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2 Introduction

This report explores some of the key responsibilities and tasks that engineers would take on within a regular day in the engineering industry. As technology advances so does the need to be more aware of the risks involved with using equipment, making sure the correct health and safety precautions are taken. Engineer roles in society are implied by codes of conduct. These define an engineer's responsibilities towards sustainability and environmental issues amongst other obligations. In this report, codes of conduct will be analysed through two companies, comparing their different opinions of engineers' responsibilities, problem-solving, and the main role in an engineer's career.

3 Health & and safety with risk assessments

Welding in a university workshop is classed as a high-risk activity. It takes place in an environment where there are likely to be students and members of staff who are not necessarily aware of the risks and dangers that are involved with welding.

Welding fumes are extremely bad for your health, “Both acute and chronic health risks are associated with welding fumes. Occupational lung disease, including lung cancer, is the most common health risk” (HSE.gov.uk, 2023) when being exposed to welding fumes. This is why it is important to make sure the relevant fume extraction unit is switched on and placed close enough to your workpiece. This will remove the harmful fumes before you can breathe them in. Another option is to use an air-fed welding mask, which will take in clean air from a respirator that is fitted to your belt, pass through a filter, and then the clean air is poured down over the welder's face (see Figure 1).



Figure 1 (air-fed welders mask) (Warehouse, 2023)

When welding in any environment, it is important to make sure you are wearing the correct (PPE) “personal protective equipment—PPE” (Haddad, 1 december 2021) as well as ensuring the safety of those around you. If a person was to get injured as a result of your welding, the correct precautions must be taken. The main PPE requirements for welding are:

1. Face shield. This is used to protect your face from heat and spatter that would come from the welding.
2. Eye protection. Welding produces an extremely bright light which, if looked at by the naked eye, will give you an arc eye, “Arc eye, or the medical condition photokeratitis, can feel like a sunburn on the eye. Arc eye can happen when welders’ eyes are exposed to the UV radiation flashes from welding torches known as “arcs.” (Hipp, 2021). Eye protection is a necessity when welding.
3. Respiratory protective equipment. A fume extraction system is required to remove harmful gasses or an air-fed welder mask to supply the welder with a clean feed of air.
4. Hand and arm protection. This protects the welder against spatter “Weld spatter is the small droplets of molten metal that are generated during MIG or MMA welding, at or near the welding arc” (Limited, 2023).

5. Protective clothing and footwear. Fireproof overalls are essential when welding. This dramatically reduces the risks of setting fire to your clothes and spatter burning through your clothes onto your skin. Safety boots or steel-toe cap trainers are required as welding usually involves heavy metal pieces.
6. Protective screen if welding in an open environment. Protective screens would be put around the place where the welding is taking place. This would allow people who may not be wearing PPE to be in the same place where the welding is taking place, without it affecting them.

A Risk Assessment Matrix is a visual tool to display the likelihood and impact of risks and prioritise them based on their potential consequences. In this matrix, risks are categorised into different levels of likelihood and impact, and each combination is assigned a risk rating and priority level.

Risk ID	Risk Description	Likelihood (1-5)	Impact (1-5)	Risk Rating (L x I)	Priority Level	Mitigation Strategies
R1	[setting fire to your clothes]	2	5	10	High	[wear fireproof overalls]
R2	[Getting arc eye]	1	4	4	Medium	[use welding mask equipped with tinted lens]
R3	[heavy objects falling onto feet]	4	3	12	Medium	[make sure objects are secured and protective footwear is worn]
R4	[burning your hands and arms]	3	3	9	High	[welding gauntlets (gloves) are worn to protect hands and arms from heat and spatter]
R5	[causing injury to others]	2	5	10	High	[warning signs are put out, welding screens are put in place, people are aware of risk]
R6	[leaving a hot object unattended]	3	5	15	High	[make sure the object is cool before being left, leave a sign to make people aware the object is hot, and do not allow people to approach the object]

Likelihood Scale: 1 - Rare 2 - Unlikely 3 - Possible 4 - Likely 5 - Almost Certain

Impact Scale: 1 - Negligible 2 - Minor 3 - Moderate 4 - Major 5 - Catastrophic

Risk Rating: (Likelihood x Impact)

Priority Level: Low: Risk Rating 1-4, Medium: Risk Rating 5-15, High: Risk Rating 16-25

Figure 2 (risk assessment matrix on welding)

4 Engineers role in society

Codes of conduct are there for engineers so they "perform under a standard of professional behavior that requires adherence to the highest principles of ethical conduct" (engineers, 2019). Codes of conduct are put in place to provide guidelines for engineers to follow. Engineers need to follow these guidelines to make sure they minimize the effect they have on waste, pollution, and resource usage. By doing this, it will have an overall lower impact on the planet.

Companies like "The Institution of Mechanical Engineers" (engineers, 2023) and "The Institute of Automotive Engineer Assessors" (assessors, 2023) both publish their unique codes of conduct that the engineers who work under their legislation are required to follow.

The Institute of Automotive Engineers Assessors represents more than 1300 automotive engineer assessors across the United Kingdom. Rule number three of their conduct states "A member of the institute, irrespective of grade, shall act by the principles of sustainability, and prevent avoidable adverse impact on the environment and society" (assessors, 2023). This implies that engineers are solely responsible for making sure they keep their environmental footprint to a minimum, using sustainable resources where applicable and making as little to no impact on the environment around where the activity is taking place. The institution of Mechanical Engineers on their code of Conduct states:

- Recognise the importance of socioeconomic and environmental factors.
- Comply with obligations for health and safety and environmental protection.
- Take account of the needs of a diverse environment, while never knowingly or deliberately exploiting natural resources
- Balance the needs of the present with the needs of future generations.
- We should engage responsibly with the environment.

(engineers, 2023)

The Institution of Mechanical Engineers appears to have more legislation on their sustainability conduct stating importance for future generations showing they are not just concerned about the current day sustainability but the future too. They state engineers will never knowingly or deliberately exploit natural resources. This is so there is no careless and excessive use of certain resources leading to things such as deforestation, extinction of species, and desertification.

5 Problem Solving

When developing a new product, many human errors can happen within the development process and supplying the product. Issues will be found during the development process of a new product, such as flaws in the design, the cost of making certain components and being able to produce the product in a cheap yet tough and durable manner. (Quelch, 1983) One way to reduce the risks of the product not being usable or unfit for purpose could be by prototyping and testing before the product goes into production. This can be done by rapid prototyping; “Rapid prototyping is an agile strategy used throughout the product development process. With this approach, 3-dimensional prototypes of a product or feature are created and tested to optimize characteristics like shape, size, and overall usability”. (Plan, 2023) this is to see how it will react to being handled or conjoined with other components to make sure it fits correctly, for example.

Sometimes issues with a new product would not be discovered until after it has reached the open market. That is why it is important to make sure there is a procedure in place in case it happens. The first step would be to consult a quick response team who would be able to investigate the issues and determine whether the product needs to be recalled or the problem can be resolved with replacement or compensation. A possible next step would be to create a fishbone diagram (see Figure 1) to delve deeper into the factors contributing to the problem. This would allow the manufacturers to understand what went wrong and at what point. This would then allow the correct precautions to be put in place to make sure it doesn't happen again.

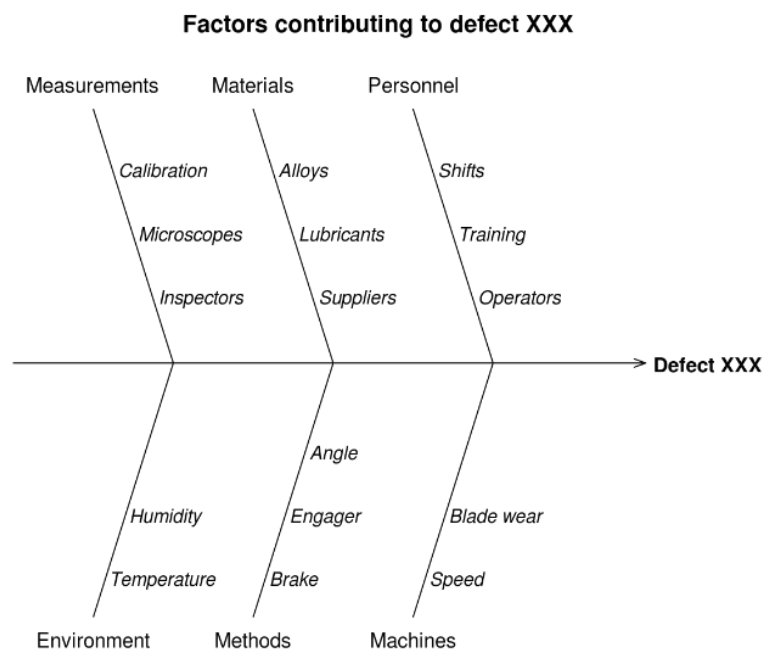


Figure 3 (fish bone diagram) (Ishikawa, 1990)

6 Team Structure

During my first year at university, we completed a group project where we were tasked with designing and costing a soap box to compete in a soapbox race. Working in a team is usually more effective than working as an individual, although it does produce its challenges and issues. Some examples of issues that might occur are:

1. Poor communication and lack of clear communication can lead to misunderstandings, confusion, and a breakdown in teamwork.
2. Inadequate leadership, poor leadership, or lack of a strong team leader can result in a lack of direction, unclear goals, and a disorganized workflow.
3. Conflicting goals and priorities. team members may have different priorities, goals, or values, leading to conflicts in decision-making.
4. Lack of accountability, when team members don't take responsibility for their actions or tasks they have been assigned, which can lead to missed deadlines, inadequate work, and frustration among the other team members.
5. Poorly defined roles, where team members are unsure of their roles or responsibilities, which can lead to duplication of efforts, gaps in the task at hand, and frustration among others.
6. Personality conflicts, clashes in personalities, and working styles can create tension within a team, affecting collaboration and overall morale.

Addressing these challenges requires communication, strong leadership, always having a positive attitude toward teamwork, constant feedback, and communication which can help improve overall team effectiveness.

Although there are many negative reasons people may not like to work in a team or think it is an effective way to work, "success or failure in business is a result of whether people work together effectively in teams" (Charles Margerison, 1990), working in a team can offer many benefits and can be a highly effective choice in many different situations. Here are some examples of why working in a team on a task is a good idea:

1. Diverse skills and perspectives. Teams bring together individuals with diverse skills, experiences, and different perspectives, which can lead to more effective and creative problem-solving.
2. Increased efficiency. Tasks can be divided among team members based on their strengths and expertise, leading to increased efficiency and faster completion of projects.
3. Shared workload. Working in a team allows for the distribution of workload, preventing individuals from feeling overwhelmed and ensuring that tasks are completed more quickly and effectively.
4. Improved decision-making, which often benefits from the collective knowledge of team members, different perspectives, and expertise, contributing towards more well-rounded decisions.
5. Increased motivation, a sense of shared responsibility, and accomplishment can boost motivation. Team members often find motivation in contributing to the success of the team and achieving the tasks at hand.
6. Social support. Teams provide a support system, allowing team members to share successes, challenges, and feedback. This social support can contribute to a positive work environment.

While teamwork can be highly beneficial, it's essential to address potential challenges and ensure effective communication and collaboration. Successful teamwork “Is about being able to collaborate, cooperate and manage conflicts with other people to get things done” (Indeed, 10 march 2023).

A great way to visually show a timescale of the tasks that need to be completed is by using a Gantt chart. A Gantt chart is a type of bar chart that provides a visual representation of a product schedule. They are used in project management to show the start and finish dates of various elements of a project. (Post-it, 2023)

Gantt Chart

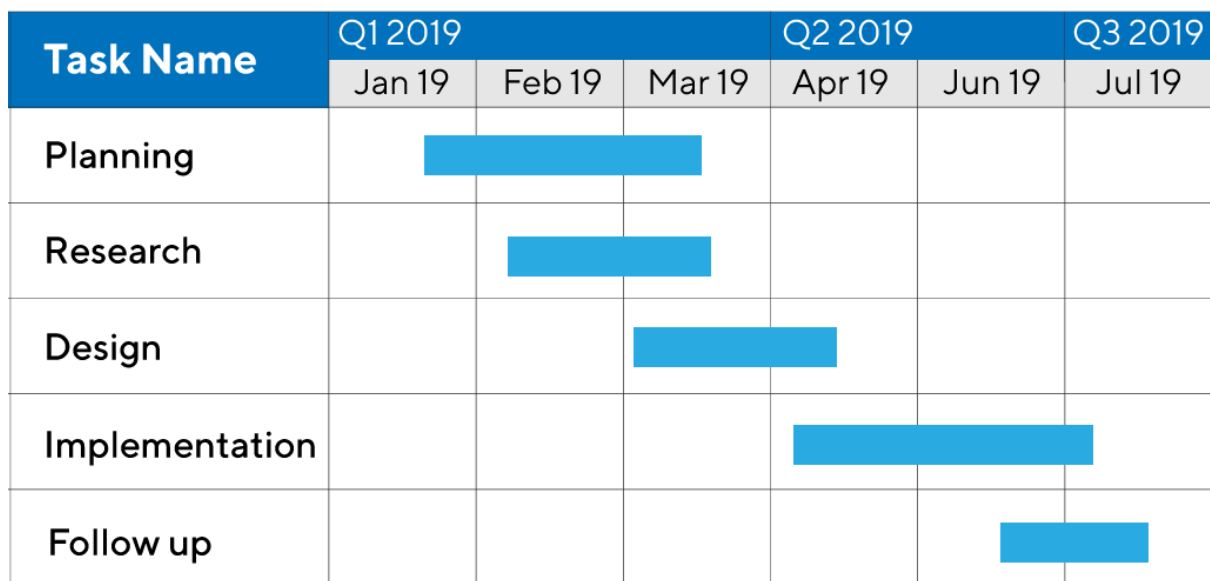


Figure 4 (Gant chart) (Productplan, 2021)

7. Personal Development Plan

Personal Development Plan

Previous Qualifications –

- city and guilds full qualification in electrical installations,
- Foundation motorsport engineering qualification

Previous Experience –

- John Lewis sales assistant (3 years)
- Performance go-kart mechanic at Club 100 (3 years)

Long Term Goals (5 to 10 years)				
Have a stable career with importance and responsibility. Own my own home. Have children. Be married.				
Short Term Goals (0 to 5 years)				
Graduate university with a 2,1 Increase my savings. Make more time to study.				
Goal	Objective	Resources Required	Measurement	Target Date
To increase my savings.	To be able to comfortably fund myself.	A stable job and self-control.	Increase to 20k	2026
To create a study plan to fit around work and study commitments.	To be able to manage my time effectively and to improve my confidence with assignments and exams.	Refer to the assessment calendar to prepare for upcoming deadlines.	Keeping up to date with the calendar and making sure I stick to the schedule.	2026
To graduate university	To be able to obtain a successful career.	Pass modules and exams.	Assignments and exams pass rate.	2026
To seek permanent employment.	To be in a stable career.	Having a well-structured CV, a proactive persona and relevant work experience.	Passing a probationary period at future employment.	2026
To own my own home.	To be settled and have independence.	A career to save for a house.	Obtaining a mortgage and purchasing a house.	2028
To be married.	To build a future with a partner.	Money to fund wedding and a stable career.	Organising and booking a wedding.	2029
To have children.	To be able to create a family life.	Wife/house/stable income.	Reaching the point of being comfortable and stable.	2033

8 Conclusion

To conclude, health and safety in the workplace is an exceptionally important part of an engineer's career. It allows workers to feel secure that they are being looked after by their company. PPE helps make a workplace a safer environment with the use of risk assessments as well. Due to health and safety being an integral part of a workplace, a company's Code of Conduct can prevent engineers from not understanding what their company expects of them, to abide by environmental precautions. Moreover, problem-solving is another important part of an engineer's career so it is important for them to be able to solve problems in the most effective manner.

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