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STEM Racing Guide for Beginners (Dev/Pro)

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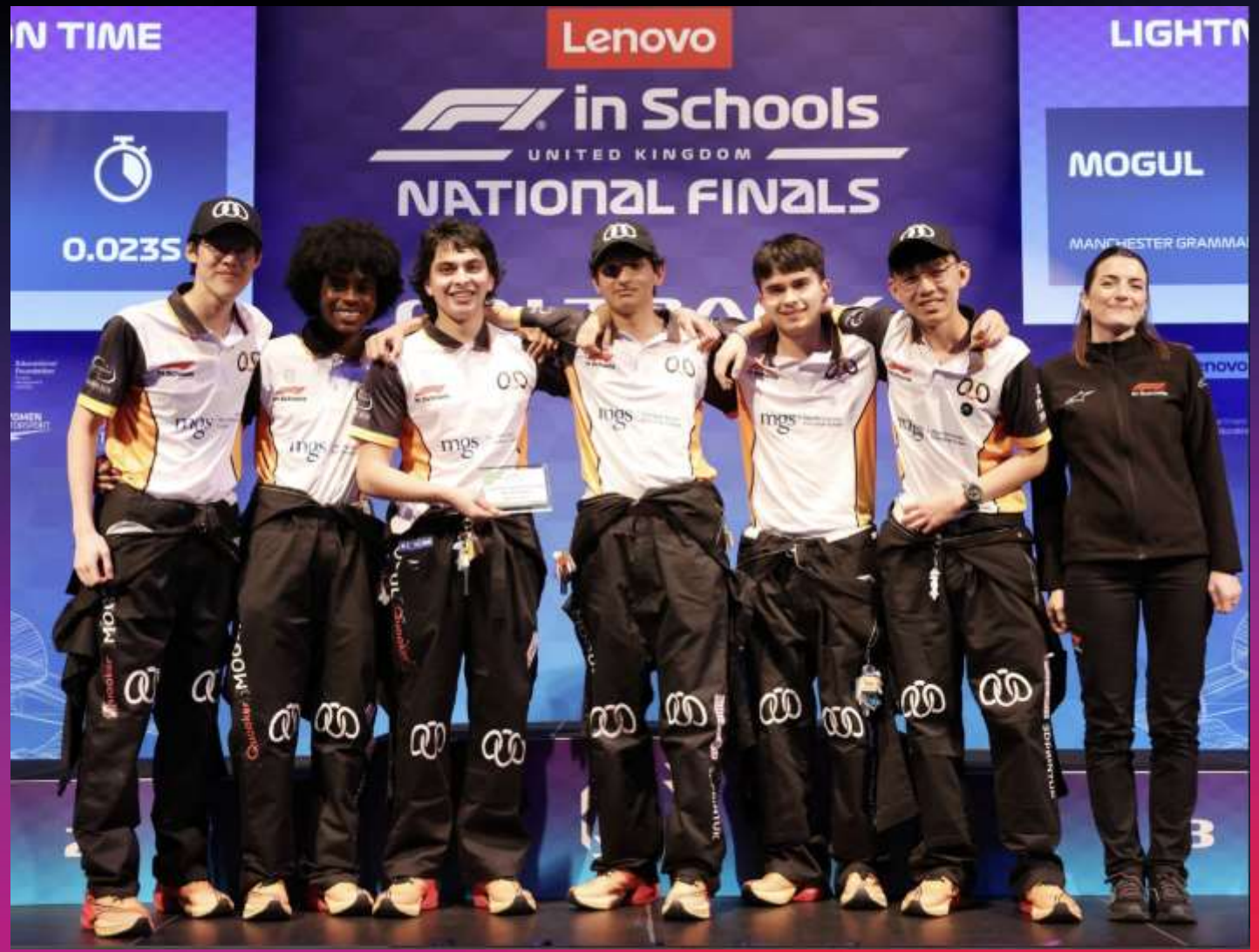

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What is STEM Racing?

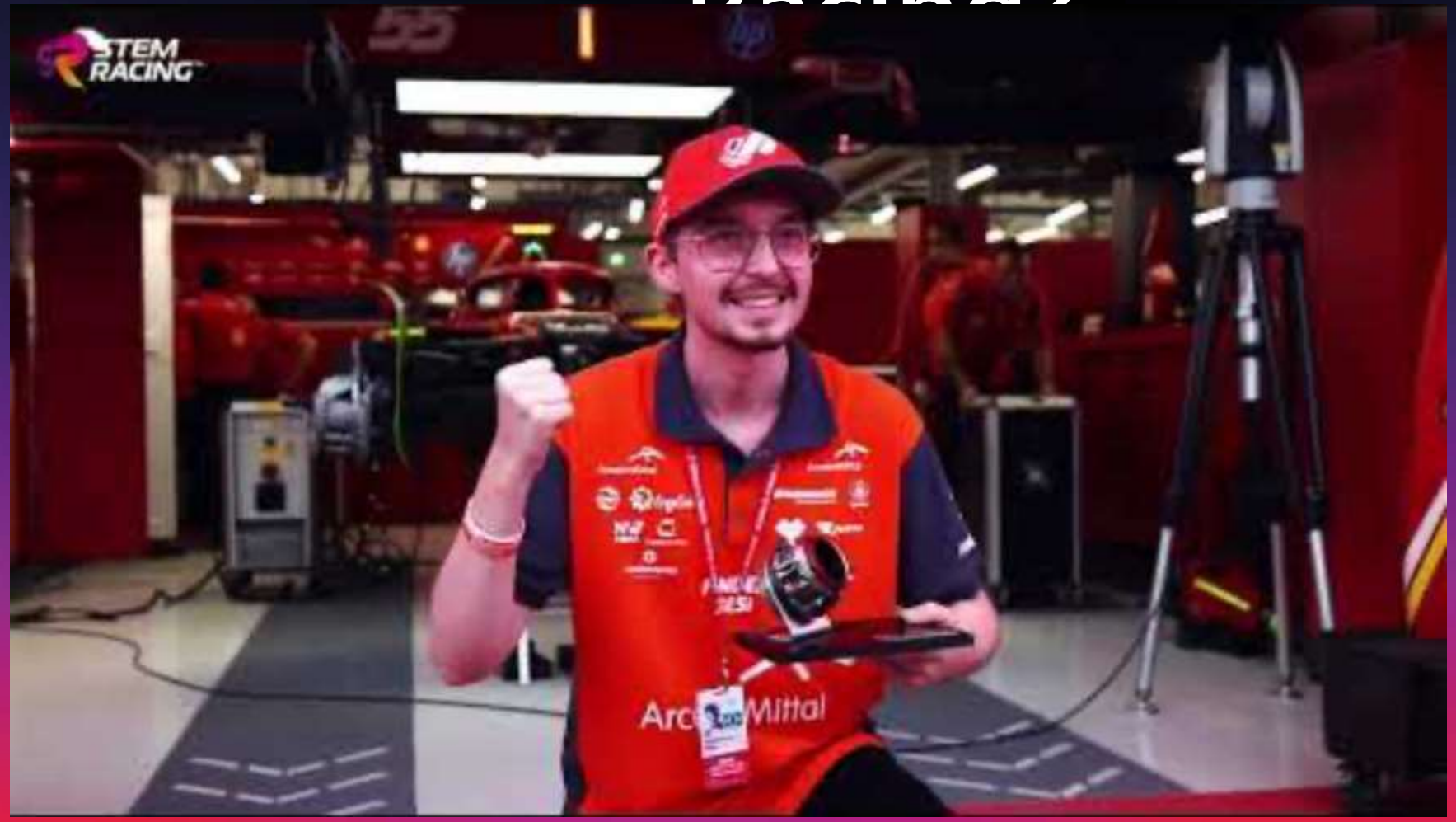
What Is STEM Racing?

STEM Racing is a competition where you and your team work together to design, engineer and manufacture miniature F1 Style Cars to race. However, you aren't just judged on the speed of your car, most of your points come from your portfolios, verbal presentation and brand identity. These are based off of your ability to work together well as a team and get the job done.

There are multiple competition classes to participate in: Entry, Primary, Development and Professional. This presentation is targeted at Development and Professional class entrants between 12-18 years old.

The Scorecards are your best friend within the competition. These outline exactly how you will be judged across each category, and they should be analysed and understood by all members of your team. Bring them to all your team meetings and make sure that everything you write, design and develop are based directly off of the scorecards to get the most points.

What Is STEM Racing?



Judging Categories

The judging categories of each competition class varies. Please refer to the STEM Racing website for more information on your class here -

- **Enterprise Portfolio (160 points)** - Business, Finance, Marketing, Project Management
- **Design and Engineering Portfolio (180 Points)** - Car Design, Testing and Manufacture
- **Verbal Presentation (160 points)** - Presentation on team story assessing delivery and teamwork
- **Brand identity (100 Points)**- Pit Display, Consistent Visuals, Brand Strength
- **Racing (220 Points)** - Reaction Racing (total race time) and Time trial (car time)
- **Scrutineering (170 Points)** - Car compliance with technical regulations.

General Guidance

- **FOLLOW THE SCORECARDS** - Everything that you do within the competition should be found within the scorecards.
- Read The Guidebooks - Make sure you read the guidebooks relevant to your competition class so that you know exactly what your team needs to do -
- **Assign clear roles** - This is so that it is clear what each team members responsibilities are: Project Manager, Design Engineer, Manufacturing Engineer, Sponsorship Manager, Marketing Manager and Finance manager. Make sure that each person is assigned a role which best suits their capabilities.
- **Allocate time** - Allocate time and budget effectively to the points, e.g. the pit display is 60 points compared to the verbal presentation which is 160, so spend more time on the verbal presentation
- **High Band** - You should treat the high band of the marking criteria as a 'to-do list' to get the most marks. If there are any terms you don't understand, make sure to research them
- **Resources** - Access all free to use resources from the stem racing website, there are multiple sample portfolios to take inspiration from.

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Enterprise

Enterprise Portfolio

The enterprise Portfolio judges your teams Project management, Sponsorship and marketing. Make sure that you directly follow the scorecard when structuring and writing content for the highest marks. It is worth 160 points, so to be hitting those high bands, set deadlines for the first, second and final drafts. Assign pages in a way which works best for your team i.e. whoever was in charge of marketing writes the sections on marketing.

General advice:

- **Use the scorecard as a to do list to reach maximum marks**
- Make sure to get a teacher/ external person to check your portfolio against the scorecard so you know that it is easy to find all markable content
- Structure your portfolio in the same order as the marking criteria e.g. Project scoping -> roles and responsibilities -> Budget and Risk Management. (This makes it easier for the judges and then also for you)
- Only include information that will get you points (don't spend an entire page on 'about us')
- Bolden keywords '**Project Scope**' and '**Gantt chart**' to make it clear to the judge where to find the marks.
- Use clear and bold visual supports and graphics
- DO NOT copy the content / structure of open source portfolios found online, the judges can very easily tell and people immediately lose marks no matter how professional their portfolios look

Project Management

A strong project manager is essential for team success, make sure the project manager reads the STEM Racing Project Management guidebook here

General Advice:

- Read the STEM racing Project management guidebook.
- Schedule regular meetings
- Document all work
- Manage Deadlines and accountability
- Ensure Efficient progress tracking

Documenting all your tasks and jobs as project manager gives your team great content to write up in the enterprise portfolio.

Sponsorship and Finance

Sponsorship and Finance are sections which are marked within the enterprise portfolio, so these should be documented effectively. Set a rough outline budget at the beginning of the competition to see how much your campaign will cost and set a sponsorship target. Lots of teams generate sponsorships through cold outreach to local businesses and also fundraising such as bake sales. There is valuable information on how to sort budgets and finance in the project management guidebook.

General Advice:

- Set a general outline for how much you think the competition will cost you covering all costs
- ‘More’ is the best approach for sponsorship - call more people, email more people…
- Car dealerships and local engineering related businesses are common sponsors for lots of teams
- Read the project management guidebook for advice on documenting budget and finance.

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Design and Engineering

Design and Engineering Portfolio

The Design and Engineering Portfolio judges your design, manufacturing and testing process. Make sure that you directly follow the scorecard when writing your portfolio in order to achieve the highest marks. It is worth 180 points, so make sure that you are aiming for the criteria within the high bands by keeping organised and spending the appropriate amount of time on this for your team.

General advice:

- **Use the scorecard's high band as a to do list to reach maximum marks**
- Make sure to get a teacher/ external person to check your portfolio against the scorecard so you know it is easy to find all markable content
- Structure your portfolio in the same order as the marking criteria e.g. Design Concepts p1… manufacturing p6
- Only include information that will get you points (don't spend an entire page on 'about us')
- Bolden keywords '**CAD**' and '**CNC**' to make it clear to the judge where to find the marks
- Use clear and bold visual supports and graphics
- DO NOT copy the content / structure of open source portfolios found online, the judges can very easily tell and people immediately lose marks no matter how professional their portfolios look
- Use lots of pictures for this portfolio, it is very evidence heavy for the marking criteria.
- When presenting, it is best to nominate one person to show the judges all the key information so that there is limited dispute between team members

Renderings/ Engineering Drawings

Renderings and Engineering Drawings accompany your Design and Engineering Portfolio. You should keep them in A4 format.

Renderings:

- Follow the scorecard
- Print anywhere between 10 and 40 different car renders with varying backgrounds and lighting.
- Print on high quality paper/card for a better presentation and finish
- Generate renders using Blender
- Present in a binder/ folder or similar – just do not keep loose

Engineering Drawings:

- Follow the scorecard and info in the rules and regs
- Make sure to colour code the different parts of your car
- Make sure to refer to the technical regulations within your drawings, this is a common mistake at competition level.
- Print on high quality paper/ card for a better presentation and finish
- Present in a binder/ folder or similar

Designing the Car

This is the role of the Design Engineer, There can be multiple design engineers or just one. Make sure to use the scorecard and follow the specific technical regulations found on the STEM Racing website for your competition class here

General Advice:

- Use the scorecard and technical regulations to ensure maximum marks
- Ask your teacher to sign you and your team up for the FREE Autodesk collaboration with STEM Racing schools- you design your car in this software
- Talk to your Maths/ Physics teacher about different engineering and physics principles you can use to optimise the design of your car to reduce all frictions
- There are limitless tutorials for using fusion on YouTube, and also within the STEM Racing website,
- Make sure to test using CFD which is essential for research and development
- Download the essential STEM Racing pieces from the website here
- 3D print cars to test if you have access to a track and a 3D Printer - this is a cheaper alternative to CNC milling and manufacturing. This means that you can test as many as you want and as quickly as possible.
- Make sure to scrutineers the car yourself when manufactured to see if it follows regulations, and remake it if it doesn't.
- Email your nearest stem racing centre of excellence to ask to use their track for testing.

Car Manufacture

It is essential to follow regulations when manufacturing the car e.g. the whole car body must be a one piece milled Denford model block. Contact the centres of excellence to request a car milling here - This process is generally done by the manufacturing engineer.

General Advice:

- Email your local centre of excellence to see if they have any STEM Racing related events throughout the year and also request to test your cars there.
- The majority of teams at Nationals 3D print their wings and wheels from 3DPRINTUK for the lightest result. They offer heavily discounted printing for teams competing in nationals.
- Finishing touches to the body can be done using a file or sanding paper,
- The best value for money decals are water-slide decals, which have a great finish when applied correctly.

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Verbal Presentation

Verbal Presentation

The verbal presentation is worth 160 points which is the same value as the enterprise portfolio. Teams always make the mistake of leaving this until the last minute and then learning their lines on the bus towards regionals. You will immediately have an edge on all your competition by preparing this far in advance, setting deadlines for the first second and final draft and having regular rehearsals.

General advice:

- **Use the scorecard as a to do list to reach maximum marks**
- Schedule rehearsals as a team for everyone to learn their lines and ensure that you are happy with your presentation
- Time your presentation multiple times so that you are comfortably within the time
- Make a PowerPoint presentation to play behind you with good visuals
- Make sure to invest in props/ visuals to show to your judges
- Bring an adaptor on the day so that you are able to project your presentation
- Team contribution in this is the easiest marking criteria in the competition make sure everyone speaks at a similar amount.

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Brand Identity

Brand Identity

Brand identity is worth 100 points and it judges your pit display and corporate identity. Make sure to follow the scorecard and assign the appropriate amount of time to each section.

General Advice:

- Keep a consistent colour scheme and font across all areas of the competition including - logo, kit, car, portfolios and pit display
- Choose a strong and meaningful team name which all the team knows.
- Wearing the exact same kit (including shoes) gives you more points on the day

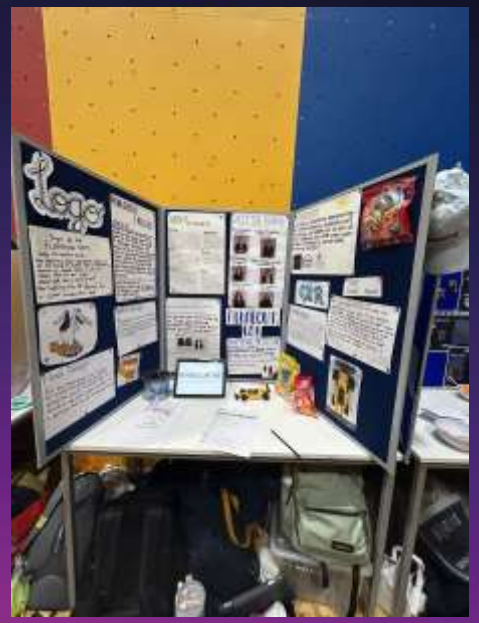
Pit Display

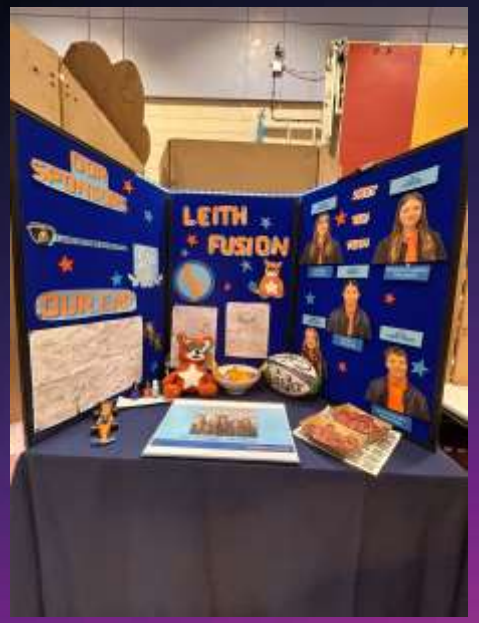
The Pit Display is only worth 60 points, and many teams often spend too much time and money on their pit display when the difference between an average pit display and a high quality one is 20 points. Do not make this mistake and instead make sure that your team does not dispute unnecessarily over the pit display wasting time which could have been better spent elsewhere. The Pit Display is important, but do not overemphasise its importance.

General Advice:

- Follow the scorecard
- At regionals all you will be given is a standard school table, you need to design and build your pit display around this.
- You can either professionally print your posters from printing companies, or stick multiple a4 sheets together depending on budget.
- The majority of teams display their portfolios on their pit displays.
- Many teams make the mistake of blowing their budget on the pit display for an extra 20 points when that money could be better spent elsewhere such as testing/manufacturing.
- At the Regional competition there is limited plug sockets, so it is first come first served to access the tables which are next to the plug sockets. Come early to have the best chance of getting a socket.

Regional Pit Display Examples





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Scrutineering and Racing

Racing

Racing your car makes up 220 points total through ‘reaction racing’. Each team has 4 races, (2 per lane). All races are manual/driver launch mode - team members launch their own cars. Races record both total race time and also reaction time. Information on how your racing times are scored can be found in the rules and regs.

General Advice:

- If you have access to a track before the competition (through a centre of excellence) test who in your team consistently has the fastest reaction time.
- Do multiple tests to see whether their reaction time decreases under caffeine or sugar. This can be recorded for the D+E Portfolio under ‘testing’
- Let your racer bring headphones on the day to listen to preferred music to stay focused and decrease reaction time
- Watch the livestreams of previous events on the STEM Racing YouTube to familiarise yourself with how the racing works

Specifications/ Scrutineering

This is a detailed inspection process where all race cars plus any additional components are judged for compliance with the STEM Racing technical regulations for your competition class. The engineering drawings, renderings and quality of finish will also be assessed. You begin the scrutineering judging with 110 points, and any violations of the technical regulations results in penalties and a loss in points.

General Advice:

- Follow the scorecard
- Scrutineer the car yourself using vernier callipers to check compliance with the scorecard. Do this multiple times
- Follow the Technical regulations for more specific guidance and advice on the design of your car.
- If you have access to a 3d Printer, use this to print your initial cars to scrutineer before paying for your cars to be manufactured.

Tips from ex-competitors

ZJ - Read the specification and guidelines carefully when you produce anything so you hit the high band marking points .

Semi – Set organised, clear goals for each person and communicate clearly.

Mariano - Make sure to get all your responsibilities to a decent level before optimising one.

Josh - never leave anything to the last minute. Be organised as a team and stick to the scorecards as much as possible, that is the only way you will receive marks

Daniel - Stick to the scorecards and make sure to have effective project management – this will set out clear goals and deadlines to streamline your competition.