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**A FORMULA STUDENT TÁRSADALMI HATÁSÁNAK ÉRTÉKELÉSE:
A TU VIENNA RACING TEAM ESETTANULMÁNYA**

**ASSESSING THE SOCIAL IMPACT OF FORMULA STUDENT: A
CASE STUDY OF THE TU VIENNA RACING TEAM**

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1. Introduction

After spending multiple years in a Formula Student racing team, I would be lying if I said that I have not wondered about if it is worth it or not. This question pops up in the head of millions of students, sponsors, teachers and parents worldwide, so I decided to try and find an answer to that.

Formula Student is an international engineering competition and student movement. The goal is to build a competitive formula style race car and go to various tracks competing with it. As the teams are nonprofit organisations, it is not easy to quantify its impacts on the different stakeholders. Most of the participants spend multiple years of their life voluntarily working on a race car, putting their studies and even jobs on the back burner. The sponsors and universities provide the teams with a huge amount of money, in-kind services, and know-how, sometimes with the built car not even finishing a single race. Without supporting parents, most of the team members could not afford this lifetime. If you count this and the many other sacrifices, I think it is understandable that a few individuals are very sceptical about this kind of hobby.



1. Figure: Formula Student race car (Source: FS EAST)

In my thesis, I will evaluate the social impact of Formula Student in a case study of the team of the TU Vienna. I will calculate the SROI (Social Return of Investment) index of the team, taking

a three-year perspective to evaluate both immediate and future impacts. This method was created at the end of the 1990s to measure the socio-economic value of nonprofit enterprises (Emerson, J. & Cabaj, M., 2000).

My calculations utilize proxies, which are data-driven assumptions that help us translate intangible benefits and costs into quantifiable numbers.

The goal of this thesis is to examine the social impact of Formula Student, with the research question being:

"How does Formula Student participation contribute to societal advancement, as assessed through the Social Return on Investment (SROI) framework?"

The tested hypothesis is that Formula Student brings significant social benefits and plays a big role in the development of future professionals. This means that the Social Return on Investment is greater than one.

This research helps understanding how participating in Formula Student impacts students, sponsors, universities, and society at large. By using the Social Return on Investment (SROI) framework, we can measure both the tangible and intangible benefits of Formula Student involvement. The results of this thesis contribute to ongoing discussions about the value of experiential learning in higher education.

2. Methodology

This study employs the Social Return on Investment (SROI) method for evaluating the social impact of Formula Student participation. SROI is a robust framework designed to measure the social value generated by an initiative, focusing on both quantitative and qualitative aspects of impact assessment.

The SROI process involves several key steps. First, I identified the stakeholders affected by Formula Student participation, including students, sponsors, universities, and society. Next, I gathered data on inputs (resources invested), outputs (activities undertaken), and outcomes (changes resulting from participation).

Once the data was collected, I assigned a monetary value to each outcome, utilizing proxies and valuation techniques to quantify both tangible and intangible benefits. Proxies were used to represent outcomes that are difficult to measure directly.

With all data and valuations in hand, I calculated the SROI ratio by comparing the social value created to the resources invested. This ratio provides an indication of the social return achieved per unit of investment. I chose to consider a three-year timeframe, which is adequate in a rapidly changing environment like motorsports.

3. Background

3.1 Introduction to Formula Student

Formula Student (FS) is an international race car engineering series for students. The first event, called Formula SAE took place in the USA, organized by the Society of Automotive Engineers, in 1981. Today, however, Europe and mostly Germany is considered to be the hub of the Formula Student/FSAE movement. By now it has grown to be worldwide and to host more than 20 events yearly, being sponsored by some of the greatest companies in the automotive sector (Dean et al., n.d.).

The goal of this series is to prepare the students for the challenges of mobility-related industries by forcing them to solve real world engineering problems. It gives them the practical experience that most universities lack, while also teaching important leadership and teamwork abilities (*Learning Objectives - Formula SAE Knowledge*, n.d.).

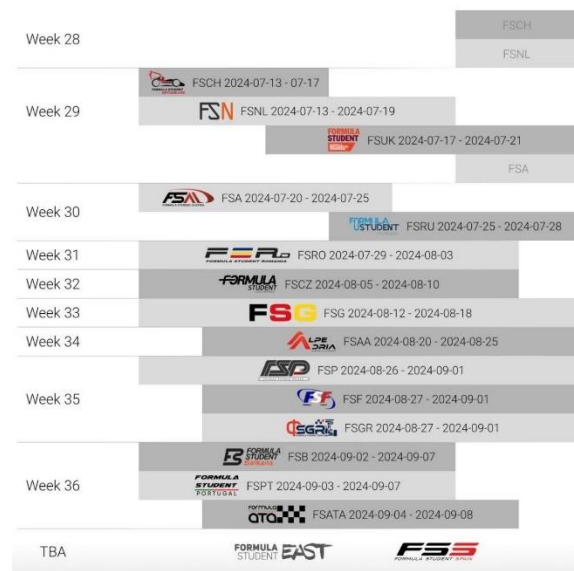
According to the Society of Automotive Engineers, during FSAE/FS, the “experiences may include but are not limited to:

- Project management, budgeting, communication, and resource management skills
- Team collaboration
- Applying industry rules and regulations
- Design, build, and test the performance of a real vehicle
- Compete with other students from around the globe
- Develop and prepare technical documentation”

(*Learning Objectives - Formula SAE Knowledge*, n.d.)

Only active students can be part of the teams, but not only engineers: to manage a complex team like this, various disciplines are needed. The most successful teams have members from many different majors: business, arts, physics, and so on. The teams are usually divided into submodules, split up into a technical and an organizational unit.

FS is divided into seasons, with the events taking place mostly in the summer. The teams have to build and test a new race car each year, normally between October and May. Beginning in July, the students then travel to various countries and various famous (partly Formula One) racetracks to show off their design.



2. Figure: Timetable of European FS Events in 2024 (Source: FSG LinkedIn page, 2024)

In this research I will mostly focus on the European teams and FS rules, since these can differ from the rules and habits of other regions. Europe hosts more than 10 events yearly, with examples as Formula Student Germany (FSG), Formula Student Austria, FS East in Hungary or FS Alpe Adria in Croatia. These events all follow the official rule set of Formula Student, with their own handbooks to make some minor changes.

As mentioned before, the rules regulate a lot of different aspects of the engineering series: starting from the team members, behaviour on the racetrack and of course the technical specifications of the car. The members must be inscribed to a bachelor's or a master's program, and are not allowed to take part in the FSG event more than 4 times. Behind each team, there must be a university that gives its name to the team, but apart from that, the members can also come from different universities (*Formula Student Rules 2024*, 2024).

The competition itself is divided into three categories. The original category, that of the combustion vehicles, is decreasingly popular, mirroring the tendency of the whole industry. FSG does not organize this category from 2024 on, but the other events do. The other two categories are for electric vehicles and autonomously driving cars. These two are judged separately or together, depending on the event. FSG is the only competition that already expects the teams to drive autonomously to get the full points (*Formula Student Rules 2024*, 2024).

FS races do not only consist of traditional racing, in fact there is no wheel-to-wheel racing at all. The teams must show off their car and talent in seven different categories to collect the most points possible. There are three static disciplines, where the car does not run. In Business Plan, the teams have to create a fictive business plan based on their car and present a pitch. In Cost and Manufacturing, the team's knowledge of the manufacturing processes is judged, along with the understanding of the costs associated with the construction of a prototype. The third static discipline, Engineering Design inspects the way the car was designed, with the engineers having to explain every decision they made along the process (*Formula Student Rules 2024*, 2024).

The four dynamic disciplines are the part where the car starts and runs. This tests multiple important properties of the car, with tasks like acceleration on a straight, in circles, and also a track with narrow curves. The main event is the Endurance, where the cars have to drive 22 km, as fast as possible (*Formula Student Rules 2024*, 2024). The exact names of the disciplines can be seen in the 1. table.

1. Table: Max points awarded in FSG

	CV & EV
Static Events:	
Business Plan Presentation	75 points
Cost and Manufacturing	100 points
Engineering Design	150 points
Dynamic Events:	
Skidpad	50 points
Driverless (DV) Skidpad	75 points
Acceleration	50 points
Driverless (DV) Acceleration	75 points
Autocross	100 points
Driverless (DV) Autocross	-
Endurance	250 points
Efficiency	75 points
Trackdrive	-
Overall	1000 points

(Source: Formula Student Rules 2024 (2024))

Each year after the events, the world ranking list is published, which takes the last 6 participated events from a team into account. To be on the top of this list is a dream of every Formula Student team (*Formula Student - World Ranking*, n.d.).

3.2 Introduction TU Wien Racing

TU Wien Racing is the FS team of the Technical University of Vienna. Since it was founded in 2007, the team has built 14 race cars, firstly combustion and then switching to electric. Nowadays the team designs their own electric motors and inverters, being one of the few in FS to do so. After the 2022 season they achieved place 22 on the world rang list, being in the top 7% of all teams. Currently they have around 100 team members building the 15th car, the EDGE 15 (*Saisonnen & EDGEs*, n.d.).



3. Figure: Racing Team of the TU Vienna (Source: TU Wien Racing)

3.3 Introduction to Social Return on Investment (SROI)

REDF, headquartered in San Francisco, California, is a philanthropic foundation dedicated to enhancing economic opportunities for homeless and extremely low-income individuals. Their approach, rooted in venture philanthropy, emphasizes the long-term social and economic returns of investing in nonprofits. They have been seeking to quantify and improve the impact of its investments by documenting and analysing the results achieved by their partner organizations (Emerson, J. & Cabaj, M., 2000). For this purpose, REDF developed its SROI framework in the late 1990s (Gates, 2008).

“Social Return on Investment (SROI) is a framework for measuring and accounting for this much broader concept of value; it seeks to reduce inequality and environmental degradation and improve wellbeing by incorporating social, environmental and economic costs and benefits” (The SROI Network Intl., 2012, p. 8.).

Despite REDF no longer using its SROI methodology, the foundational concepts behind it have significantly impacted the development of various approaches over the past decade. In 2003, a group of international practitioners introduced a revised method for calculating SROI (The SROI Network Intl., 2012). This updated approach combined REDF's methodology with steps from cost-effectiveness analysis and other methodologies, forming a comprehensive SROI framework. This SROI Framework was further refined and published in a book in 2006 (Gates, 2008).

The SROI method assesses the inputs, outputs, outcomes, and impacts of an organization's activities and assigns a monetary value to the benefits and societal costs created. The resulting value, expressed through a ratio, relates the value created to the investments made. For example, an SROI ratio of 3:1 indicates that for every pound invested, the organization generates a social value of three pounds. While SROI uses monetary terms, it doesn't represent financial value but serves as a comprehensive way of expressing the “currency of social value” (Arvidon et al., 2010).

According to the guide from The SROI Network, the SROI method was developed from social accounting and cost-benefit analysis and is based on the following seven principles:

- Involve stakeholders.
- Understand what changes.
- Value the things that matter.

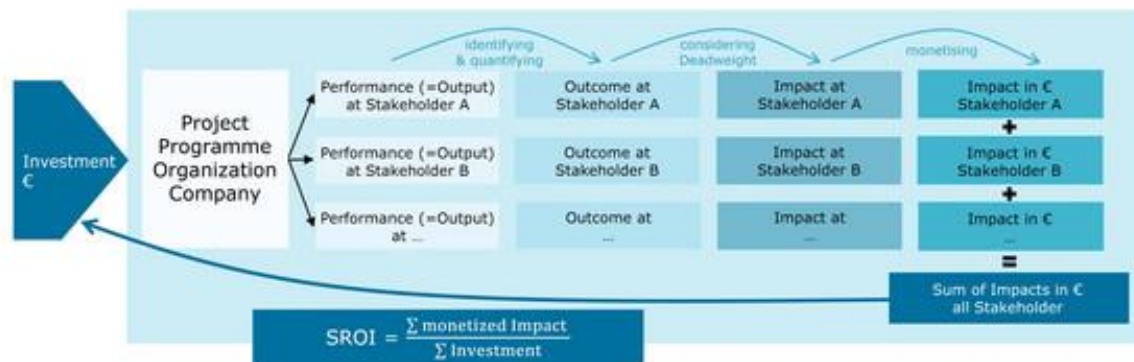
- Only include what is material.
- Do not over-claim.
- Be transparent.
- Verify the result.

(The SROI Network Intl., 2012)

Along these principles, they recommend preparing the SROI analysis in the following six steps:

1. Establishing scope and identifying key stakeholders
2. Mapping outcomes
3. Evidencing outcomes and giving them a value
4. Establishing impact
5. Calculating the SROI
6. Reporting, using and embedding

(The SROI Network Intl., 2012)



4. Figure: The process of calculating the SROI (Source: WU (Vienna University of Economics and Business), n.d.)

An important method to mention is determining value using proxies. These are indicators used to estimate the financial value of an outcome. This is often called monetisation, as we assign a monetary value to things that usually do not have a market price (The SROI Network Intl., 2012). Some examples for this are listed in the 2. table.

2. Table: Examples for proxies

Stakeholder	Outcome	Indicator	Possible proxies
Person with mental health problem	Improvement in mental health	• Amount of time spent socialising • Extent to which participants engage in new activities • Level of use of mental health services	• Cost of membership of a social club/network • Percentage of income normally spent on leisure, • Cost of counselling sessions
Local community	Improved access to local services	• Take-up of those services, and by whom	• Savings in time and travel costs of being able to access services locally
Person with physical health problem	Improved physical health	• Number of visits to doctor • Extent of improvements in health (self reported) • How often they exercise	• Cost of visiting private doctor clinic • Cost of health insurance • Cost of gym membership
The environment	Less waste	• Amount of waste going to landfill • Level of carbon emissions	• Cost of landfill charges • Cost of CO² emissions
Offenders	Reduced reoffending	• Frequency of offences for which participant is charged • Nature of offence	• Forgone wages due to time spent in prison or doing community service
Care leaver	Reduced homelessness	• Access housing upon leaving care • Satisfaction with appropriateness of housing	• Rent • Cost of hostel accommodation
Women offenders	Improved family relationship	• Child continues living in the family home	• Amount that parents spend on their children annually • Value of time spent with children • Cost of childcare
Local community	Improved perception of the local area	• Residents report improvements in local area	• Change in property prices • Amount spent on home improvements

(Source: The SROI Network, 2012)

Social Return on Investment (SROI) analysis emerges as a powerful tool within the nonprofit sector, offering multifaceted benefits. Serving as both a legitimization and advocacy tool, SROI enables organizations to quantify their social impact, enhancing credibility and influencing public opinion. Moreover, it aids decision-makers in rational resource allocation, fostering transparency and accountability. Beyond its instrumental value, SROI stimulates learning processes within nonprofits, sparking discussions about impact value chains and stakeholder perspectives. In summary, SROI analysis provides a comprehensive framework for assessing

social impact, driving positive change, and promoting organizational effectiveness within the nonprofit sector (Maier et al., 2015).

The limitations of the SROI method include insufficient availability of required data for establishing outcomes and base case scenarios. Additionally, attaching monetary value to social and environmental impacts is difficult due to the absence of guidelines or benchmarks, especially in sectors where monetization is new. Also, significant financial and human resources are needed for the analysis, requiring training for staff and investments in information systems. Furthermore, the SROI analysis assumes linear change processes, yet real-world change often proves chaotic and non-linear, complicating outcome projection and base case scenario determination (Context international cooperation, 2006).

The SROI method is fitting to assess the societal impacts of Formula Student for various reasons. The teams operate with a primary focus on educational and community-oriented initiatives rather than profit-making, so the SROI framework offers an ideal approach to quantify and evaluate their societal contributions. By systematically measuring the social, environmental, and economic benefits of their activities, we can effectively demonstrate their commitment to social responsibility and community engagement. It emphasizes transparency, accountability, and the pursuit of broader social objectives beyond competitive performance.

4. Calculating SROI

In the following I calculate the SROI of the 2022/2023 season of TU Wien Racing, taking a 3-year perspective evaluating immediate and future impacts. I work with confidential data and discoveries that I acquired along my two-year journey as a leader in the team. They kindly allowed me to use these findings in my research.

The calculations follow the guidelines of The SROI Network. Although, at some points I simplified the process because of the significantly smaller size of the Formula Student project than the usual use case.

4.1 Key stakeholders

I start with identifying the key stakeholders. It is important to determine which stakeholders are included in the process, because most projects have a nearly unlimited number of different

stakeholders, with whom it would be impossibly complicated to calculate. In the 3. table I have listed our significant stakeholders and why I did or did not consider them.

3. Table: Key stakeholders and excluded stakeholders from the SROI process

Key stakeholders:	Reason for inclusion:
Team members	Mostly impacted by the project
Sponsors	Key actors in the success of the project
University	Key actor in the success of the project
Local community	Severely impacted by the project
Excluded stakeholders:	Reason for exclusion:
Team Alumni	Not influential enough to consider at the complexity of this research
Parents of members	Not influential enough to consider at the complexity of this research

(Source: own rendering rendering based on data from TU Wien Racing)

4.2 Inputs and their value

Firstly, I calculate the total investment for one season, for building one race car from scratch. For this, I consider the tangible and intangible contributions from the sponsors, and the time invested by the team members.

In the 2022/2023 season, the team had a total of 119 sponsors. Among these were 8 companies providing raw and intermediate materials, 48 companies providing manufacturing services, 20 companies supplying commercial parts and materials and 20 financial sponsors. The rest provided the team with miscellaneous items and licences. Although the Technical University of Vienna plays a special role and is not considered an average sponsor, their contribution (finances & infrastructure) is also included.

For the value determination of the sponsor contributions net market prices were used, and in case of doubt the sponsors were also consulted. The sum of the investment by sponsors is **813 500 €**, the distribution can be seen in the 4. table.

4. Table: Investments into the 2022/2023 season of TU Wien Racing

Nature of the investment:	Amount:
Manufacturing	469 400 €
Licences	50 000 €
Miscellaneous	10 000 €
Finances	105 000 €
Facility	112 300 €
Materials and parts	66 800 €

(Source: own rendering based on data from TU Wien Racing)

The second part of the calculations is that of the invested time by team members. This is a particularly tough to calculate, since all the team members are volunteers and the time spent with actual work depends significantly on the individuals and on the time of year. After careful consideration and consultation with the team leaders, we agreed on an estimation of roughly 20 hours/week/team member. This means 4 hours/workday. The estimated distribution of the 90 team members is seen in table 5.

5. Table: Distribution of the work invested into the racing team

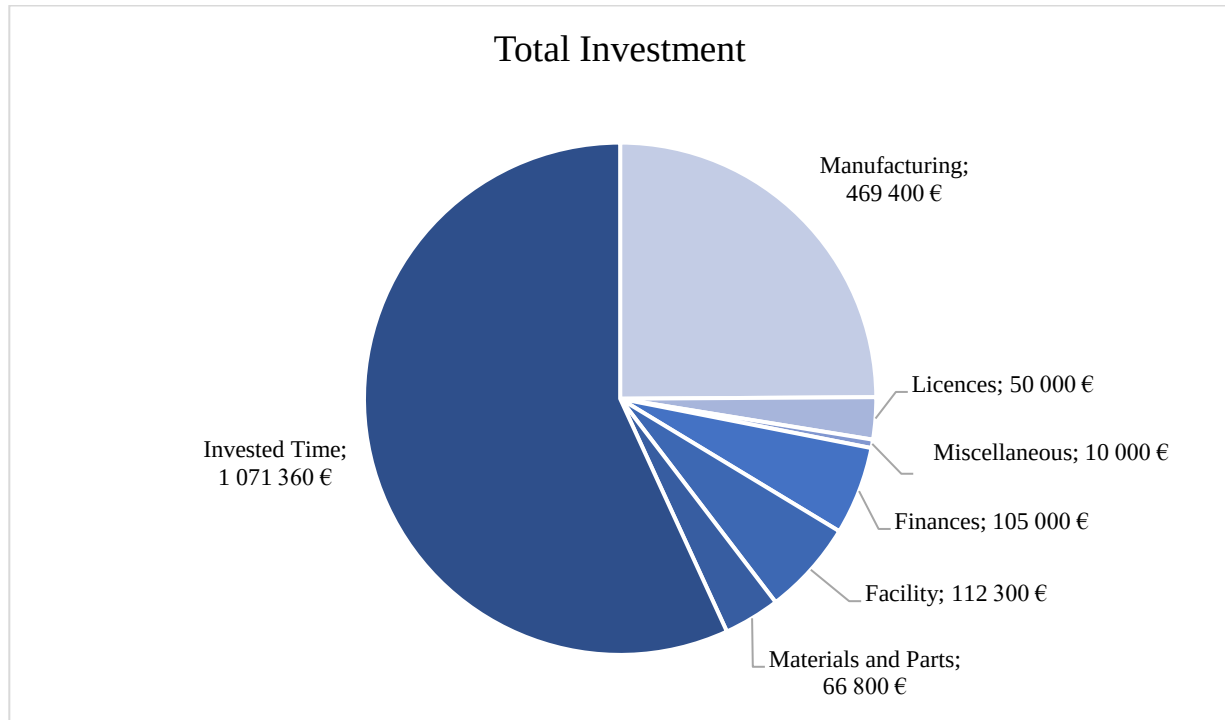
Number of people:	Hrs/week:
10	50
15	30
25	20
22	10
18	5

(Source: own rendering based on data from TU Wien Racing)

For calculating the monetary value of the invested time, I used an average part time job as proxy, since this would be the most possible activity the members would do, if they were not part of the team. According to Statistics Austria, the average salary of part time workers in Austria is around 12 € / hour (Statistics Austria, 2024). In Austria this year, the gross annual contractual worktime was equal to 262 days, from which I subtracted the public holidays and

so I got 248 days. Counting with the formerly mentioned 4 hours/day, I get an actual annual worktime of 992 hours per member. In these 992 hours, our team members could earn 992×12 €. This means that the monetary value of the time invested from the 90 team members is equal to **1 071 360 €**.

5. Figure: Total Investment in the 2022/2023 season (Source: own rendering based on data from TU Wien Racing)



4.3 Outcomes and their value

Positive outcomes

The next step is determining the positive outcomes and their financial value. I found 4 of these that are significant enough to be included in the SROI calculation. The estimation process of their value can be seen in the 6. table.

- Direct student learning: Formula Student provides practical application of engineering concepts, fostering hands-on experience and skill development. To estimate the financial value, I use the price of similar on-hand workshops and practical courses.

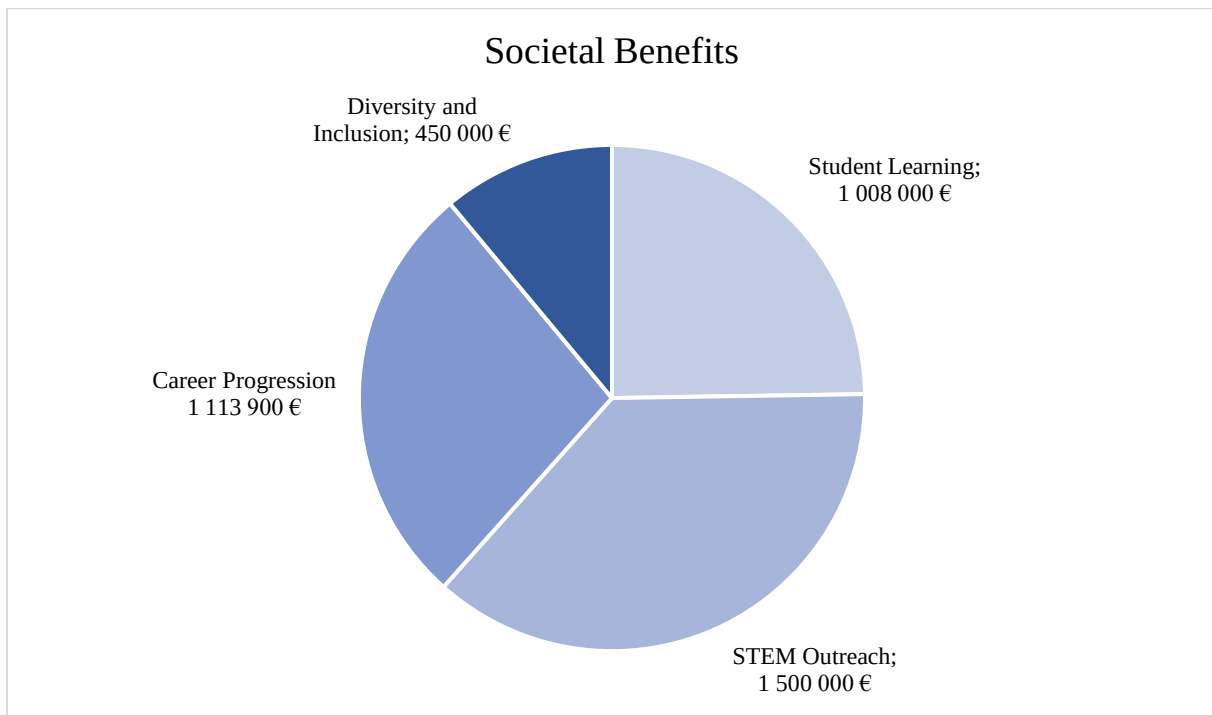
- **STEM outreach & inspiration:** Through outreach initiatives, Formula Student teams inspire interest in STEM fields by showcasing the excitement and opportunities in engineering and motorsports. For monetisation I use the average funds government allocates to STEM promotional activities as a proxy.
- **Career progression:** participation in Formula Student offers valuable networking and industry exposure, enhancing students' career prospects in the automotive and engineering sectors. For the monetary value of this outcome the saved recruitment and training costs were used.
- **Diversity and inclusion:** Formula Student fosters an inclusive environment where students from diverse backgrounds collaborate, promoting equity and representation in STEM fields. As a proxy I use the average diversity and inclusion budget of companies.

6. Table: Value estimation of the positive outcomes

	Average quantity	Proxy	Value of proxy	Value of outcome
Direct student learning	Experience worth 2 weeks of practical seminars	University application price and seminar prices	800 € / day / person (Source: alumni experience)	1 008 000 €
STEM outreach & inspiration	Reaching 1000 people	Funds allocated to R&D in Austria	Austria: 5 billion € to reach 1 000 000 people (Source: <i>Federal Ministry, Republic of Austria</i> , n.d.)	1 500 000 €
Career progression	25 Students working by sponsors later	Recruitment and training costs saved	4.300€ / person (Source: sponsors)	1 113 898 €
Diversity and inclusion	Reaching 1000 people	Diversity and Inclusion budget	450 000 € at firms who reach the same amount of people (Source: sponsors)	450 000 €

(Source: own rendering based on data from TU Wien Racing)

6. Figure: Societal Benefits in the 2022/2023 season (Source: own rendering based on data from TU Wien Racing)



Negative outcomes

There are not only benefits, but also societal costs of the FS Project. I found 3 negative outcomes that must be incorporated. The estimation process of their value can be seen in the 7. table.

- Noise pollution: the workshop of the team is in the residential zone of Vienna. Almost 100 students building a race car can result in significant noise pollution. Firstly, actual working can be very loud depending on the tools, and students bring their free time also very often in the workshop with some loud music or talking. To calculate the monetary value of the pollution, I use the local noise disturbance fees as proxy.
- Extended studies: spending most of their days in the workshop, a significant amount of team members slow down with their studies. This creates a monetary disadvantage for them and for the economy. To estimate this amount, I use the average starting salary as proxy.

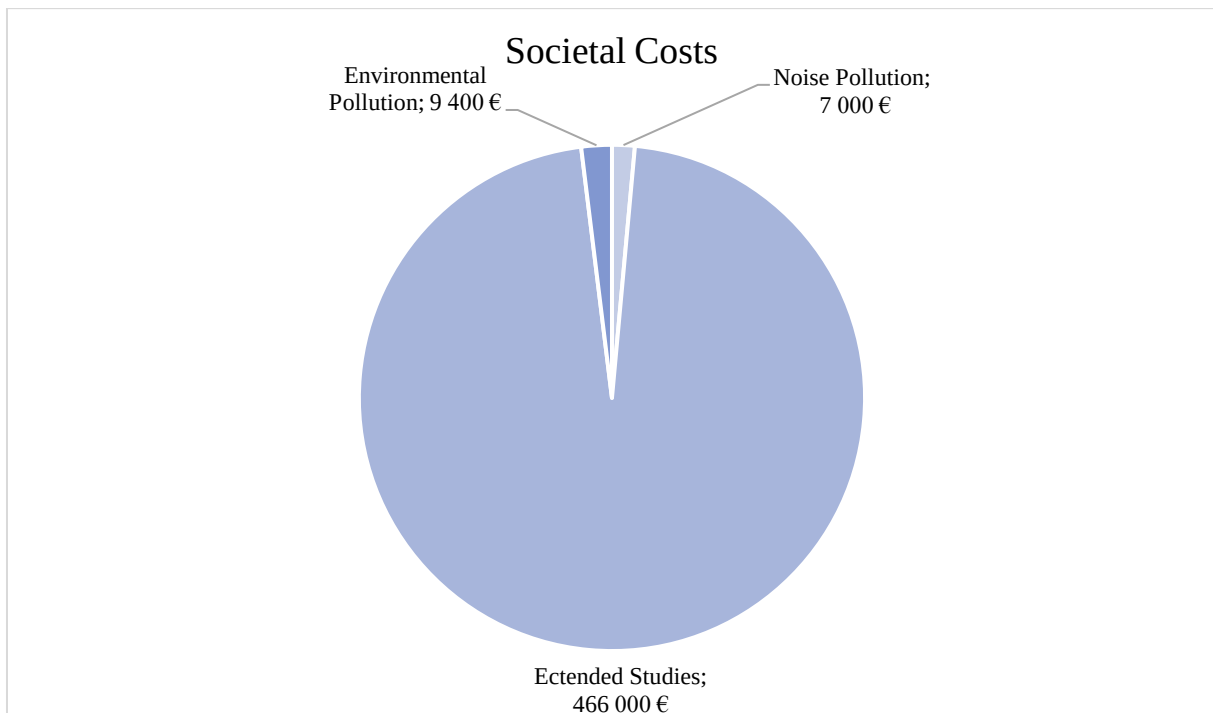
- Environmental pollution: because of the production of the carbon, metal, and electronic components, the team has a significant carbon footprint. To estimate the financial value of this harm, I take the average cost of offsetting a ton of CO2 for companies in Europe.

7. Table: Value estimation of the negative outcomes

	Average quantity	Proxy	Value of proxy	Value of outcome
Noise pollution	10 disturbances	Noise disturbance fees	700 € / disturbance (Source: Kammer für Arbeiter und Angestellte für Wien, 2023)	7000 €
Extended studies	1 year extension / person	Avg. starting salary	37 274 € (Source: talent.com, 2024)	465 925 €
Environmental pollution	93,55 metric tons of CO2	Costs of offsetting a ton of CO2	100 € / ton of CO2 (Source: L, 2023)	9 355 €

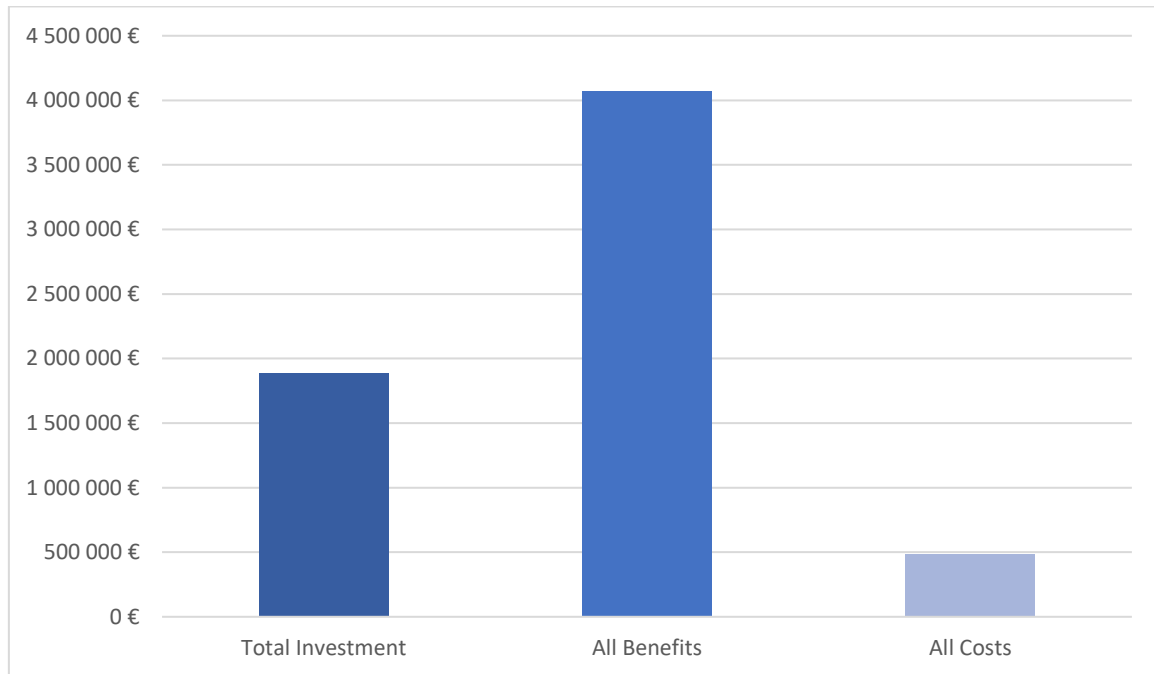
(Source: own rendering based on data from TU Wien Racing)

7. Figure: Societal Costs in the 2022/2023 season (Source: own rendering based on data from TU Wien Racing)



4.4 Calculating the SROI

8. Figure: Overview of the estimated values (Source: own rendering based on data from TU Wien Racing)



To calculate the SROI, I needed the sum of the value to the community (positive outcomes minus negative outcomes), and the sum of the investments.

9. Figure: Calculation of SROI (Source: Sulis & Syamsul Bahri, 2021)

$$\text{SROI} = \frac{\left(\begin{array}{c} \text{Tangible} \\ \text{Value to the Community (TV)} \end{array} + \begin{array}{c} \text{Intangible} \\ \text{Value to the Community (IV)} \end{array} \right)}{\left(\begin{array}{c} \text{Clock Icon} \\ \text{Total} \end{array} + \begin{array}{c} \text{Dollar Icon} \\ \text{Total} \end{array} \right)}$$

Total Investment: 1.884.860 €

All Benefits: 4.072.000 €

All Costs: 482.400 €

$$\text{SROI} = (4\,072\,000\,€ - 482\,400\,€) / 1\,884\,860\,€ \cong 1,9$$

5. Conclusion

In conclusion, the SROI analysis of the 2022/2023 season of TU Wien Racing provides valuable insights into the social impact of the Formula Student project. By identifying key stakeholders such as team members, sponsors, the university, and the local community, I gained a comprehensive understanding of the project's reach and influence. Through calculation of inputs, outcomes, and their respective values, I determined the significant positive outcomes, including direct student learning, STEM outreach, career progression, and diversity promotion. However, it's important to acknowledge the negative outcomes, such as noise and environmental pollution.

With a calculated SROI ratio of approximately 1.9, we see that for every euro invested, the project generates almost two euros in social value, showing its overall effectiveness and societal contribution.

In addition to its social value, conducting an SROI analysis for Formula Student projects shows stakeholders and possible future stakeholders valuable insights into the benefits of supporting such teams. For sponsors, understanding the social return on investment provides assurance that their contributions yield social impacts beyond traditional metrics like brand exposure. With this, sponsors can enhance their corporate social responsibility profile. Also, universities can leverage SROI analyses to showcase the educational and societal value of Formula Student programs to potential partners.

However, it's essential to acknowledge the limitations of SROI analysis. Firstly, the methodology relies heavily on quantifying both inputs and outcomes, which can be challenging for intangible or qualitative factors. Additionally, SROI calculations may oversimplify complex social phenomena, potentially overlooking certain indirect or long-term impacts of non-profit initiatives. The accuracy of SROI assessments depends on the availability and reliability of data, which may be limited or subjective in some cases, leading to potential biases or inaccuracies in the analysis. Finally, while SROI provides a valuable framework for evaluating social impact, it should be complemented by qualitative assessments and stakeholder engagement. Despite these limitations, SROI analysis remains a valuable tool for assessing and optimizing the social value of Formula Student projects, providing valuable insights for stakeholders and decision-makers alike.

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