

ENGINEERING TECHNICAL REPORT

**Workshop and Practice
(ACHA4011)**

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1. Introduction

Within this report the health and safety legislations as well as an assessment of the risks involved with an engine strip activity will be discussed. An engineer's role in society will also be analysed in regards to a professional engineer's responsibility towards the environment as well as the current environmental issues within motorsport. The ability to solve real world problems within the engineering industry is an integral part of an engineer's skillset. This will also be analysed within this report. A previous team experience will also be discussed and compared to an ideal team structure as an effective team structure can make light work of any task. The final segment of this report will be a personal development plan outlining my short and long term goals and the requirements to meet them.

2. Engine Strip Activity

A five week engine strip exercise was held for all students in order for them to gain familiarity with the inner workings and components of an engine. This section will analyse further the health & safety legislations followed for these sessions as well as discuss the risks and hazards that were present.

2.1 Health & Safety

As stated in the Personal Protective Equipment at Work Regulations 1992, one of the main hazards which necessitates safety boots are *“objects falling on and crushing the foot/toes – this hazard may occur in jobs requiring manual handling”* (Health & Safety Executive, 2022). An engine strip will inevitably result in having to manually handle heavy components such as the engine head. Therefore, according to these legislations, safety boots were necessary in the engine strip sessions. This necessity was fulfilled and students did use safety boots.

A case can also be made for the use of gloves during the engine strip sessions to provide *“protection from cuts and abrasions; for example, when handling sharp or pointed objects”* (Health & Safety Executive, 2022). This addition would protect student's hands from injury predominantly whilst unthreading tight bolts that give quickly. This occurrence presents the risk of hitting a sharp edge of the engine with a large amount of force. However, the use of gloves could also prove to be a hinderance whilst stripping more confined areas of the engine where more precision is required.

2.2 Risk Assessment Matrix

An effective way to assess the risk of a hazard is a risk assessment matrix (as seen in Table 1 below). This uses the probability and the possible impact of a hazard to determine its risk level.

		Impact				
		Insignificant 1	Minor 2	Significant 3	Major 4	Severe 5
Probability	Almost Certain 5	Medium 5	High 10	High 15	Very High 20	Very High 25
	Likely 4	Low 4	Medium 8	High 12	High 16	Very High 20
	Moderate 3	Low 3	Medium 6	Medium 9	High 12	High 15
	Unlikely 2	Very Low 2	Low 4	Medium 6	Medium 8	High 10
	Rare 1	Very Low 1	Very Low 2	Low 3	Low 4	Medium 5

Table 1: Risk Assessment Matrix table (author's own)

As previously discussed, a major hazard whilst stripping an engine is dropping a part and getting an injury because of it. This occurrence is relatively unlikely to happen. However, if it was to happen it would have a significant impact depending on the size and weight of the component dropped. A score of 6 puts this hazard comfortably in the medium risk level. Further measures such as multiple people lifting engine parts could be considered although this hazard isn't something that would need immediate review.

The second hazard discussed was students injuring themselves whilst unthreading bolts. This hazard is far more likely to happen due to the number of bolts on an engine and especially because of the awkward positioning many of them have. Despite this, the impact is minor as it would only result in small injuries to the hand or fingers. A score of 8 also gives this hazard a medium risk level.

3. Engineer's Role in Society

It is stated in the Statement of Ethical Principles which is jointly published by the Engineering Council and the Royal Academy of Engineering that professional engineers should *“protect, and where possible improve, the quality of built and natural environments”* (Engineering Council & The Royal Academy of Engineering, 2017). However, this has proven to be a challenge within the motorsport industry due to its excessive carbon footprint. The biggest contributor by far to this footprint is the transportation from each round of a championship to the next. For example, *“For an entire race season, approximately 256,000 CO₂ equivalent tonnes are generated”* (Formula 1, 2019) *with 45% of that total being generated by logistics* (Formula 1, 2019). Whilst Formula 1 is an example of a higher scale than most motorsport categories, it gives a clear indication of where the biggest changes need to be applied in order to reach the objectives of the Statement of Ethical Principles.

Despite the current footprint motorsport championships generate, *“future trends are beginning to be oriented to sustainability issues and there is a growing interest in assessing the sustainability profile of racing vehicles”* (Pero, 2020). Formula E is a clear example of this shift towards sustainability. Not only are its cars fully electric, but it also *became “the first global sport to be certified with a net zero carbon footprint from inception back in 2020”* (Formula E, 2022). Achieving net zero status from inception is near impossible for more established championships. However, the engineers working within Formula E have showed that through *“effective measurement of carbon output, prioritising reducing of the championship footprint and offsetting unavoidable emissions”* (Formula E, 2022), it is possible for engineers within the motorsport industry to *protect, and maybe even improve the quality of the environment* (Engineering Council & The Royal Academy of Engineering, 2017) in the future.

4. Problem Solving

4.1 An issue found in development

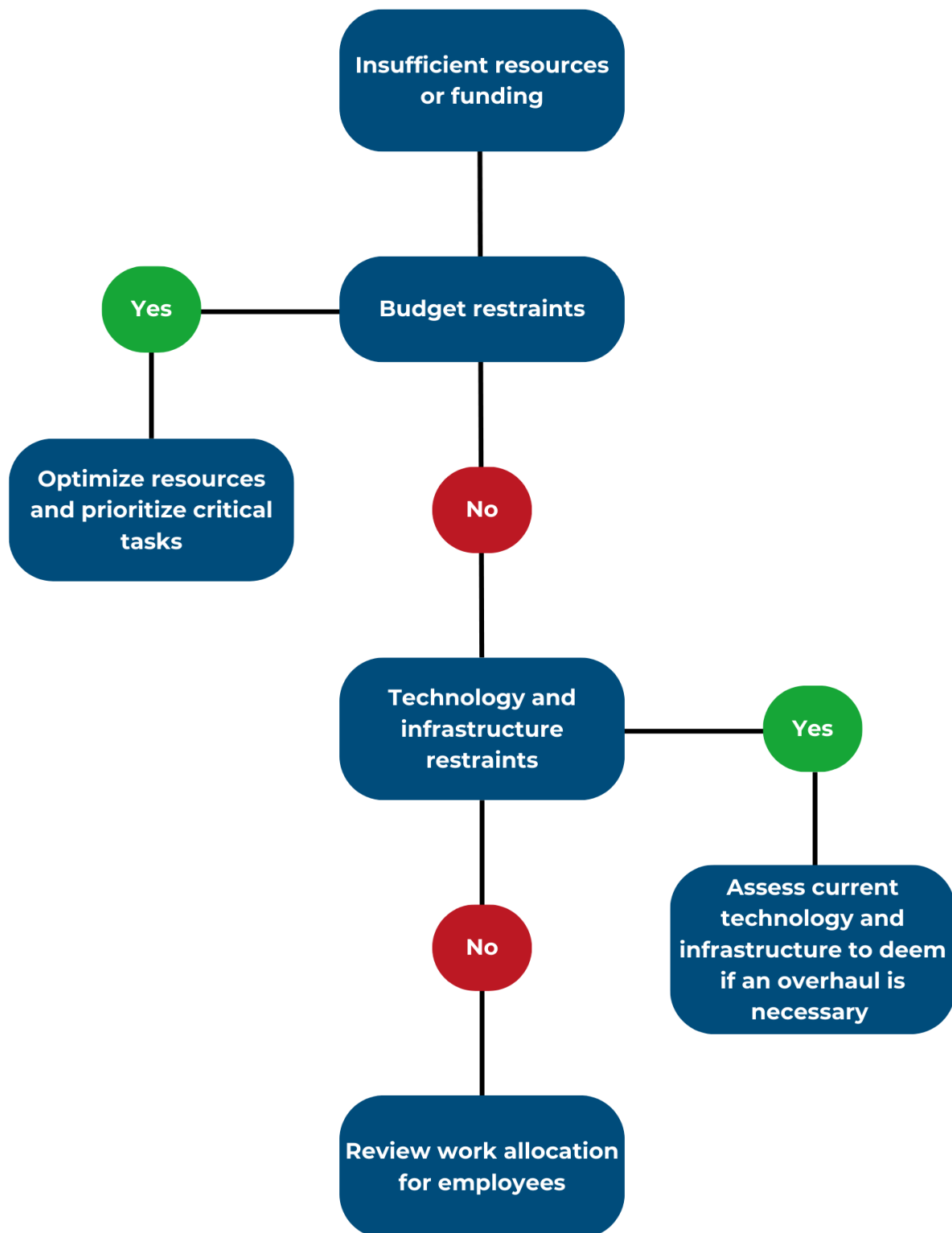


Figure 1 (author's own)

As seen to the left (Figure 1) there are multiple ways to resolve a lack of resources or funding with effective problem solving; problem solving being *“the application of knowledge or thinking and the ability to achieve certain goals”* (Dewi, 2019). The first and most obvious answer would be to review the budget for the product and prioritise essential tasks to keep development running. Technology and infrastructure could be another issue that could be resolved by a review to assess whether an investment in new resources is necessary. If all else fails, a review into the work allocation might be needed to boost resources.

4.2 An issue found once on the market

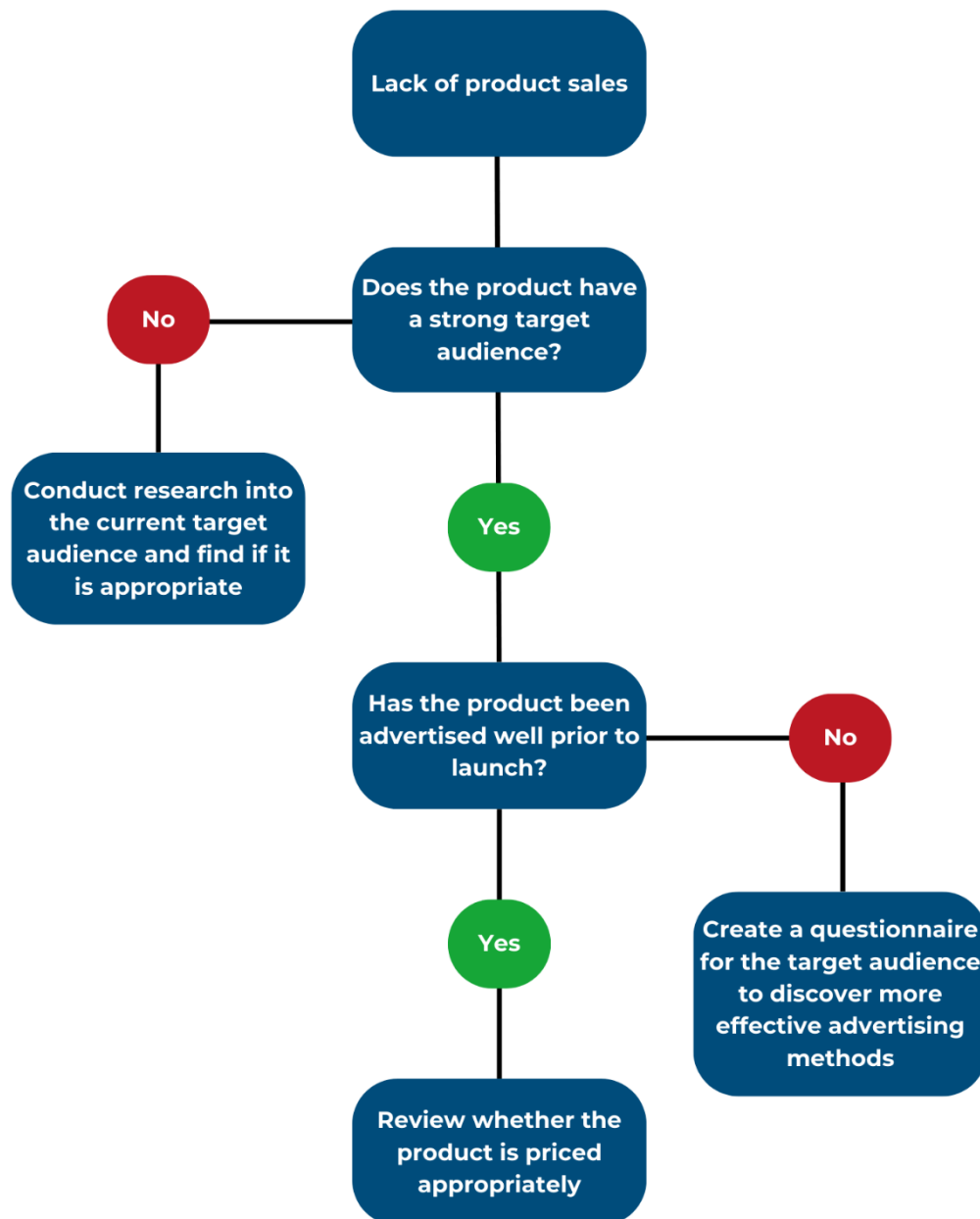


Figure 2 (author's own)

As seen to the right (Figure 2) if a new product faces a lack of sales after going onto the market, a review of the intended target audience could be in order to ensure the product is being pushed towards the right demographic. If this isn't the case then advertising could be another weakness of the new product. Effective advertising methods for the target audience could be explored or even a questionnaire directly towards them. However, if the price isn't appropriate then these factors

won't matter because interest will rarely pick up regardless of the product's benefits or quality.

4.3 A supplier issue in the production process

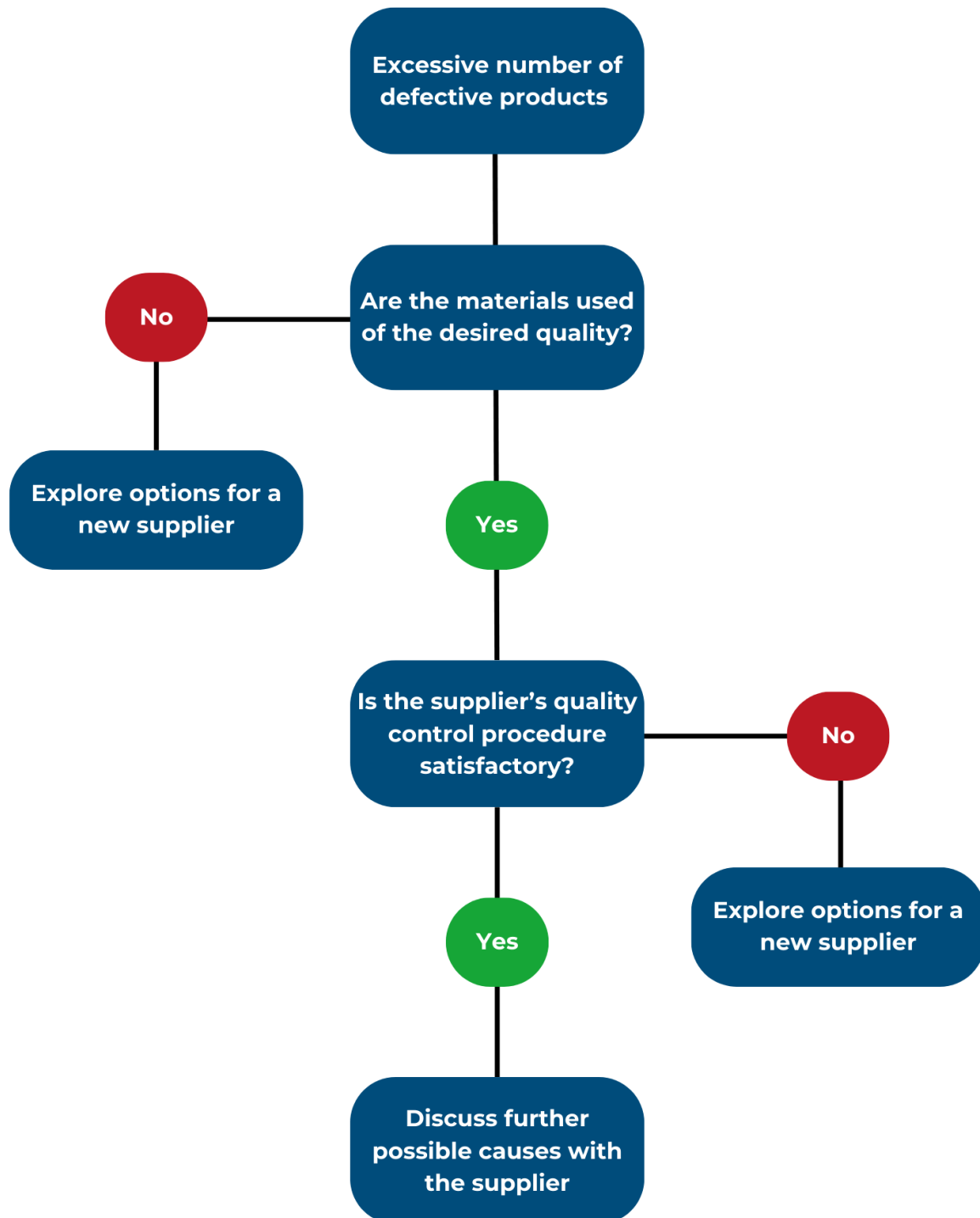


Figure 3 (author's own)

Working with an external supplier means ensuring quality and managing risk, running costs as well as meeting compliance requirements (Tracelink, 2021). However, if any of these conditions aren't met by the supplier, alternative options may need to be considered. One example of these failures would be an excessive number of defective products being supplied. As seen to the left (Figure 3), there are possible causes such as material quality and quality control thoroughness that could be to blame. Rather than immediately seeking to cut ties with the supplier, further discussions to find the issue and stop it happening in future could also be more constructive.

5. Team Structure

On the third day of the university's welcome week we were split into groups for a bridge building team exercise within which we were given a limited amount of time and resources to build a functional bridge. This bridge would then compete against all other teams with the bridge surviving the most weight placed onto it without failure being the winner. Our team took a structure similar to that of a functional organizational structure where *"teams are grouped based on their skills and knowledge"* (Team Asana, 2023). Although in our scenario the groups were individuals as there were only 4 of us altogether. I took responsibility for the gluing of all components for the bridge whilst another one of my teammates took the role of arranging the components correctly in order to glue them more efficiently. The final two teammates decided to brainstorm further possible ideas and visualise them on paper first rather than trying it out on the real bridge and risk an idea failing on the real thing.

Overall, I believe that our team structure worked relatively efficiently mostly because everyone had their own individual job and knew exactly what they were doing. However, one negative aspect of this team structure is that communication wasn't being used to its full potential. We went on with our individual tasks and sometimes forgot to stop and check how the rest of the team were doing. For example, there were a few occasions when I had asked for a specific arrangement of pieces to glue and hadn't received them due to my teammate engaging with the brainstorming of the rest of the team. I believe the time limit was also something that negatively affected the team because with it came rushed work and carelessness. It got progressively more difficult to convey new ideas and converse with the team as the time limit approached. This is where I believe a clear team leader to make the final decisions would have benefitted us greatly.

In terms of a more appropriate team structure, I believe a hierarchical organizational structure in which *"one person in the group should be given the authority for directing the hiring process* and should solicit the opinions of those involved but maintain sole responsibility for the final decision"* (Messmer, 2004). Had we used this structure, every member of the team would have been able to present their ideas to one individual which would then decide on the best one themselves. This would eliminate the uncertainty we had within the team over which idea we were actually going for.

*Referenced journal discusses team structures within a hiring process specifically but explains the concept of a hierarchical organizational structure effectively.

6. Personal Development Plan

Name - Aron Evans

Degree - Motorsport Engineering

Previous Qualifications - Level 3 National Certificate in Engineering, Duke of Edinburgh Bronze

Previous Experience - Track Marshall, Volunteering at AzTech Precision

Long Term Goals (5 to 10 years)

- Secure employment within the motorsport industry

Short Term Goals (0 to 5 years)

- Make connections within the motorsport industry
- Improve my understanding of vehicle anatomy
- Continue to participate in practical workshops
- Apply the theory learnt within the course modules into practical workshops

Goal	Objective	Resources Required	Measurement	Target Date
Secure employment within the motorsport industry	- Build on the industry connections made during the course - Create a professional portfolio - Conduct further research to discover employment opportunities	- LinkedIn - References - Experience in the industry - Motorsport Engineering Degree	- Gain employment using the connections and experience gathered	- 2028 onwards
Make connections within the motorsport industry	- Attend conferences, races and events - Attend guest lectures at the university - Conduct further individual research on the relevant companies	- LinkedIn - University Library - Seminars and webinars - Extracurricular university trips	- Build a healthy profile of contactable businesses	- 2023 - 2026

Improve my understanding of vehicle anatomy	- Use university resources to gain further understanding - Attend MCR workshop sessions - Conduct individual research	- University Library - Individual research - Practical workshop sessions	- Make a substantial advance in my understanding of car components and their behaviours	- 2023 - 2026
Continue to participate in practical workshops	- Attend MCR workshop sessions - Familiarise workshop tools and their functions - Learn good workshop etiquette	- University workshops - Progress tracker - Tool chart	- Successfully recognise and use the correct tools within a workshop for a set task	- 2023 - 2026
Apply the theory learnt within the course modules in practical scenarios	- Attend MCR workshop sessions - Attend motorsport events - Research motorsport vehicles to gain a further understanding of their architecture	- University workshops - Event calendar - Journals	- Gain the ability to identify components and their purpose when removing and replacing them onto vehicles in the workshop	- 2023 - 2026

7. Conclusion

To conclude, there are many legislations and regulations operating in the background to keep individuals safe from the many hazards and risks whilst working in workshop. Professional engineers in motorsport are finding new ways to reduce the footprint of the industry on the environment using sustainable methods and technologies. Engineering problems have many constructive ways to be solved such as using visual methods like flow charts to help communicate ideas clearly and effectively. The use of adequate team structures in a group task can vastly increase group efficiency as well as the end product even if it's as simple as selecting a clear leader who has the final say on new ideas. Creating a personal development plan helps massively with visualising my targets as well as what I need to do to achieve them within a realistic timeframe.

8. Reference List

Dewi, G. S. W. S. A., 2019. The needs analysis on module development based on creative problem solving method to improve student' problem solving ability. *Journal of Physics: Conference Series*, 1153(1), pp. 1-6.

Engineering Council & The Royal Academy of Engineering, 2017. *Statement of Ethical Principles*. [Online]

Available at: <https://www.engc.org.uk/media/2334/ethical-statement-2017.pdf>

[Accessed 23 November 2023].

Formula 1, 2019. *Formula 1 Sustainability Strategy*. [Online]

Available at: <https://corp.formula1.com/wp-content/uploads/2019/11/Environmental-sustainability-Corp-website-vFINAL.pdf>

[Accessed 23 November 2023].

Formula E, 2022. *How Formula E Achieves Net Zero*. [Online]

Available at: <https://www.fiaformulae.com/en/news/2023/how-formula-e-achieves-net-zero>

[Accessed 26 November 2023].

Health & Safety Executive, 2022. *Personal protective equipment at work*. [Online]

Available at: <https://www.hse.gov.uk/pubns/priced/l25.pdf>

[Accessed 19 November 2023].

Messmer, M., 2004. The Politics of Hiring. *Strategic Finance*, 86(1), pp. 11-12.

Pero, F. B. L. D. C. D. M., 2020. Environmental sustainability analysis of Formula-E electric motor. *Proceedings of the Institution of Mechanical Engineers, Part D: Journal of Automobile Engineering*, 235(2-3), p. N/A.

Team Asana, 2023. *Team structure: 10 effective ways to organize your team*. [Online]

Available at: <https://asana.com/resources/team-structure>

[Accessed 29 November 2023].

Tracelink, 2021. *The Top 6 Supplier Relationship Management Challenges-and the Digital Capabilities You Need to Overcome Them*. [Online]

Available at: <https://www.tracelink.com/knowledge-base/the-top-6-supplier-relationship-management-challenges#:~:text=The%20main%20challenges%20facing%20supplier,compliance%20requirements%2C%20and%20managing%20costs.>

[Accessed 27 November 2023].