) – PPE is mandatory for the operation of a lathe as it will keep the user safe. The most important forms of protective clothing that are needed when operating a lathe are:
 - Safety glasses – this is to protect the users' eyes from the metal shavings from the work piece as it tends to fly around the workshop as it is removed.
 - Steel toe safety boots – this is to protect the feet from injury as items may be accidentally dropped on them, for example the heavy work piece.
 - Protective clothing – this is to protect the users clothing from getting damaged or catching on fire as the metal shavings can be hot due to the friction from the cutting tool.
2. The removal of loose clothing and jewellery and tying back long hair – this is to prevent entanglement hazards such as the loose clothing and jewellery from getting caught in the spindle and pulling the user into the machine. (Carvey and Hage, 2021)
3. Don't operate a lathe under the influence of drugs or alcohol – operating a lathe under the influence can cause serious injury. This is because alcohol or drugs can cause impaired judgement and coordination making it difficult and very unsafe to operate the lathe.
4. Operating the lathe at the correct speed – the lathe should be adjusted to the correct speed that is recommended for the material that is being worked on. This is because if excessive speed is used it could cause more accidents. (Dao and McMullin, 2019)

3 Engineers Role In Society

Engineers play a very important role in society by solving some complex problems that are faced by people. To solve these problems, they apply their mathematical and scientific concepts to design and develop solutions for the challenges that are being faced in the society. Chartered engineers are held at high standard in their society, and they are expected to follow a code of conduct.

(Professional approach to engineering ethics) There are many different codes of conduct that have been published for engineers to follow that are in line with an engineer's responsibility towards sustainability and environmental issues for manufacturing engineering. (Martin, Conlon and Bowe, 2021) This chapter will look at two of this code of conduct and compile the engineers roll in becoming more sustainable towards the environment. The two code of conducts that will be used are the National Society of Professional Engineers (NSPE) Code of Ethics and the Engineering Council Joint Statement of Ethical Principles.

Manufacturing engineering plays a very important role in sustainability in the manufacturing system. This means that manufacturing engineers have the role of incorporating practices that are more sustainable into the manufacturing system starting from design, production, operation, and disposal. Below is an in-depth look into an engineer's responsibility towards sustainability in each of the manufacturing systems mentioned above:

3.1 Sustainability in design

Sustainability in design is very crucial as it is the starting point in the manufacturing process. This is where the designers and engineers decide what ways they can make the design process more sustainable. Engineers can achieve this by:

- Reducing the material consumption – carbon footprint can be reduced by designing products that involve less materials as it makes them lighter allowing for easier transportation meaning less vehicles will be on the road.
- Material selection – this helps increase sustainability as recycled materials can be used, as well as renewable resources. This will help reduce the carbon footprint by minimising processing and resource extraction. (FEO (2015) Sustainable engineering for a future worth living. FEO. (p. 45))
- Incorporating energy efficient designs – this can help reduce the carbon footprint by reducing the electricity used to make the products.

3.2 Sustainability in production practices

After the designing of the products that are to be manufactured, the engineers can implement sustainable production practices such as:

- Reduction of waste – the implementation of waste reduction strategies, such as reducing the amount of scrap materials produced as this will help to reduce the amount of waste taken to the landfills.
- Conservation of water – this is implementing efficient water practices, such as reusing wastewater to clean products at the end of the manufacturing process and reducing the amount of harsh chemicals that are mixed with water by using more environmentally friendly chemicals.
- Energy optimization – this can be done by industrial engineers by implementing energy efficient machinery, optimization of the production schedule and general controlling of energy consumption. (Heller and Tilley (2006) Sustainability: A business imperative. Routledge. (p. 72))

3.3 Sustainability in operations and maintenance

Sustainability also extends to the maintenance of the manufacturing systems as the machinery also needs to be kept to its most efficient standard. Some other ways of sustainability in operations and maintenance are:

- Maintenance – regular maintenance will help preserve the machines and allow them to last longer, meaning less machines will be thrown out to wastelands. Predictive maintenance can also help reduce downtime and the energy consumption that the machines use. (IMechE (2019) Sustainable mechanical engineering. IMechE. (p. 23))
- Watching over environmental hazards – this includes the safe handling of hazardous material and disposing them correctly rather than dumping them down the drain. The reduction of emissions by reducing the carbon footprint.
- Employee engagement – employee participation can be key in encouraging sustainability in operations by starting sustainability initiatives such as rewards for recycling.

3.4 Sustainability in product end life

Sustainability of a product goes beyond the manufacturing phase as it still has environmental impacts after the manufacturing phase. Engineers can make product end life more sustainable by:

- Designing for recycling – engineers can do this by designing products that can easily be dismantled and recyclable. This will result with less materials becoming landfill waste.

- Product longevity and durability – engineers can do this by designing products with the future in mind by making them have an extended lifespan. This will reduce resource consumption.

These are the responsibilities that engineers have towards sustainability and environmental issues to help reduce their carbon footprint.

4 Team Structure

The time that I worked in a team was for an integrating project for my foundation year. At the beginning of the project the team structure was set in a way that everyone was leading, and everyone could take over a chapter of the project they were confident about. This had its advantages and disadvantages. The advantages were:

- Increased motivation and engagement due to everyone feeling like an equal.
- Greater accountability as everyone is responsible for the team's success.

The disadvantages:

- Lack of clear direction and leadership due to everyone being a leader it is difficult to see the direction the team is going in because everyone has different ideas and aspects.
- Conflict and disagreement as everyone lead there is high risk of conflict as everyone has different ideas on how the direction of the team should go.
- Can be challenging on managing as everyone is equal meaning anyone can speak and do as they please when they want.
- May be difficult to do meetings with the lecturer as we cannot go with 6 people to a meeting every time.

As seen above the disadvantages faced outweigh the advantages, which shows the results that the team structure did not function as intended. The group ended due to conflict which resulted in the group failing the project.

There are different types of team structures that we could have used to make the project a success such as the one below:

A functional structure is one of the structures that could have pushed the team to success. In a functional structure, team members are organized according to their functional areas of competence. This means that there is one main leader that the team falls under, but everyone is split to lead in a department or section that they are good in.

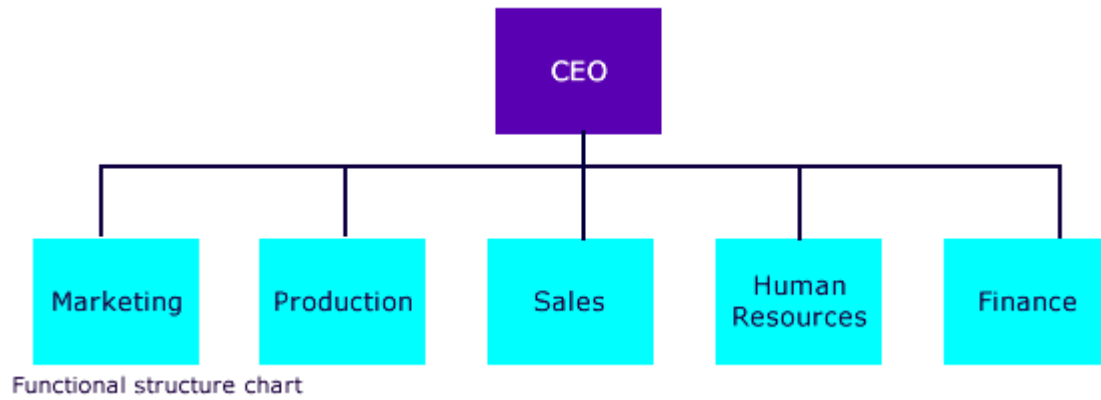


Figure 2: image of hierarchy in a functional team structure.

The above image shows the functional team structure, but in the case of the image the CEO is the team leader, and the following branches are the different sections of the project that are ran by the people with expertise in that section. (Ahmady, Mehrpour and Nikooravesh, 2016) In a bigger group under the other sections will be more people who are also experienced in that field. This is a better structure because when it comes to external meetings the main elected leader of the group can go to the meetings and handle the meetings. Its main disadvantage is that the pressure is put on the leader to organise the team and make sure everyone pulls their weight. This can also lead to conflict between the leader and some of the team members that are not pulling their weight. Although this may happen it is easier to manage as the leader and the rest of the group can discuss the actions that they plan to take to deal with the matter.

Although team structures are there it is mainly down to how dedicated everyone is to complete the project. I say this because in my experience my team members were not as dedicated to finish the project and to work hard for it. Some where dedicated and wanted to work hard to completing the project and some were not pulling their weight.

5 Personal development plan

Personal Development Plan

Name - Sheunesu John Ziki

Degree – Mechanical and Manufacturing Engineering

Previous Qualifications – A - Level

Previous Experience - N/A

Long Term Goals (5 to 10 years)				
After my course write the exams to become a chartered engineer. Work as a manufacturing engineer at a startup or developed company to gain some more work experience. Starting a manufacturing plant in Zimbabwe and reviving the manufacturing industry.				
Short Term Goals (0 to 5 years)				
To finish my degree and acquire some skills that have certification along the way e.g. welding, soldering, coding etc. To get a company to do a year in industry for in the beginning of 2025. Get a job after iv completed the course.				
Goal	Objective	Resources Required	Measurement	Target Date
Graduate as a mechanical & manufacturing engineer.	Complete mechanical & manufacturing engineering course.	Course Training .	Successful completion of course.	2027
Placement or year in industry.	Complete a placement or a year in industry.	Training for work experience.	Completion of year in industry/placement.	2025
Job	Complete course and placement to get to this goal	Course and placement.	Graduate Job	2028
Learning Welding	Completion of welding course	Welding course	Welding certificate	2024
Chartered engineer	Completion of chartered engineering exams	Completion of course	Chartered engineer	2027

Figure 3: Personal development Plan.

6 Conclusion

In conclusion this report shows the health and safety of using a lathe and all the procedures that need to be followed in order to operate the lathe with minimal risk of injury. This is to make sure that the machine, user, and people around the machine are safe. It also looks at an engineer's role in society in terms of sustainability and environmental issues in manufacturing. It shows that it is very important for the manufacturing industry to become more sustainable by implementing different tasks such as recycling material and designing for and long-term sustainability. This means that less materials will be wasted and will end up in landfills. Team structure is also an important topic that was covered in the report talking about how important team structure is for a team to be able to complete tasks and how a functional structure is the most appropriate team structure. A personal development plan is a plan that shows long term and short-term goals that want to be achieved by an individual. My long term and short-term goals are showed under the personal development plan.

7 References

European Federation of Engineering Organisations (FEO). (2015). Sustainable engineering for a future worth living. FEO.

Heller, M. J., & Tilley, F. (2006). Sustainability: A business imperative. Routledge.

Institute of Mechanical Engineers (IMechE). (2019). Sustainable mechanical engineering. IMechE *pmc_6342623*.

Professional approach to engineering ethics.

Ahmady, G.A., Mehrpour, M. and Nikooravesh, A. (2016) 'Organizational Structure', *Procedia - Social and Behavioral Sciences*, 230, pp. 455-462 Available at: <https://doi.org/10.1016/j.sbspro.2016.09.057>.

Bird, J.O. and Ross, C.T.F. (2012) *Mechanical engineering principles*. 2nd edn. London: Routledge.

Callister, W.D., , J.R. and Rethwisch, D.G. *Materials Science and Engineering An Introduction by William D. Callister, Jr., David G. Rethwisch (z-lib.org)*.

Carvey, M. and Hage, R. (2021) 'Conference lanyards; why does it take so long to provide health hazard free options?', *Translational Research in Anatomy*, 23, pp. 100110 Available at: <https://doi.org/10.1016/j.tria.2020.100110>.

Dao, A. and McMullin, J. (2019) 'Unintentional Injury, Supervision, and Discourses on Childproofing Devices', *Medical anthropology*, 38(1), pp. 15-29 Available at: <https://doi.org/10.1080/01459740.2018.1482548>.

Martin, D.A., Conlon, E. and Bowe, B. (2021) 'A Multi-level Review of Engineering Ethics Education: Towards a Socio-technical Orientation of Engineering Education for Ethics', *Science and engineering ethics*, 27(5), pp. 60 Available at: <https://doi.org/10.1007/s11948-021-00333-6>.

Pramudya, I., Andesta, D. and Hidayat, H. (2022) 'Safety Application and Health Work (K3) At Department of CNC Lathe Using Hazard Identification Risk Assessment and Risk Control (HIRARC) Method (Case Study of PT. Swadaya Graha)', *Journal of Applied Engineering and Technological Science (Online)*, 4(1), pp. 318-324 Available at: <https://doi.org/10.37385/jaets.v4i1.1114>.

Verma, R.K., Nguyen, G.D., Karakus, M. and Taheri, A. (2021) 'Capturing snapback in indirect tensile testing using AUSBIT - Adelaide University Snap-Back Indirect Tensile test', *International journal of rock mechanics and mining sciences (Oxford, England : 1997)*, 147, pp. 104897 Available at: <https://doi.org/10.1016/j.ijrmms.2021.104897>.