

Assignment 1: Innovation & Research - ACCA5033

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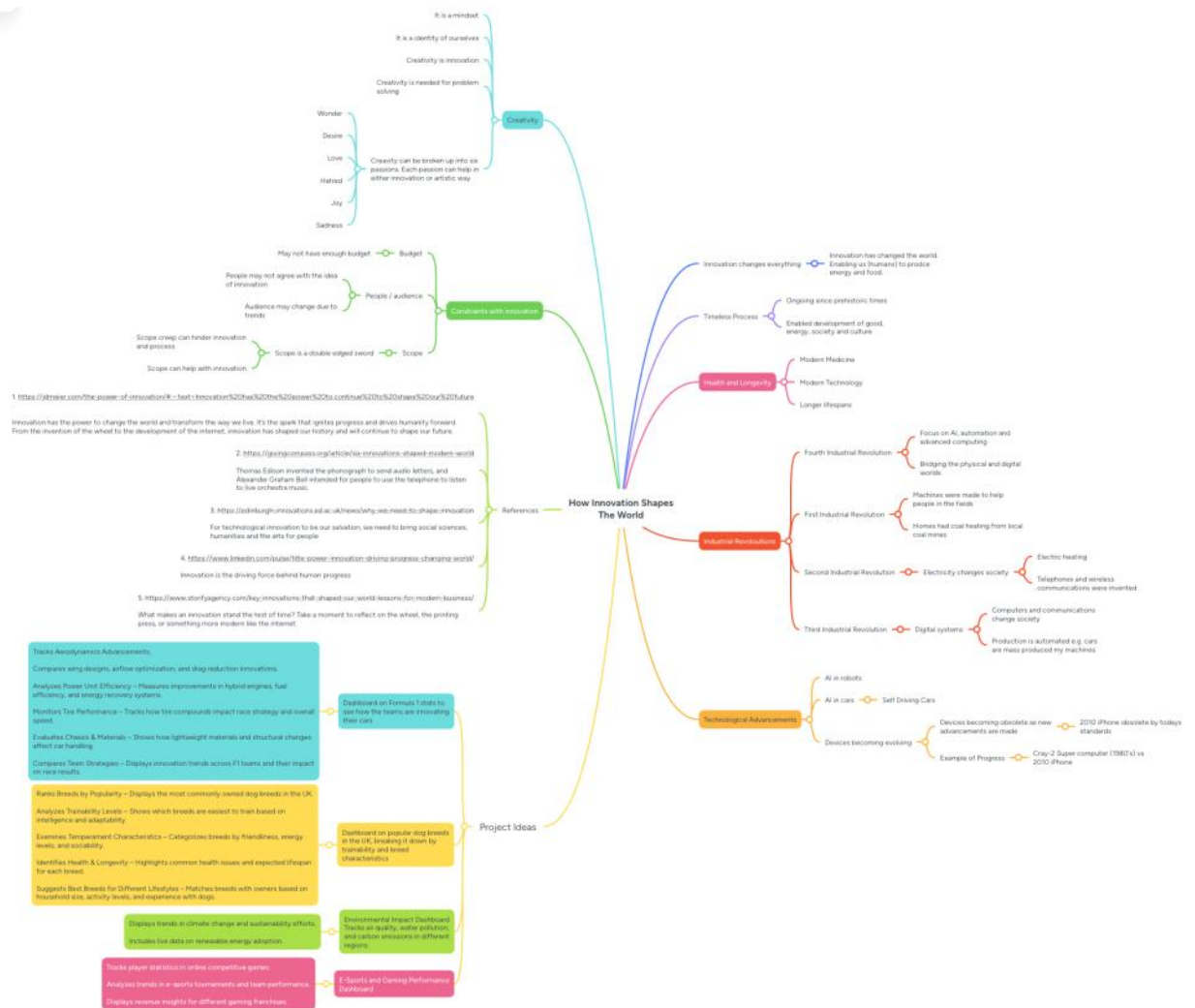
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Apprenticeship in Computing (Data and Information Systems) (BSc Hons)

Ideation and Mind Map

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Link to mind map: <https://mm.tt/map/3719027504?t=RC3QtgGx6N>

Project idea: Formula 1 Innovation Dashboard

Aims and Objectives

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Formula 1 (F1 for short) have been at the forefront of automotive innovation. Serving as a high-speed laboratory for advancements in aerodynamics, powertrain efficiency, and materials engineering for their race cars.

From the sports inception in 1950, Formula 1 has undergone dramatic technological transformations. The transformations have been driven by regulatory changes, competitive pressures, and sustainability initiatives. Teams are hard at work to refine their designs to enhance performance while adhering to evolving FIA (Fédération Internationale de l'Automobile) regulations, making F1 a showcase of cutting-edge engineering.

This project aims to develop a Formula 1 Innovation Dashboard, providing a data-driven analysis of how teams innovate their cars over time. By comparing F1 car designs from the very start of the sports inception, to it's modern iteration. This project will highlight key development areas in aerodynamics, hybrid power units, and chassis composition as well as how much time and money has been spent in research and development.

The research will investigate the impact on performance, how technological adaptations influence lap times, fuel efficiency, and strategies for races and different grand prix.

Through a structured data analysis approach, this study will offer valuable insights into the evolution of F1 engineering, helping engineers, analysts, and fans understand how teams gain a competitive edge through innovation.

Aim: To develop a dashboard that visualizes Formula 1 team innovations, highlighting technological advancements and performance improvements over time.

Objectives:

1. Identify key innovation trends in Formula 1, including aerodynamics, power units, and materials.
2. Collect and analyse statistical data on team performance and technological upgrades.
3. Develop an interactive dashboard that presents innovation metrics in a user-friendly format.
4. Evaluate the impact of technological advancements on race performance and championship standings.
5. Ensure the dashboard provides insights for engineers, analysts, and fans interested in F1 innovation.

Research Philosophy:

For this project, the best form of philosophy to tackle this is Epistemology. Epistemology is the study for knowledge. "In simple terms, epistemology is the theory of knowledge and deals with how knowledge is gathered and from which sources. In research terms your view of the world and of knowledge strongly influences your interpretation of data and therefore your philosophical standpoint should be made clear from the beginning." [1]

By breaking it down further, the best philosophy to help with this project would be Positivism and

Pragmatism.

Positivism is appropriate because the study relies on observable, measurable data such as lap times, upgrades, and standings.

"Positivism philosophy in research forms a cornerstone of scientific inquiry, shaping how researchers approach the quest for knowledge." [2]

Pragmatism supports the practical application through the creation of a usable dashboard for real-world decision-making.

"Pragmatism involves research designs that incorporate operational decisions based on 'what will work best' in finding answers for the questions under investigation and this enables pragmatic researchers to conduct research in innovative and dynamic ways to find solutions to research problems." [3]

Search Tools & Research Databases:

1. Formula 1 Official Website – For team updates and technical insights
2. RaceTeq – For detailed breakdowns of F1 upgrades and performance improvements
3. Google Scholar – For academic papers on F1 technology.
4. IEEE Xplore – For engineering and aerodynamics research.
5. SAE Mobilus – For automotive and motorsport innovations.
6. Documentaries - Gather more knowledge from documentaries F1 TV - Boldest Innovations

Dashboard software:

1. Microsoft PowerBI
2. Tableau
3. Google Analyst / Google Data Studio
4. Databricks

Databases:

1. <https://github.com/toUpperCase78/formula1-datasets>
2. <https://github.com/f1db/f1db>
3. <https://github.com/slowlydev/f1-dash>
4. <https://github.com/br-g/openf1>
5. <https://github.com/edmundhong/formula1-dataanalysis>

Research Strategies

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Research Strategies, Validity, and Data Analysis in F1 Innovation Dashboard Development

Validity

Validity will be address in this project by using verified data sources. These data sources will include data from the FIA and academic studies on Formula 1. Validity refers to how well the data represents the real-world. By getting data from different sources and data sets that focus on the projects aims and objectives, the data that the dashboard aims to build upon are the technical regulations, lap-times and innovation history of the sport.

"Validity refers to how accurately a method measures what it is intended to measure." [4]

Reliability

Reliability will be addressed by applying consistent and transformative procedures in the data extraction. The data will be normalised and cleansed using automated scripts as well as SQL to minimize any human error. This can be done by incorporating Python scripts before importing into a dashboard software like Power Bi or Tableau.

"Reliability refers to how consistently a method measures something. If the same result can be consistently achieved by using the same methods under the same circumstances, the measurement is considered reliable." [4]

Generalisability

Generalisability refers to how the findings beyond the data can apply to other areas. This project is focused on Formula 1 but can also be used for insights into engineering, investments, innovation cycles and performance correlations with the engine manufacturers. This can be taken further into broader motorsports like Le Mans, Nascar and other motoring events. However as this project is focused on Formula 1, there will be limitations due to the context.

"Generalization is the measure of how useful the result of a study is for a specific population." [5]

Ethical Considerations

The considerations here that the project will be sourced by public data sets. There will be no personal or sensitive information within the data set. As Github is the main repository for the data and the API's used to get the data. Proper attribution will be maintained and permission requested if it is necessary. The data will be used in accordance with fair use and ethical data-sharing practices as well as compliance with UK GDPR policies.

"Ethical consideration refers to the process of evaluating the moral implications of a decision, action, or policy. It involves identifying, analyzing, and addressing the potential ethical issues that may arise in various contexts, such as research, business, healthcare, technology, and public policy." [6]

Data Collection Methods & Pilot Design

The study adopts a quantitative research strategy, focusing on secondary data. The main data collection methods include:

- **Data scraping:** of publicly available performance metrics (e.g. fastest lap, pit stop times, qualifying vs. race delta)
- **API integration:** from databases like RaceTeq or OpenF1
- **Technical literature reviews:** from IEEE Xplore and SAE Mobilus

To improve the focus of the project, a "pilot" will be designed. A sample dataset from the available

data sources will be created using five races from the beginning of the 2021 and end of the 2021 season to capture the following:

- The Team name
- Engine Manufacturer
- Car upgrades that the data source has logged
- Lap time improvement compared to previous race
- Championship points gained for the team and driver

This pilot dataset will be visualized using the dashboard software Microsoft Power BI and will be shared with peers for feedback.

Based on their input and feedback the project can then be further improved upon by:

- More longitudinal data needed (e.g. minimum of 10 seasons)
- Innovations needing to be tagged by their type (e.g. chassis, engine, software)
- The dashboard required filters by team, year, race location and innovation type

Quantitative and Qualitative Analysis Approaches

Quantitative analysis in this project includes:

- **Descriptive statistics** (average lap time changes)
- **Time-series analysis** (trends in car upgrades vs. points gain)
- **Correlation analysis** (e.g. update frequency vs. team standing)

Qualitative analysis may be used as a complementary tool:

- **Content analysis** of team principal interviews or FIA technical briefings to infer innovation intent
- **Thematic coding** of technical documents to classify upgrades
- **Sentiment analysis** (if team communications or media quotes are included)

While this project is quantitatively driven, integrating qualitative insights adds context to the data trends and enhances interpretability.

Innovation changes everything

From prehistoric times to the 21st century, **innovation has changed the world.**

This has enabled humans to produce more food and energy and to establish social order and cultural meaning.

In fact, innovation has marked several key turning points in human history; **transforming society and our daily lives.**

Continue ►

Dive Deeper 'A Whole New Mind'

"It is an age animated by a different form of thinking and a new approach to life-one that prizes aptitudes that I call **"high concept"** and **"high touch."**

High concept involves the capacity to detect patterns and opportunities, to create artistic and emotional beauty, to craft a satisfying narrative, and to combine seemingly unrelated ideas into something new.

High touch involves the ability to empathize with others, to understand the subtleties of human interaction, to find joy in one's self and to elicit it in others, and to stretch beyond the quotidian in pursuit of purpose and meaning."

Close

Back

Is innovation changing things for the better?

As you have seen so far, modern advances are – in general – changing the world for the better.

Psychologist **Steven Pinker** agrees with this, and in his book **Enlightenment Now** (2019), he describes how the welfare of humankind has never been better. In his 2018 TED Talk, he states:

"We will never have a perfect world. But there's no limit to the betterments we can attain if we continue to apply knowledge to enhance human flourishing."

His argument encourages the belief that we can continue to improve the welfare of humankind by making **collective wellbeing** our goal, and by using science and reason to achieve it.



“

We live longer, suffer less, learn more, get smarter and enjoy more small pleasures and rich experiences. Fewer of us are killed, assaulted, enslaved, exploited or oppressed by the others.

Much suffering remains and tremendous peril, **but ideas on how to reduce them have been voiced, and an infinite number of others are yet to be conceived.**

”

Learnings from the video

This video demonstrates the idea that we have an **innate ability to be creative**, but education and society seem to extract that from us.

Picasso said that all children are born artists, the problem is to remain an artist as we grow up.

In his funny way, Ken Robinson points out that children seem to be happy with whatever they create. In a Christmas nativity play the children innocently misquoted their lines and did not become embarrassed by being wrong.

As students, we need to be aware that it is **wrong** to believe that mistakes are the worst things that you can do. The creative process is born from trying things that may at first seem wrong, but later appear right.



<https://www.formula1.com/en/latest/article/the-10-greatest-innovations-f1-has-given-the-world.1fy8HvHkICzpj6s353iw82>

<https://www.raceteq.com/articles/2025/01/how-teams-make-changes-to-improve-performance-in-f1>

Check

Using creativity to **avoid stress** is:

- ☐ A contemplation tool
- ☒ A distraction tool
- ☐ A means of self-development to face challenges by building up self-esteem and confidence

Correct!

When we use creativity simply to avoid something challenging or ignore something we find stressful, it is a **distraction tool**.

Only when we use creativity to give us the mind space to reassess problems in our lives and make plans can we consider it a **contemplation tool**.

Check

In this knowledge check activity you will be presented with three research questions.

Question 1 of 3

What do we call it when we reduce the data of the population into a smaller manageable unit? We call it a...

- ☒ Sample
- ☐ Snowball

Correct!

A sample is a group of people, objects, or items that are taken from a larger population for measurement. The sample should be representative of the population to ensure that we can generalise the findings from the research sample to the population as a whole (Bineham, 2006).

Check

Question 2 of 3

Which of the following are relevant reasons for why we have to reduce the data we research into a smaller unit? (Choose which ones you think apply)

- ☒ Your time and resources may be stretched
- ☐ There are limited people who have experiences you are studying
- ☐ There are limited people/results with the relevance to the area you are studying

Not quite...

If your sample size is large, it may limit your ability to produce findings that represent your population as a whole. It is therefore good practice for triangulation purposes to recruit a variety of respondents (e.g., children, adults, service users and providers).

Check

Question 3 of 3

When you select a sample from the population by picking the names out of a hat, what type of sampling are you conducting?

- ☐ Unusual sampling
- ☒ Random sampling
- ☐ Stratified sampling

Correct!

In this approach, every piece of data is considered to be equally relevant. This means if you include it in your research it is based on a random chance whether it's included or excluded from the sample you study.

Check

Question 1 of 2

Would a survey of 300 students, chosen at random, from your university and asking them the question: "On a scale from 1-5, how satisfied are you with your professors?" be a good sample?

☒ Yes

☐ No

Correct!

The survey has been conducted at random to avoid any bias. The survey will of course have some bias as it is a sample of the entire university, but it has mitigated this by randomising the trial.

Check

Question 2 of 2

Could research of the recovery of people from Covid living on the island of Jersey be used be applied to people living in the city of New Delhi, India?

☐ Yes

☐ No

☒ It depends

Correct!

It depends. Do you think that the people living in Jersey are comparable to the people who live in New Dehli? If yes then the research is valid, if not then the research should not be used in the New Delhi context.

References

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- [3]. <https://www.nottingham.ac.uk/helmopen/rlos/research-evidence-based-practice/designing-research/types-of-study/understanding-pragmatic-research/section03.html> Understanding Pragmatic Research
- [4]. <https://www.scribbr.co.uk/research-methods/reliability-or-validity/> Reliability vs Validity in Research | Differences, Types & Examples
- [5]. <https://study.com/learn/lesson/generalizability-research-study-population.html> Generalizability in Research | Overview & Importance
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