

University of Wales Trinity Saint David

Wales Institute of Science & Art



Engineering Technical Report

Workshop and Practice

ACHA4011

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1 Introduction

This report provides an overview of keys topics that were covered during Semester 1 of Workshop and Practice. These topics are Health and Safety, the role of engineers in society, Problem solving, Team structure and Personal development plan.

2 Health and Safety with Risk Assessment

2.1 Workshop session

For the past month students have worked in small groups to complete some workshops sessions, such as learning how to operate a lathe and a milling machine. During these sessions, all students were required to wear appropriate Personal Protective Equipment (PPE), including Steel-toe boots, Lab Coat and Safety Glasses.

In the UK, health and safety regulations are governed by the Health and Safety at Work etc. Act 1974, which places a legal duty on employers and institutions to protect people from harm. Also, equipment must comply with Provision and Use of Work Equipment Regulations 1998(PUWER) (Health and Safety Executive, 2014;2020).

The British standard (BS EN ISO) for PPE And the safe use if machinery in the workshop is:

- “BS EN ISO 13688:2013 – protective clothing (Lab Coat).”
- “BS EN ISO 166:2002- personal eye protection (safety googles).”
- “BS EN ISO 23125:2015-Machine tools – Safety – Turning machines (lathes).”
- “BS EN ISO 12100:2010-Safety of machinery – general safety design and risk reduction for machinery.”

These standards are in place to minimise the risk of injury when using workshop equipment such as the lathe. A lathe is a machine that used to shape materials like metal or plastic by rotating the workpiece against a cutting tool.

2.2 Risk Assessment matrix

A risk assessment matrix is a visual tool used in engineering and workplace safety to assess the level of risk associated with a specific task. It works by rating each potential hazard based on two key factors: the probability of the risk occurring and the impact of the potential outcome. These ratings are then combined to calculate a risk score, which helps organisations prioritise which risks require the most immediate attention and apply appropriate control measures.

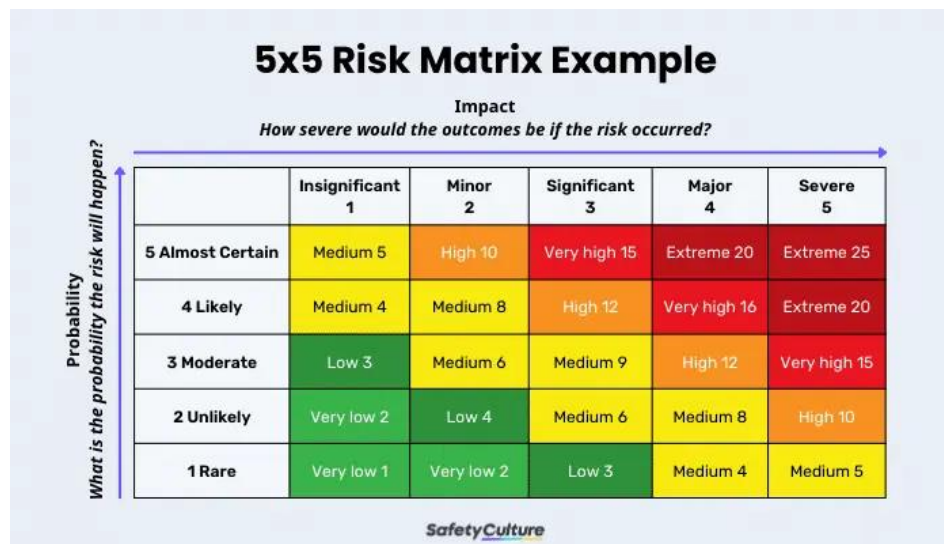


Figure 1 Risk Assessment Matrix (Patricia Guevara, 2024)

2.2.1 Risk Assessment for operation of a lathe:

Table 1 hazards when using a Lathe (made by student)

Hazard	Probability	impact	Risk level	Control measure
Entanglement in rotating part	Moderate (3)	Major (4)	High (12)	Wear snug clothing, tie back hair
Flying debris (swarf)	Likely (4)	Minor (2)	Medium (8)	use safety goggles and wear lab coat
Contact with sharp material	Moderate (3)	Significant (3)	Medium (9)	Use gloves and proper handling technique
Tool breakage	Unlikely (2)	Significant (3)	Medium (6)	Inspect tool regularly and before use.

3 Engineers' role in society

The Engineer's role in society is to create, build, maintain and support modern technology, essential infrastructures, projects and make other specialist such work a reality.

3.1 Chartered engineers

Chartered engineers (CEng) are a licenced professional who uses new or existing technologies to develop solution to complex engineering problems while also using creativity and technical analysis. Their academic knowledge is at master's level or equivalent.

3.2 Research

Two key organizations that publish code of conducts for engineers are the Institute of Mechanical Engineers (IMechE) and the National society of professional Engineers (NSPE). Each organization focuses on ethical practices and responsibilities toward suitability and environmental protection, these are relevant to motorsports engineering.

3.2.1 IMechE and NSPE

IMechE outlines four main principles in its code of conduct:

1. Care and competence- maintain and develop professional knowledge and keep record of continuous development.
2. Integrity and trustworthiness- present and review engineering evidence truthfully and accurately.
3. Environmental responsibility- recognises the importance of socio-economic and environmental factors when making decisions.
4. Positive contribution- promote a positive image of profession through clear, truthful and competent communications (IMechE,2021).

NSPE offers a similar code of ethics:

1. Public safety and welfare – prioritise the safety, health and well-being of the above all.
2. Professional competence- Provide services only in areas of their expertise.
3. Truthfulness in communication – Issue public statements in an objective and truthful manner.
4. Loyalty and honesty- Act as a faithful agents or trustees for clients and employers.
5. Ethical conduct- Avoid deceptive acts and maintain honourable behaviour in all professional matters (NSPE, no date).

3.2.2 Relevance to Motorsports

Motorsports are traditionally associated with high environmental impact, these are use of fossil fuels, Co2 emissions and resource-intensive manufacturing processes. Both organizations encourage motorsports engineers to always develop and improve sustainability and advancement in racing technologies. Motorsports serve as a place to test new automotive technologies; engineers are obligated to ensure innovation benefits society by improving vehicles efficiency and safety. Both organizations are advocate for electrification, such as formula E or other EV race series and hybrids systems like in F1 and Hypercar class in world endurance championship.

4 Problem solving

4.1 Issue found during development:

in automotive and motorsports engineering, development projects often face challenges due to complexity of system, extreme performance demand and tight timelines. Some common issues are challenges with managing temperature, material selection and durability and reliability during high stress.

One way to solve the issues is through Root cause analysis (RCA). RCA helps engineers identify the underlying cause of a failure instead of just addressing the symptoms. A useful tool within the RCA is the Fishbone Diagram, also known as the Ishikawa diagram. This tool helps teams systemically categorise potential causes of a problem into areas such as environment, methods and machine, as shown below (Figure 2), allowing for a detailed analysis (Syafina Firdaus,2024).

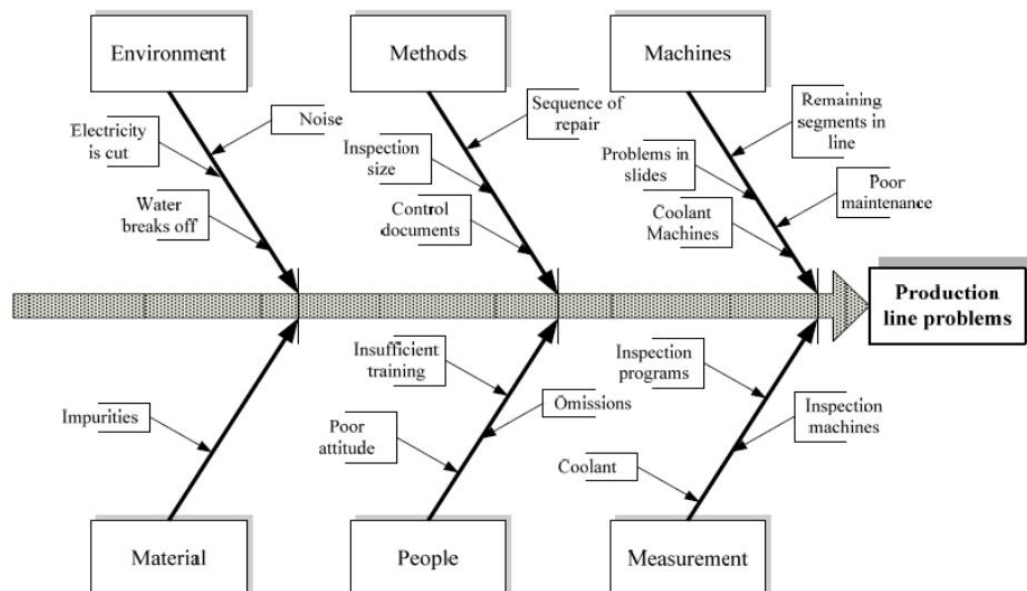


Figure 2 RCA Fishbone diagram (Syafina Firdaus 2024)

4.2 Issue Found Once on Market

Once an automotive or motorsports product gets released to the market, new challenges can appear that were not recognised during the development. These problems often appear due to real world usage. Some common issues are reliability and durability issue, software problems and safety concerns.

There are some ways to solve issue found once it's on the market:

- Customer Feedback Analysis:
Collect data from customers to understand the scope and impact.
- Corrective Action Plan:
Develop a containment and remediation plan (e.g., recall, software updates).

4.3 Supplier Issue in the Production Process

In automotive and motorsport engineering, supplier related problem in the production process can significantly affect the overall project due to high-performance requirement tight and stringiest quality standards. Some common supplier issues are component quality failing, material shortage and manufacturing defects.

There are some ways to solve issue supplier related problems in the production:

- Supplier Audit:
Review supplier processes and quality control measures.
- Alternative Sourcing:
Identify backup suppliers for critical components.

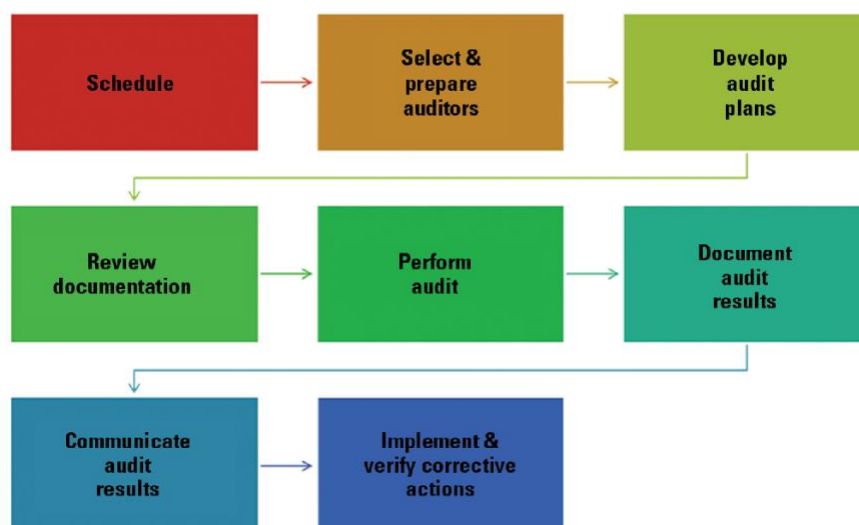


Figure 3 supplier audit flow diagram (Jim White, 2019)

5 Team structure

Last year, during our foundation course, we were tasked with working in a team to design a soapbox for the Richards Castle Soapbox Derby. The project lasted a few months and consisted of a two-part assignment.

in the first part, we focused on researching material, costs, drivability, additionally, we were tasked with documenting meeting minutes and maintain a Gannt chart to track progress. We also developed four viable concepts for the soapbox. In the second part, we finalised the design, created a list of materials, calculated the total cost. At the end we presented our findings and plans to our lecturer.

Our team was structured with each member assigned to a specific role. For example, one person focused on researching material, another finalised the design, and someone else handled the cost analysis. Splitting the jobs had its advantage such as with everyone assigned a distinct task, we could work more efficiently and avoid duplication.

However, there were problems if a team member did not complete their work effectively or on time, it could hinder the progress of the entire group, as other had to wait for them to finish before proceeding.

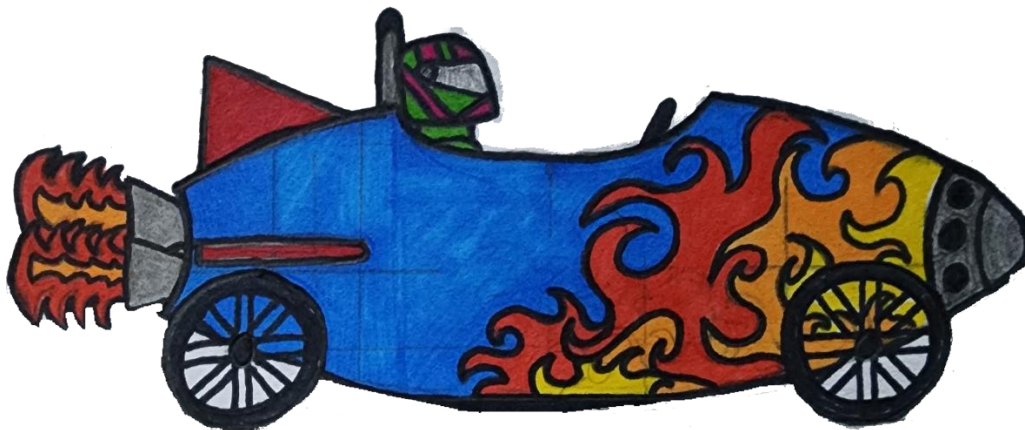


Figure 4 drawing of our final soapbox (designed by us)

5.1.1 Research

The type of team structure used was a functional team structure. Characteristics of a functional organisational structure include department being organised based on common skills, expertise and work activities. It features strong hierarchy-based decision making, with information flowing vertically and limited cross functional communication. Each department has clear goals, and employees develop specialised skill sets and extensive expertise within their specific field. According to AIHR (2024), this structure improves efficiency through clearly defined authority and roles, but it can reduce flexibility and limit cross functional collaboration.

Pros:

- Specialization and expertise
- Efficient resource uses
- Clear chain of command
- Consistency in work
- Opportunities for career growth (AIHR,2024)

Cons:

- Reduced flexibility
- Overdependence on functional managers
- Delayed decision making
- Potential for employee dissatisfaction (AIHR,2024)

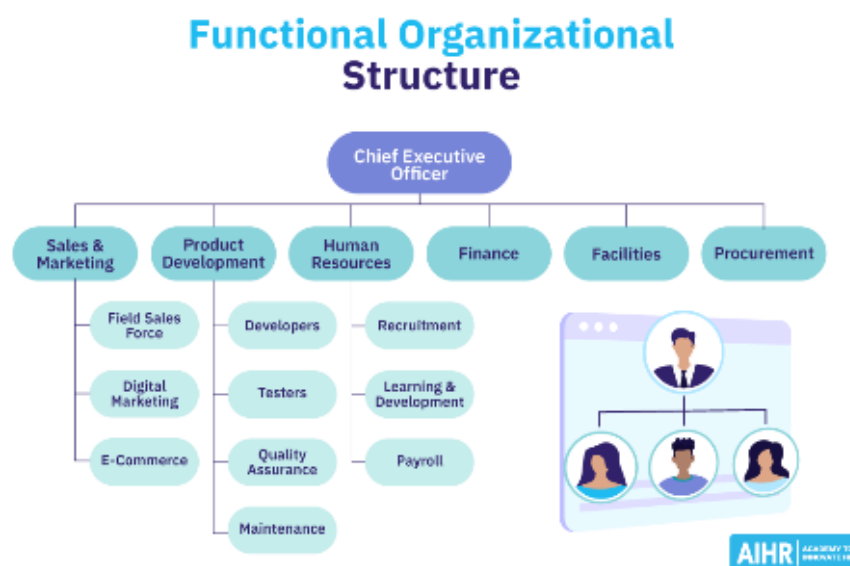


Figure 5 Functional structure chart (AIHR,2024)

5.1.2 Alternative

Matrix structure:

Matrix structure is a type of organizational design that blends functional and project-based (or product-based) structures to create a flexible and dynamic work environment. It is commonly used in businesses to optimize resource utilization and improve communication across different departments and projects. Key characteristics of a matrix structure are, dual authority employee report to two managers, resource sharing and flexibility and adaptability. (Asana,2024)

Pro:

- Efficient resource utilisation
- Enhanced collaboration
- Improved decision making
- Flexibility

Cons:

- Conflict in authority
- Complexity
- Time consuming
- Employee stress

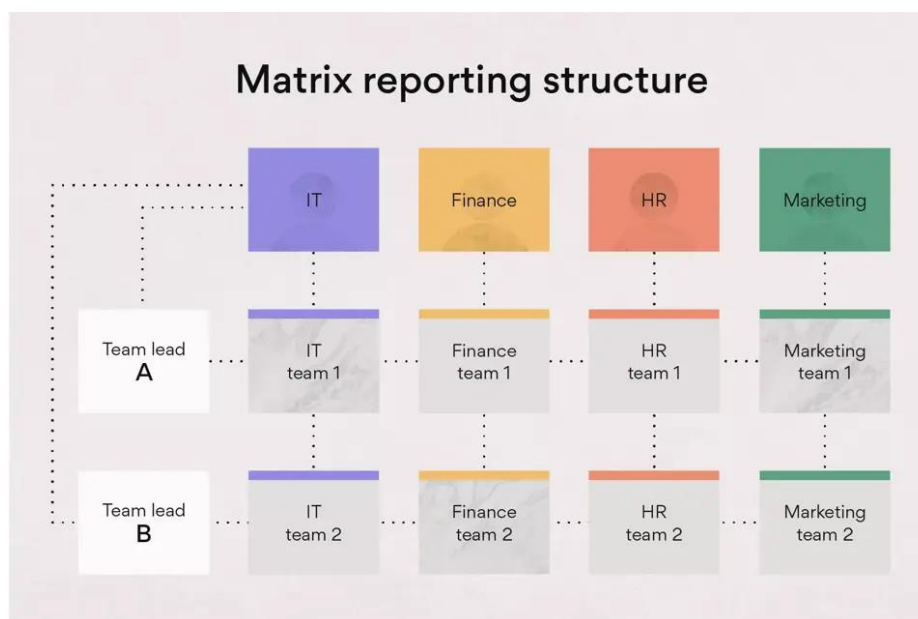


Figure 6 Matrix Structure (Asana,2025)

While the functional structure worked well for the soapbox project in terms of clarity and task completion, the team occasionally struggles when tasks overlapped or required group decision-making. While a matrix structure may have encourage better collaboration, during design reviews and material sourcing. In future projects, a combination of both structures could offer a balance between structure and adaptability.

6 Personal development plan

personal development plan (PDP) is a continuous process that's drives an individual to improve their knowledge, skills, and experience, allowing them to achieve their goals. A PDP is a method of focusing a person's goals into achievable steps, helping them track their progress and support their overall personal growth.

Degree: Motorsports Engineering

Previous qualification: mathematics, Geography, Environmental systems and societies, Japanese ab initio, English. International Baccalaureate (IB)

Previous experience: raced semi-pro for 2 years back in Thailand. Worked on personal cars before.

Table 2 personal development plan long term goals (made by student)

Long term Goals (5-10 year+)	Objective	Resources Required	Measurement	Target Date
Work in competitive motorsports.	Secure a role within WEC or a GT series as a mechanic or engineer.	Technical training, industry experience and contacts.	Employment with a professional race team.	2035
Open a personal workshop and a race team.	Open and manage a motorsports garage and workshop in Thailand (home).	Industry experience, planning, money and contacts.	Garage successfully opened and operating.	2045

Table 3 personal development plan short term goals (made by student)

Short term goals (0-5 years)	Objective	Resources Required	Measurement	Target
Becoming a Competent motorsports mechanic.	Gain more hands-on experience working on engine and mechanical systems.	Knowledge from technicians, manuals and online resources.	Becoming confident in disassembling and reassembling engines and other components.	Jun/2027
Building industry contacts.	Attend events, engage and with motorsports communities.	Guest lectures, LinkedIn and events.	Established contact with people in the motorsports industry.	End of 2027
Graduating with at least a 2:1 degree.	Attend lectures and revise effectively.	Lecturers support, study and materials	Final average grade of 60% or higher.	June 2027
Join a professional race team.	Secure a full-time position with a race team.	Hands-on experience, motorsports contacts, university support and CV.	Employed by a race team within 6-12 months of graduating.	December 2028

7 Conclusion

This report has explored important parts of engineering place, such as health and safety, critical role of engineers in society, problem solving methods, team structure and the importance of CPD. By analysing workshop session and identify safety measures like using risk assessments. The report shows the diverse responsibilities of engineers from ethical consideration to sustainability advancements in industries like motorsports. though problem solving and teamwork emphasises the significance of structured collaboration. Additionally, the integration of AI in engineer is an important tool for innovation and efficiency, as discussed during the CPD event. Engineers need to understand these advancements to remain at the top of their profession.

In summary, the report combines practical knowledge and theoretical insights, offering a better understanding of engineer's role in making a safer and more sustainable future.

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