



Speqqle

Innovating spectral analysis

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Master of Science in Responsible Management

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“Final Result Report for Speqqle”

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What Is Responsible Entrepreneurship and Why It Matters?

For a long time, entrepreneurship has been framed in what we can perceive as binary terms, either profit-driven or impact-driven. However, this separation remains misleading. It stigmatizes financial gains within social ventures, and it excuses traditional businesses from taking responsibility for their broader effects, reinforcing the idea that creating positive impact is optional, not essential. The result is a siloed landscape that discourages mutual learning and a proper understanding of problems. This has reinforced a mindset where entrepreneurs feel forced to choose between making money or making a difference.

Responsible entrepreneurship seeks to overcome this division, to rethink the status quo. The term does not refer to a separate category of enterprise, but a mindset and practice that integrates economic, environmental, and social performance into the core of entrepreneurial interest. Rooted in both ethical reflection and strategic thinking, responsible entrepreneurship emphasizes long-term value creation for a broad set of stakeholders, not just investors or customers, but also communities, employees, future generations, and of course the environment that englobes everything.

What distinguishes responsible entrepreneurship is not the industry or product, but the way in which the venture is conceived and run. Responsible entrepreneurs recognize trade-offs, confront unintended consequences, and embed continuous learning into their strategy without relying on assumptions or vague claims. A responsible entrepreneur ensures that, in addition to long-term viability, their business consciously manages its impact, minimizing the negative, maximizing the positive, and continuously works to improve operational sustainability at every stage of the product or service value chain.

In the business world, there's a common myth that sustainability increases problems and costs for entrepreneurs. However, unlike large corporations, startups have the advantage of building responsible practices from the start, avoiding future complications. In reality, sustainability is closely linked to better financial performance, with benefits like stronger reputations, lower risks, and higher long-term returns. Today, 89% of investors consider ESG factors in their decisions¹.

To push their business one step further and realize their mission to become a “responsible entrepreneur”, the founders must challenge their perspective on addressing all the stakeholders, not just the shareholders, by critically thinking of the planetary boundaries and the interconnectivity of all the groups and communities their business might impact.

The Sustainable Development Goals (SDGs) can guide the entrepreneurs towards developing a long-term sustainable business; however, the entrepreneurs must be aware of using such tools as a viable assessment, rather than forcefully connecting each goal to the business operations.

Ultimately, the responsible entrepreneurs must remember although their goal is to address the customers' pain points and bring value to their lives, one must avoid over obsession with its solution, as it will make them turn a blind eye to the real implications and damage both sides of the coin, the stakeholders and the entrepreneurs themselves.

¹ Key ESG. (2025, April 28). 50 sustainability statistics you need to know in 2025.
<https://www.keyesg.com/article/50-esg-statistics-you-need-to-know-in-2024>

Summary of Key Insights and Implications for Speqqle

This summary outlines the main conclusions from the analysis conducted by students of the Master of Science in Responsible Management at the University of Geneva, as part of the “Entrepreneurship Lab” course held from March to May 2025. The analysis was carried out by two student groups working independently and in parallel.

As a result, each group arrived at its own conclusions. While there are some commonalities, the outcomes reflect distinct perspectives and approaches. To respect this diversity, we present two versions of the summary, one from each group. Readers are invited to compare both and draw their own insights from the differences and overlaps.

Each of the following chapters has been prepared and edited by the respective group. The content, formatting, and presentation are the full responsibility of each group individually.

Summary of Key Insights and Implications for Speqqle

Chapter 1: Value propositions, Mission, Vision and Purpose

Based on the interview with Iris Crassee, and thorough analysis of Speqqle's website, the direct customers were identified to be the companies active in pharmaceuticals, dentistry and medical, construction, aerospace and defence, renewable energy (solar panels), semiconductors, electronics, and watchmaking industries, university laboratories of the departments of Materials Science, Chemistry, Mechanical, Life Science, Energy, and Sustainability, and the spectroscopy hardware manufacturers. Material developers such as scientists, PhD students and laboratory technicians are the direct users of the software, and professors and students benefit from this software through teaching and discovery activities.

By May 8th, when this assignment was revised, Speqqle did not distinguish between its mission, vision and purpose statement on the website. Our suggestions were to include a long-term aspiration and a clear projection for the future in vision statement, address the customer's pain points and reflect on willingness for partnerships in mission statement, and have a clarified reflection of problems and challenges the company aims to address for the purpose statement.

Chapter 2: Theory of Change, Intended Positive Impacts

In this chapter, we mapped how Speqqle's key outputs, such as its spectroscopy software and consulting services, lead to outcomes like improved material performance, reduced emissions, and enhanced circularity. These outcomes benefit scientists, industrial users, and academic institutions, while aligning with the SDGs. The analysis is supported by proposed indicators, including software usage frequency, number of consultation sessions, and resource efficiency metrics. This help assess Speqqle's contribution to SDG 9 (Industry and Innovation), SDG 11 (Sustainable Cities), and SDG 12 (Responsible Consumption and Production). The framework encourages the development of stronger data collection systems in collaboration with clients and stakeholders. Tracking metrics such as material recovery rates, energy use, and time savings can support a transparent impact narrative and strengthen customer trust.

Chapter 3: Negative Environmental Impacts

Speqqle's environmental impact is best assessed through user-hours, with current usage estimated by Group 1.1 at 72,000 hours annually. Electricity consumption, primarily during the use and data storage stages, drives the majority of CO₂ emissions, making climate change the most relevant impact category. Although Speqqle does not host its own servers, its reliance on third-party infrastructure like Microsoft's Swedish data centers currently ensures relatively low-carbon operations. However, future expansion into other regions may increase emissions, depending on local energy mixes. Speqqle should therefore regularly evaluate the sustainability credentials of its hosting providers, optimize software to reduce idle-time energy use, and adopt frameworks such as the Software Carbon Intensity standard. Strengthening transparency and aligning growth with environmental performance will be key to maintaining trust and mitigating rising sustainability risks.

Chapter 4: Unintended Negative Impacts

Speqqle's spectroscopic software involves five main risks that need careful attention. Sensitive research data can be exposed through third-party systems, risking confidentiality and legal issues. The software's fast identification of mineral sites might lead to harmful mining practices, affecting ecosystems and local communities. Clients without enough expertise may misinterpret

material results, causing problems in construction, recycling, or healthcare. The software could also be used by industries involved in weapons or illegal substances, raising ethical and reputational concerns. Finally, focusing on performance alone may help clients make false claims about sustainability, misleading consumers and stakeholders. To manage these risks, Speqqle should work closely with its external partners on cybersecurity, set clear rules to prevent unethical use, offer clients guidance and support in interpreting results, and keep monitoring risks as the company grows.

Chapter 5: Sustainable Business Models

Assessing Speqqle's business model through a sustainability lens highlighted both its strengths and areas for improvement. Using the Business Model Canvas, we analysed how sustainability is integrated across partnerships, key activities, value creation, customer service, and cost structure. Speqqle's core product (cloud-based, physics-driven spectroscopy) is inherently sustainable. It avoids energy-intensive AI and operates on Microsoft's renewable-powered servers, helping to minimize its carbon footprint.

Nonetheless, as Speqqle scales, energy consumption from cloud services could increase, and without sufficient training, users might misinterpret results. Enhancing communication around the platform's sustainability features could help address these issues. Speqqle is well-positioned to scale responsibly by keeping sustainability and equity central to its business model. Recommended strategies include, among others, building ESG-aligned partnerships, flexible pricing for students and emerging markets, and expanding training and sustainability reporting tools. Supporting education and workforce development also presents a long-term opportunity.

Chapter 6: Competitive Environment

The external environment offers both opportunities and challenges for Speqqle. A STEEPLE analysis reveals increasing pressure to demonstrate societal and environmental impact, driven by political mandates and ESG regulations. Speqqle's strength lies in its transparency, avoiding the complexity and trust issues typical of AI-heavy competitors. Its adaptable, accessible, and clear software is valuable, especially as many clients struggle to interpret complex sustainability data. Competitor analysis shows many rivals focus on costly hardware, AI analytics, or limited consulting, leaving a gap for a simple, credible solution like Speqqle's. This positions Speqqle to attract users seeking clarity over complexity. Success depends on maintaining clear communication and managing the shift from free to paid versions without losing trust. By meeting the demand for ethical, transparent tools, Speqqle can turn external pressures into growth opportunities.

Chapter 7: Alternative Market Opportunities

Based on the findings in previous assignments, Speqqle's core abilities and technological elements were found to be high precision material analysis, advanced data algorithms, customizability of the software to client's need and the team's expertise in materials science data analysis and consultation. The GHG emissions measurement in the energy industry, tablet coating development in the pharmaceuticals industry, and alloy development in the watchmaking industry were found to be the three most attractive market opportunities. Finally, based on the attractiveness map, the suggested strategy was to pursue the GHG emission measurement in the energy industry market now, stay open and agile towards the tablet coating development in the pharmaceuticals industry and place the alloy development in the watchmaking industry in the storage for when Speqqle becomes more established.

Summary of Key Insights and Implications for Speqqle

Chapter 1: Value propositions, Mission, Vision and Purpose

Our analysis reveals how Speqqle can deliver value through its spectroscopic analysis software across multiple sectors including academia, healthcare, and diverse industries (pharmaceuticals, dentistry, construction, aerospace, renewable energy, semiconductors, and watchmaking). Moreover, our analysis distinguishes between different value recipients within these ecosystems. Customers include university laboratories funded through departmental budgets, various industry R&D departments, and spectroscopy hardware manufacturers seeking integrated solutions. Users comprise scientists, researchers, Ph.D. students, lab technicians, and engineers who directly interact with technology. Beneficiaries extend to scientists requiring quality data for research output and patients with health care needs.

Chapter 2: Theory of Change, Intended Positive Impacts

In this chapter, we examined how Speqqle's core outputs, its spectroscopy software and consulting services, translate into meaningful outcomes such as efficient material identification, thickness and coating analysis, defect detection, and customized lab-based measurements. Furthermore, the integration of Speqqle's analytical capabilities into third-party systems and tailored workflows contributes to improved process optimization across industries. These outcomes support industrial users, research labs, and system integrators while reinforcing Speqqle's alignment with SDG 9 (Industry, Innovation and Infrastructure), SDG 12 (Responsible Consumption and Production), and SDG 17 (Partnerships for the Goals). To assess impact, we propose key indicators including the number of customers, customer retention rate, satisfaction score, and frequency of software use. This framework encourages collaboration with stakeholders to enhance data collection systems and impact reporting. Tracking these metrics enables Speqqle to build a transparent narrative around performance, strengthen client relationships, and drive long-term value.

Chapter 3: Negative Environmental Impacts

The goal of Chapter 3 was to assess the environmental footprint of Speqqle's spectroscopy software using a hotspot Life Cycle Assessment (LCA) focused on one average algorithm request. By analyzing each life cycle stage (from development to post-use) the chapter identifies energy consumption, carbon emissions, and water usage as the primary environmental impacts, with software development and use phases as the most intensive. These findings matter for Speqqle as they expose critical areas for operational improvement and highlight growing expectations for digital sustainability. Major concerns include high estimated energy use per user (approx. 266.67 watts), reliance on energy-intensive infrastructure, and limited transparency around emissions data. However, key opportunities lie in optimizing algorithms, adopting green computing strategies, using renewable-powered servers, and improving water efficiency. Proactively addressing these areas will not only reduce Speqqle's environmental impact but also strengthen its value proposition as a responsible, future-ready software provider.

Chapter 4: Unintended Negative Impacts

The outputs under analysis present several risks that require proactive management to avoid unintended harm. RefFit's reliance on cloud infrastructure may exclude users in regions with poor internet access, limiting scalability and undermining inclusive innovation. Additionally, its energy-intensive operations could contribute to a growing digital carbon footprint, conflicting with sustainability goals. The API, while powerful for data-driven decision-making, carries risks of

misinterpretation and security breaches, particularly when handling sensitive research or healthcare data, which could lead to flawed conclusions or compromised privacy. Consultancy services, if priced prohibitively, may deepen inequities by restricting access for underfunded institutions, particularly in developing regions, hindering scientific and medical progress. To mitigate these risks, measures such as offline functionality for RefFit, robust API documentation and security protocols, and tiered pricing models for consultancy services are essential. Continuous monitoring such as tracking usage patterns, energy consumption, and user feedback will ensure these solutions remain equitable, secure, and sustainable as they evolve.

Chapter 5: Sustainable Business Models

The overall goal of **Chapter 5** was to critically assess Speqqle's business model through the lens of sustainability and identify actionable improvements across its value chain. By expanding the traditional Business Model Canvas with sustainability-focused inputs, the chapter outlines how Speqqle can enhance its value proposition, partner network, and customer engagement strategies while minimizing environmental and social impact. Key concerns include limited transparency around resource use, energy-intensive operations, and potential gaps in communicating sustainability value to clients. However, the analysis reveals major opportunities for Speqqle to lead in sustainable digital infrastructure by optimizing algorithms, adopting green hosting solutions, and providing ESG-enhancing services. Moving forward, embedding circular economy principles, offering affordable access to underserved markets, and aligning cost structures with responsible practices will position Speqqle as a scalable and ethical tech innovator.

Chapter 6: Competitive Environment

Speqqle operates in a rapidly evolving context where sustainability is becoming a core expectation rather than a differentiator. The STEEPLE analysis reveals that social demand for ethical technologies, tightening environmental regulations, and pressure from ESG frameworks are shaping how startups like Speqqle must position themselves. Unlike many competitors that rely on expensive, opaque AI systems or complex hardware bundles, Speqqle offers a flexible, easy-to-understand software solution that empowers users to make more informed decisions around material performance and process efficiency. This simplicity and clarity resonate with clients navigating the complexity of sustainability transitions. Still, maintaining this positioning will require proactive communication, continuous alignment with evolving SDG frameworks, and a thoughtful approach to scaling. As external pressures mount, Speqqle has a strategic opportunity to define itself as a transparent, impact-driven partner—turning regulatory demands into long-term value creation.

Chapter 7: Alternative Market Opportunities

By exploring to identify opportunities for new products, services, and markets in chapter 7, we have identified a strong market position by offering three main services: software for analysing materials, support for sustainable practices, and expert consulting support. Speqqle can focus first on hospitals (for detecting infections, improving cancer tests and reducing the cancer cell) and mining companies (for finding minerals and monitoring environmental impact) because these markets offer the biggest opportunities and highest value. Moreover, Speqqle's easy-to-use, no-code software provides a major advantage since people without technical expertise can use it, making it easier to sell to different industries. With multiple ways to make money through software subscriptions, consulting fees, and support services, Speqqle can build a successful business by starting with healthcare and mining, then expanding to other areas like manufacturing, dental, and recycling industries once they establish themselves in the main markets.

Chapter 1. Value Proposition, Mission, Vision and Purpose

This chapter aims to establish the value creation and proposition development for Speqqle. We explored how Speqqle's software can address critical market challenges such as slow data processing and material analysis, reduced research efficiency, delayed academic publishing, and inefficient training. Analysis in the present chapter aims to show how Speqqle can create value through their approach, delivering better precision and efficiency than conventional AI methods while working with any existing hardware system.

Furthermore, as part of our analysis, we developed comprehensive value proposition statements for Speqqle tailored to different stakeholder segments. Additionally, we formulated vision, mission, and purpose statements that lays out Speqqle's aspirations, operational approach, and fundamental reason for existence. The objective of these statement is to form a strategic framework that positions Speqqle's solution in relation to market needs and long-term societal impact.

Chapter 1. Value propositions, Mission, Vision and Purpose**Part I****Customers:**

1. Companies active in various industries (including pharmaceuticals, dentistry and medical, construction, aerospace and defence, renewable energy (solar panels), semiconductors, electronics, and watchmaking).

Job: Companies constantly perform research and development to enhance the properties of traditional materials and innovate and produce new materials. They would use Speqqle's services to analyze and monitor the results.

Pain point: Slow process of data collection and material analysis, resulting in reduced efficiency, high energy usage, and slowing down the innovation that could give them a competitive advantage.

2. University Laboratories (funds from the Professors' budget, the departments of Materials Science, Chemistry, Mechanical, Life Science, Energy, and Sustainability).

Job: University laboratories constantly perform research to enhance the properties of traditional materials and innovate and produce new materials. Such projects are done both internally for publishing scientific articles and externally in collaboration with companies. They would use Speqqle's services to analyze and monitor the results.

Pain point: Slow process of data collection and material analysis, resulting in reduced efficiency, high energy usage, and slow process of publishing academic articles, inefficient training and education provided for laboratory staff and students.

3. Spectroscopy hardware manufacturers

Job: Provision of hardware for spectroscopy.

Pain point: providing a holistic solution to the customer, which includes the analysis, material identification, and properties using software.

Users:

1. Scientists and PhD students (university laboratory users, the departments of Materials Science, Chemistry, Mechanical, Life Science, Energy, and Sustainability).

Job: As an employee of the University, this group of users must perform material analysis and identification, material development and composition modification, quality control, thickness measurement, and collect the data and deliver the insights and results from thorough data analysis.

Pain points: Slow process of data collection and material analysis, resulting in reduced efficiency, high energy usage, and slow process of publishing academic articles.

2. Lab Technicians (university laboratory staff and employees, the departments of Materials Science, Chemistry, Mechanical, Life Science, Energy, and Sustainability).

Job: As an employee of the University, this group of users must perform material analysis and identification, quality control, thickness measurement and collecting the results for

researchers and professors or other academic purposes, without driving insights from the data (pure technical testing and data collection).

Pain points: Slow process of data collection, resulting in time loss.

Beneficiaries:

1. Students in engineering and life science departments.

Job: As a part of their course assignments, students must write laboratory reports and class assignments based on the results obtained by the scientists and lab technicians.

Pain points: Obtaining high quality images, data and results to write the laboratory report and assignment.

2. Professors in engineering and life science departments.

Job: Research and development of Innovative material and publishing academic papers is a major point of professors' responsibilities. They also collaborate and work for the companies to support them in developing new materials.

Pain points: slow process of publishing academic articles.

What are the company's products and services?

Product: Software for material science. Clients get access to the software based on subscriptions to a web-based application for material analysis.

Services: B2B advice on material usage.

How do they address the customers' pain points and help them get their jobs done?

Ensure material detection and quality control by analysing materials at the nano- and macroscale relying on quantum physics principles (not just on machine learning or statistical methods as its competitors).

Propose the hardware-agnostic software, meaning it can be integrated with any system utilizing light-matter interaction techniques.

Translate the results into a value proposition statement.

Value Proposition 1. (addressing scientists working at research institutions)

Our advanced spectroscopy analysis software, developed based on quantum physics, helps scientists working at academic institutions to conduct efficient material analysis and quality control, ensuring precision and ease of use to support the continuous innovation in academia and the smooth process of delivering results and insights for publishing academic journals. (unlike traditional offerings, which rely on AI and machine learning that lack expert scientific interpretation and consultation).

Value Proposition 2. (addressing engineers and product developers at companies)

Our advanced spectroscopy analysis software, developed based on quantum physics, helps engineers and product developers working in various industries to conduct efficient material analysis and quality control, ensuring precision and ease of use to support the continuous innovation in through smooth process of material property and quality analysis and giving companies competitive advantage to lead the innovation in their industry. (unlike traditional offerings, which rely on AI and machine learning that lack expert scientific interpretation and consultation).

Value Proposition 3. (addressing spectroscopy hardware manufacturers)

Our advanced spectroscopy analysis software, developed based on quantum physics, helps spectroscopy hardware manufacturers to provide a holistic and integrated solution to their clients, relieving them from looking for external software providers.

Part II

Develop purpose, vision, and mission statements for your company.

Vision:

- Our Vision is to empower academia and businesses to innovate and develop high-quality materials by providing user friendly software that provides precise data in a timely manner so that the innovators can focus on fostering the culture of curiosity without worrying about detecting technical errors.

Mission:

- Access advanced material spectroscopy analysis in an actionable and digestible format.
- Ensure quality control by analysing materials at the nano- and macroscale relying on quantum physics principles.
- Offer hardware-agnostic software that can be integrated with any system utilizing light-matter interaction techniques.

Purpose:

- Material analysis is at the heart of product manufacturing, which we need in everyday life.
- Companies usually rely on traditional machine learning or statistical methods to assess the quality and composition of materials, which often lack precision and may lead to poor business decisions. Current solutions are convoluted, slow, and hard to translate.
- Speqqle provides easily digestible materials spectroscopy and makes science accessible for the clients. Our solution is available to companies and empowers users to make informed business decisions based on the scientific analysis of the complex characteristics of quantum objects.

Compare your results to what the company communicates on their website and pitch deck: Which differences do you see, and why?

We assume that this is the mission, vision, and purpose, but we are not sure as it is not clearly defined at the Speqqle website:

Vision:

- “With Speqqle we change the way you do spectroscopic analysis.”

Mission:

- “Speqqle offers cutting-edge optical analysis software designed to quickly and accurately interpret optical data. Our unique adjustable software features multiple scientific models to meet specific application needs, offering reliable results that meet the highest standards of accuracy. Whether you're an engineer, scientist, or healthcare professional, our solutions give you the tools you need to save time and make informed decisions.”

Purpose:

- “In the world of material analysis, Speqqle aims to be a reliable and versatile tool. Rooted in solid academic research, we strive to cater to both the scientific community and

industries at large. Our goal is simple: to make advanced optical spectroscopy more accessible and user-friendly for everyone.”

Which recommendations would you give to the company?

- Upon checking their website, Speqqle does not clearly differentiate their vision, mission, and purpose. As a reader, this causes some confusion, and we would recommend as a group that they define these statements to clearly relay their intentions to potential investors and prospective users. This would enable them to improve customer acquisition, talent attraction and potentially incite more funder interest.
- The vision statement does not inspire long-term aspiration or a clear projection for the future. We recommend formulating a vision that elaborates on how Speqqle would look from a long-term perspective.
- The company’s purpose does not clearly reflect the problems and challenges it aims to address. We recommend formulating more clearly the benefits that the Speqqle software provides.
- The mission does not reflect the company’s willingness to engage in collaboration with other companies and industries. We recommend defining the target audience more clearly and addressing their needs.

GROUP 1.2

Chapter 1. Value propositions, Mission, Vision and Purpose

1. Who are Speqqle's customers and consumer? Who are the key beneficiaries?

Industries	University	Pharmaceutical/ Healthcare	Various Industries (Mining Industry, Hardware Manufacturer, Dental Industry, Recycling/Waste Management, Engineers)
Customers	University and Researchers (mainly in the field of astronomy, chemistry, materials science, and physics)	Hospitals, Clinics	Respective Managers
Users	a. Researchers & academics (mainly in the field of astronomy, chemistry, materials science, and physics) b. Students (mainly in the field of astronomy, chemistry, materials science, and physics)	a. Scientists b. Health care professionals	a. Engineers b. Scientists
Beneficiaries	a. Researchers & academics (mainly in the field of astronomy, chemistry, materials science, and physics) b. Students (mainly in the field of astronomy, chemistry, materials science, and physics)	a. Scientists b. Patients	a. Engineers b. Scientists

2. What are their “jobs” and “pain” points?

Target Audience	“Pains” Points	“Jobs”
Researchers & Academics (mainly in the field of astronomy, chemistry, materials science, and physics)	<ul style="list-style-type: none"> a. Extensive training b. Time consuming 	<ul style="list-style-type: none"> a. Conduct material analysis quickly and accurately b. Ensure accuracy in material identification.
Health Care Professionals	<ul style="list-style-type: none"> a. Installation b. Existing methods lack precision. c. Time consuming 	<ul style="list-style-type: none"> a. Accurately detect biological abnormalities (e.g., cancerous tissues)
Various Industries (Mining Industry, Hardware Manufacturers, Dental Industry, Recycling/Waste Management, Engineers)	<ul style="list-style-type: none"> a. More user friendly b. Need fast and scalable integration c. Need to integrate circular economy in their operation d. Need to reduce mineral or other important material loss 	<ul style="list-style-type: none"> a. Integrate software seamlessly into existing hardware

Speqqle addresses these challenges by offering an intuitive, fast, and customizable spectroscopy analysis software, allowing professionals to focus on what truly matters: their analyses and strategic decisions.

3. What are the company’s products and services?

- a. **RefFIT** : RefFIT (Spectroscopy Analysis Software) is Speqqle’s core product. It is a desktop version spectroscopy analysis platform that uses physics-based models to analyze material properties through light-material interactions (e.g., domains like-reflection, Raman spectroscopy, X-ray absorption, THz, and chemometrics). It helps the user to identify and control the quality of materials without any AI training or extensive calibration.
- b. **API**: Speqqle offers an API (Application Programming Interface) along with RefFIT, which enables integration of its spectroscopy analysis capabilities into third-party systems or custom workflows.

- c. Speqqle also provides consultancy services, including lab-based measurements and software customization for specific client needs.
- d. A new commercial version of the software is in development, shifting from the free academic version to a paid, subscription-based model- it will replace the existing version. Older versions need to be installed in the system and newer is web-based opposed to the older desktop version.

4. How do they address the customers' pain points and help them get their jobs done?

Speqqle addresses customers' pain points by providing them with physical knowledge of light-material interactions for immediate, accurate results without wasting extra time for training. It does so by:

- a. It eliminates dependence on large training datasets: No need for time-consuming AI model calibration.
- b. Provides real-time material analysis: Faster and more accurate quality control for industries.
- c. Non-invasive, highly precise measurements: Medical professionals can detect abnormalities more accurately.
- d. Seamless integration with existing hardware: Hardware manufacturers save time and costs.
- e. Scalability through cloud-based software: No installation needed, making it easy

5. Translate the results into a Value Proposition Statement.

Speqqle provides cutting-edge spectroscopy software that enables scientists, engineers, and industry professionals to analyze materials with exceptional speed and precision, without the need for complex machine learning or lengthy calibration. Unlike conventional tools that rely on complex, opaque setups, Speqqle's physics-based approach directly interprets quantum interactions, delivering fast, transparent, and reliable results.

- For scientists and researchers: Speqqle offers fast, user-friendly, and accessible tools to accelerate discovery, reduce lab waste, and avoid costly trial-and-error.
- For hardware manufacturers: Speqqle adds value through plug-and-play compatibility, minimal setup, and lower computational demand, helping to extend product life cycles and reduce environmental impact.

Speqqle's upcoming web-based interface will make high-performance spectroscopy available across geographies and income levels, helping to support sustainable innovation in fields like healthcare, mining, and recycling.

Speqqle's Purpose (The 'Why'):

To empower responsible science and technology by making material intelligence accessible to everyone, to help create a future where resources are used wisely and innovation serves both people and planet.

Vision (The ‘What’):

We envision a world where fast, accurate material analysis is available to all, and helps fuel smarter decisions, resource efficiency, and a global shift toward sustainable, data-driven innovation.

Mission (The ‘How’):

We envision a world where fast, accurate material analysis is available to all, and helps fuel smarter decisions, resource efficiency, and a global shift toward sustainable, data-driven innovation.

- Simplify material analysis across sectors,
- Reduce waste and overproduction through cloud-based insights,
- Support underserved researchers and institutions through accessible, scalable solutions, and
- Collaborate with partners to co-create ethical, sustainable innovations.

Chapter 2. Theory of Change: Intended Positive Impacts

Chapter 2 provides the foundations of impact measurement. We describe a structured way to assess Speqkle's effects across social, environmental, and economic dimensions. Building on the Theory of Change, the chapter outlines how Speqkle's spectroscopy software and consulting services contribute to improved material analysis, enhanced process efficiency, and integration into industrial workflows. These outputs and outcomes are connected to the long-term value the company aims to create.

The chapter also discusses how these activities align with selected SDGs, considering both global and Swiss sustainability priorities. Rather than prescribing a fixed set of goals, it acknowledges multiple possible linkages, encouraging Speqkle to define and refine its SDG focus over time.

Identified key indicators help track progress. The framework promotes transparent and adaptive measurement practices that evolve with Speqkle's operations and respond to stakeholder expectations.

GROUP 1.1.

Chapter 2. Theory of Change: Intended Positive Impacts

The following tables present a detailed breakdown of Speqkle's Theory of Change. Table 1 outlines the main stakeholder groups engaged by the company's activities. Tables 2 and 3 link Speqkle's outputs to intended outcomes and suggest indicators and data sources for measuring impact. Table 4 connects these outcomes to relevant SDGs at both the global and Swiss levels.

Table 1. Stakeholders

Stakeholder type	Stakeholder name	More detailed information
Primary Users	Scientists	Scientists, researchers and lab technicians actively conducting experiments and publishing results using Speqkle software in Switzerland and abroad.
	Lab technicians	Users who may be in the lab that are non-scientists around the world.
Secondary Users	Students	Science and Engineering Departments from Switzerland and abroad.
	Head of academic departments	Academic faculties who supervise research and may influence software adoption in academic labs.
	Spectroscopy analysis hardware manufacturers	Global manufacturers who produce spectroscopy hardware.
Customers	University laboratories	Science and Engineering Departments from Switzerland and abroad.
	Companies from various industries	Manufacturers from sectors like semiconductors, pharmaceuticals, and photonics.

Source: Group 1.1.

Table 2. Outputs

Outputs	Related Stakeholders	Indicators	Data source	Availability	Data collection requirements
Spectroscopic Material Analysis Software	Customer/Users (all)	# of users expressing interest (already-signup or request), average frequency of use per user per month, # of projects/tasks per user per month	Track software login frequency per account ID, surveys	Tbd (requires clarification from Speqqle)	Quantify sign-ups based on # of accounts
Scientific consulting on software output	Customer/Users (all)	# Contracts, # clients, size of consulting contract (in CHF or hours), type of consulting requested	Internal documentation, customer user data	Tbd (requires clarification from Speqqle)	Quantify based on customer outreach for spectroscopy software output consultation
*Materials testing and reiteration	Customer/Users (all)	# Users, repeat users, new users	Internal documentation, customer user data	Tbd (requires clarification from Speqqle)	Quantify based on user account usage patterns, # consultation requests

Source: Group 1.1.

*A software module that allows users to analyze material samples and re-test or adjust based on previous outputs

Table 3. Outcomes

Outcomes	Related Outputs	Indicators	Data source	Availability	Data collection requirements
Improved material quality and performance through in-depth material analysis	Software, consulting	Market share (%), # of users, # of consultation sessions	Software usage data, user accounts	Tbd (requires clarification from Speqqle)	Collaboration with users to provide information, require enhanced user data, e.g. obligatory corporate email addresses
Enhanced efficiency of material development, testing, and manufacturing (speed)	Software, consulting	Cost & Time Reduction (hours, CHF)	Internal time tracking, customer's reports	Tbd (requires clarification from Speqqle) Internal data (time tracking tools), customer time savings	Proper administrative records, collaboration with customer teams
Reduced emissions by supporting efficient material development and reducing the energy used for relevant activities	Software, consulting	Reduction in Electricity Consumption (%)	Utility bills, customer's sustainability reports	Tbd (requires clarification from Speqqle) Customer's site	Collaboration with customers to provide information
Reduced quantity of materials used, choose of more sustainable/alternative materials (e.g., reduction in usage of rare earth metals in photonic devices)	Software, consulting	Material Reduction Rate (%)	Product design and manufacturing documentation, customer's sustainability reports	Tbd (requires clarification from Speqqle) Customer's material usage data	Collaboration with customers to provide information

Improved detection and classification of recyclable materials to enhance circularity in industrial processes (e.g., construction industry, increased recovery rate of concrete aggregates in demolition projects)	Software, consulting	Material Recovery Rate (%)	Internal documents, customer's sustainability reports	Tbd (requires clarification from Speqqle) Customer's data (construction and demolition companies)	Collaboration with customers to provide information
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Source: Group 1.1.

*We calculate the reductions by defining a baseline, established via customer-provided data before software implementation.

Table 4. Impacts

SDGs	Related Outcomes	Sub-target/Indicator (Global)	Sub-target/Indicator (Swiss)	Target Specification
Goal 9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation. Speqqle promotes innovation and industrial efficiency by enabling precise material analysis	Provide in-depth material analysis for material development and quality enhancement. Reduce the amount of materials used, choose of more sustainable/alternative materials.	9.1. Develop quality, reliable, sustainable and resilient infrastructure, including regional and trans-border infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all.	Switzerland has needs-based, resilient and solidly financed transport and communications infrastructures (domestic policy objective).	Speqqle offers an advanced material analysis solution that can be used during the preparatory phase of construction projects, helping select high-quality, sustainable materials that minimize environmental impact and do not harm human health.

SDGs	Related Outcomes	Sub-target/Indicator (Global)	Sub-target/Indicator (Swiss)	Target Specification
and supporting sustainable infrastructure development.	<p>Reduce emissions by supporting efficient material development and reducing the energy used for relevant activities.</p> <p>Better material detection to support the circular economy practices (e.g., construction industry, treatment of the demolition waste).</p>	9.4. By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries acting in accordance with their respective capabilities.	Companies exploit their resource efficiency by optimally designing their production processes and products. The economic and technical potential for closing material cycles is realised (domestic policy objective).	Speqkle enhances resource efficiency by enabling precise material analysis, reducing emissions and energy use in industrial processes, and supporting circular economy practices, helping upgrade infrastructure sustainably while ensuring companies optimize production and close material cycles.
	Enhance efficiency of material development, testing, and manufacturing (speed).	9.5. Enhance scientific research, upgrade the technological capabilities of industrial sectors in all countries, in particular developing countries, including, by 2030, encouraging innovation and substantially increasing the number of research and development workers per 1 million people and public and private research and development spending.	Switzerland remains a leader in education, research and innovation (domestic policy objective).	Speqkle cooperates with scientists to help them enhance efficiency in material development and testing, driving innovation and technological progress. This supports scientific research and industrial advancements and strengthens Switzerland's research and innovation ecosystem.

SDGs	Related Outcomes	Sub-target/Indicator (Global)	Sub-target/Indicator (Swiss)	Target Specification
	Provide in-depth material analysis for material development and quality enhancement.	9.b. Support domestic technology development, research and innovation in developing countries, including by ensuring a conducive policy environment for, inter alia, industrial diversification and value addition to commodities.	Support domestic technology development, research and innovation in developing countries, including by ensuring a conducive policy environment for, inter alia, industrial diversification and value addition to commodities.	Speqqle offers its material analysis software free of charge to developing countries, where it can support innovation and industrial diversification.
<p>Goal 11. Make cities and human settlements inclusive, safe, resilient and sustainable.</p> <p>Speqqle supports sustainable urbanization by enabling improved material recovery from construction and demolition waste.</p>	Better material detection to support the circular economy practices (e.g., construction industry, treatment of the demolition waste).	11.6. By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management.	The population is protected from noise and vibrations to the extent that their health is guaranteed. Quiet living spaces are protected and promoted (domestic policy objective).	Speqqle enhances material detection to support circular economy practices in the construction industry and demolition waste management, reducing environmental impact. This improves waste management and reduces pollution in urban areas, aligning with Switzerland's goal of safeguarding public health through efficient waste practices and environmental protection.

SDGs	Related Outcomes	Sub-target/Indicator (Global)	Sub-target/Indicator (Swiss)	Target Specification
	<p>Reduce emissions by supporting efficient material development and reducing the energy used for relevant activities.</p> <p>Reduce the quantity of materials used, choose of more sustainable/alternative materials.</p> <p>Better material detection to support the circular economy practices (e.g., construction industry, treatment of the demolition waste).</p>	<p>11.b. By 2020, substantially increase the number of cities and human settlements adopting and implementing integrated policies and plans towards inclusion, resource efficiency, mitigation and adaptation to climate change, resilience to disasters, and develop and implement, in line with the Sendai Framework for Disaster Risk Reduction 2015-2030, holistic disaster risk management at all levels.</p>	<p>The number of damaging events affecting settlements is falling and their effects are diminishing compared with the 2005-2015 period.</p>	<p>By reducing emissions, optimizing material use, and promoting sustainable materials, Speqkle enhances material detection to support circular economy practices. This aids in improving resource efficiency in cities and fostering more resilient and sustainable settlements.</p>

SDGs	Related Outcomes	Sub-target/Indicator (Global)	Sub-target/Indicator (Swiss)	Target Specification
	<p>Reduce emissions by supporting efficient material development and reducing the energy used for relevant activities.</p> <p>Reduce the quantity of materials used, choose of more sustainable/alternative materials.</p> <p>Better material detection to support the circular economy practices (ex., construction industry, treatment of the demolition waste).</p>	<p>11.c. Support the least developed countries, including through financial and technical assistance, in building sustainable and resilient buildings utilizing local materials.</p>	<p>Through its international cooperation, the Confederation supports the construction of sustainable and resilient buildings, both within the framework of reconstruction projects and within the framework of prevention projects (e.g. through the dissemination of sustainable and risk-adapted construction methods), building on local knowledge, techniques and materials, while at the same time disseminating technically proven construction methods (foreign policy objective).</p>	<p>Speqqle provides its solutions free of charge to developing countries, enabling them to reduce emissions, optimize material use, and adopt sustainable alternatives. Through enhanced material detection for circular economy practices, Speqqle has the potential to support the construction of sustainable and resilient buildings using local materials. Additionally, Speqqle can provide capacity building, subject to funding, to improve the better application of the software in line with Switzerland's foreign policy goals.</p>
<p>Goal 12. Ensure sustainable consumption and production patterns.</p> <p>Speqqle contributes to sustainable production by optimizing material usage</p>	<p>Provide in-depth material analysis for material development and quality enhancement.</p> <p>Reduce the quantity of materials used, choose of</p>	<p>12.1. Implement the 10-Year Framework of Programmes on Sustainable Consumption and Production Patterns, all countries acting, with developed countries taking</p>	<p>Switzerland engages in the six programs of the Ten-Year Program on Sustainable Consumption and Production Patterns (10YFP) through action plans, strategies, projects,</p>	<p>Speqqle's solution plays a critical role in advancing sustainable production and consumption by enabling smarter material development across various industries. By</p>

SDGs	Related Outcomes	Sub-target/Indicator (Global)	Sub-target/Indicator (Swiss)	Target Specification
and supporting circular economy practices.	<p>more sustainable/alternative materials.</p> <p>Better material detection to support the circular economy practices (e.g., construction industry, treatment of the demolition waste).</p>	the lead, considering the development and capabilities of developing countries.	or governance of specific programs by the federal government or a Swiss actor/partner (domestic policy objective).	providing in-depth material analysis, we help reduce waste and optimize material use, ensuring that resources are used efficiently and sustainably.
	<p>Reduce emissions by supporting efficient material development and reducing the energy used for relevant activities.</p> <p>Reduce the quantity of materials used, choose of more sustainable/alternative materials.</p> <p>Better material detection to support the circular economy practices (e.g., construction industry, treatment of the demolition waste).</p>	12.2. By 2030, achieve the sustainable management and efficient use of natural resources.	<p>The overexploitation of natural resources in Switzerland and abroad is avoided. The environmental impacts of consumption and production are markedly reduced. The materials footprint is reduced substantially and in harmony with the 1.5-degree target set in the Paris Climate Agreement.</p> <p>On the basis of environmental accounting, the carbon footprint from final per capita food</p>	Speqgle's technology supports the efficient utilization of resources by optimizing material processes, helping industries adopt more sustainable practices. By improving the identification and analysis of materials, we enable a transition towards a more sustainable use of resources in a wide range of industries. In alignment with Switzerland's environmental policy, our solution helps prevent overuse of resources, contributing to a significant

SDGs	Related Outcomes	Sub-target/Indicator (Global)	Sub-target/Indicator (Swiss)	Target Specification
			demand declines by one-quarter compared to 2020.	reduction in environmental impacts.
	Provide in-depth material analysis for material development and quality enhancement.	12.a. Support developing countries to strengthen their scientific and technological capacity to move towards more sustainable patterns of consumption and production.	International cooperation supports the development, dissemination and utilization of knowledge and innovative approaches for the reduction of poverty and global risks (foreign policy objective).	Speqqle offers free access to its advanced material analysis technology, helping developing countries enhance their ability to innovate in sustainable production and material development.

Source: Group 1.1.

GROUP 1.2

Chapter 2. Theory of Change: Intended Positive Impacts

Stakeholder type	Stakeholder name	More detailed information
Customers	University	Universities in different countries
	Hospital	Hospital and health care providers in different countries
	Clinics	Pharmaceutical and dental clinics in different countries
	Companies	Companies working in the fields of mining, recycling, refining, collection, etc.
Customer /Users/Beneficiaries	Researchers & academics	Researchers & academics of partners university
	Students	Students enrolled at different universities around the world (for ex. in Switzerland, USA, etc.)
	Scientists	NASA and others (we are waiting for more information from founder)
	Healthcare professionals	Pharmaceutical and dental clinics in different countries
	Engineers	University and various companies
Beneficiaries	Patients	People benefiting from medical applications of Speqkle

Outputs	Related Stakeholders	Indicators	Data source (where to find)	Availability	Data collection requirements
RefFit	Universities, researchers, academics, companies, scientists, engineers, healthcare sector workers	i. Number of customers ii. Customer retention rate, iii. Satisfaction score, iv. Frequency of use	Speqkle's internal report	Internal data base	i. Existing data ii. existing data iii. satisfaction survey iv. our survey
API	Universities, researchers, academics, companies, scientists, engineers, healthcare sector workers	i. Number of customers ii. Customer retention rate, iii. Satisfaction score, iv. Frequency of use	Speqkle's internal report	Internal data base	i. Existing data ii. existing data iii. satisfaction survey iv. our survey
Consultancy services	Lab-based measurements and software customization for specific client needs	i. Number of customers ii. Satisfaction score	Speqkle's consultancy service report / Internal report	Internal data base	i. Existing data ii. satisfaction survey

Outcomes	Related Output(s)	Indicators (the most cost-efficient, impactful)	Data source	Availability	Data collection requirements
Conducting efficient spectroscopic analyses like material identification, thickness and coating analysis, defect detection	RefFit	i. Number of customers ii. Customer retention rate, iii. Satisfaction score, iv. Frequency of use	Speqqle's internal report	Internal data base	i. Existing data ii. existing data iii. satisfaction survey iv. our survey
Integration of its spectroscopy analysis capabilities into third-party systems or custom workflows through process optimization	API	i. Number of customers ii. Customer retention rate, iii. Satisfaction score, iv. Frequency of use	Speqqle's internal report	Internal data base	i. Existing data ii. existing data iii. satisfaction survey iv. our survey
Lab-based measurements and software customization	Consultancy services	i. Number of customers ii. Satisfaction score	Speqqle's consultancy service report / Internal report	Internal data base	i. Existing data ii. satisfaction survey

SDG	Related Outcome(s)	Sub-target/indicator (Global)	Sub-target/indicator (CH)	Own specification of target
9	Conducting efficient spectroscopic analyses like material identification, thickness and coating analysis, and defect detection	9.4 By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities.		
9	Conducting efficient spectroscopic analyses like material identification, thickness and coating analysis, and defect detection	<p>9.5 Enhance scientific research, upgrade the technological capabilities of industrial sectors in all countries, in particular developing countries, including, by 2030, encouraging innovation and substantially increasing the number of research and development workers per 1 million people and public and private research and development spending.</p> <p>9.a Facilitate sustainable and resilient infrastructure development in developing countries through enhanced financial, technological and technical support to African countries, least developed countries, landlocked developing countries and small island developing States.</p> <p>9.b Support domestic technology development, research and innovation in developing countries, including by ensuring</p>	<p>9.1 Switzerland has needs-based, resilient and solidly financed transport and communications infrastructures (domestic policy objective).</p>	Lower carbon footprint and optimize use of materials

		a conducive policy environment for, inter alia, industrial diversification and value addition to commodities.		
12	Lab-based measurements and software customization	12.6 Encourage companies, especially large and transnational companies, to adopt sustainable practices and to integrate sustainability information into their reporting cycle	<p>12.2(a) The overexploitation of natural resources in Switzerland and abroad is avoided. The environmental impacts of consumption and production are markedly reduced. The materials footprint is reduced substantially and in harmony with the 1.5-degree target set in the Paris Climate Agreement.</p> <p>12.6 Companies domiciled and/or operating in Switzerland conduct their national and international business activities responsibly, with specific regard to working conditions, human rights and the environment.</p>	Waste reduction
17	Integration of its spectroscopy analysis capabilities into third-party systems or custom workflows through process optimization	Technology. 17.6 Enhance North-South, South-South and triangular regional and international cooperation on and access to science, technology and innovation and enhance knowledge-sharing on mutually agreed terms, including through improved coordination among existing mechanisms, in particular at the United Nations level, and through a global technology facilitation mechanism	<p>17.6 Through its international cooperation in developing countries and international bodies, the Confederation supports North-South, South-South and also trilateral cooperation, thereby promoting the exchange of experience and networking, encouraging the use of the know-how and technologies of emerging countries, and contributing know-how and innovative approaches itself (foreign policy objective).</p> <p>17.8 Within its international cooperation, Switzerland promotes access to knowledge and</p>	<p>Our Recommendation: Speqqle can establish a trilateral partnership between a university, research institute, and hardware manufacturer to co-develop a low-cost, open-source spectroscopy analysis toolkit based on RefFIT's API. This toolkit can be shared globally via a Creative Commons license,</p>

		<p>technologies in selected areas and advocates equal access to information technologies for the entire world population (foreign policy objective).</p>	<p>targeting 10,000 downloads and training 500 researchers from developing countries through virtual workshops.</p>
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Chapter 3. Life Cycle Analysis: Negative Environmental Impacts

Chapter 3 examines the potential environmental impacts associated with Speqkle's operational activities. Using a hotspot Life Cycle Assessment approach, the analysis maps Speqkle's software value chain, from development to post-use, assessing the inputs used and the externalities generated. This enables the identification of key environmental concerns and highlights areas for potential improvement.

Recognizing these effects early allows Speqkle to anticipate reputational risks, benchmark against industry practices, and implement strategies that mitigate negative outcomes while supporting sustainable innovation. Openly acknowledging these impacts also enhances transparency and helps build trust with external stakeholders.

This chapter offers guidance and resources to help Speqkle monitor, manage, and minimize its environmental footprint. Addressing these issues proactively creates opportunities to integrate sustainability into core business strategy and ensure operational preparedness as the company scales.

Chapter 3. Life Cycle Analysis: Negative Environmental Impacts

1. A suitable functional unit

Speqqle's primary product is software that enables users to analyze their materials for subsequent production processes across various industries. To assess the sustainability impact associated with its use, we employ the **functional unit of hours per user**. Tracking the duration of user engagement provides an equitable comparison, irrespective of the properties of the materials examined.

To estimate the total annual user-hours of software use, we consider that the average user analyses between two and four different materials per month. Using a midpoint of three materials per month, and assuming each material analysis session takes approximately one hour, this results in an estimated 36 user-hours per year per user. With a user base of 2,000 active users, the total annual usage is approximately **72,000 user-hours per year**. This figure represents the cumulative operational time of the software across all users and serves as a basis for assessing the sustainability impact of the product. Speqqle may refine this estimate further using internal usage data, enabling more precise calculations based on actual user behaviour, material types, and session durations.

2. Inputs and outputs at the relevant life cycle stages

Table 1. Speqqle value chain.

	Stage 1 Software development	Stage 2 Hosting, operation, maintenance	Stage 3 Use	Stage 4 Post-use (including data storage)
Input	Computer, server equipment, electricity	Computer, server equipment, electricity	Computer, server equipment, electricity	Server equipment
Output	CO2 emissions	CO2 emissions, thermal pollution	CO2 emissions, material waste, thermal pollution	CO2 emissions, thermal pollution, e- waste

Source: Group 1.1.

A more detailed analysis of the approach for life cycle assessment is provided in the appendix of this document.

3. The relevant impact categories for inputs and outputs

Based on the value chain analysis, we identified that, in terms of sustainability assessments for Speqqle, the most critical factors to evaluate are its resource inputs. First, energy (electricity) consumption is essential for software operations, data storage, and air conditioning to cool data servers. Second, water usage for data warehouse cooling must be considered. Speqqle's servers are currently hosted by Microsoft in Sweden, where the electricity supply is largely based on renewable energy. This contributes to reducing the environmental impact of the software's operation. In the future, if Speqqle expands its hosting to other Microsoft data centers, it will be important to review the sustainability performance of those facilities. Additionally, Speqqle should monitor Microsoft's environmental commitments and actions over time. This will help the company

maintain transparency and respond appropriately to any questions or concerns related to its energy consumption.

High electricity consumption occurs at all stages of value creation, primarily due to the increased use of centrally supplied utility services. These services rely on burning fossil fuels, leading to high CO₂ emissions. As a result, the three most critical impact categories of the startup, considered negative externalities, are: (1) climate change due to CO₂ emissions and (2) thermal pollution resulting from data server operations.

4. The most relevant impact category

The most relevant impact category for Speqqle is climate change due to CO₂ emissions, which are caused by high electricity consumption, the major input at all stages of the value chain. Research shows that GHG emission is the main category for IT and software services.

Table 2. Negative input of Speqqle's value chain stages to the climate change.

Impact category	Measurement	Stage 1 Software development	Stage 2 Hosting, operation, maintenance	Stage 3 Use	Stage 4 Post-use (including data storage)
Climate change	kg CO ₂ from the electricity consumption	Low	Moderate	High	High

Source: Group 1.1.

During the use stage, radiation emission might occur depending on the source used in the spectroscopy hardware laser beam. For example, near-infrared (NIR) laser excitation which is used in Raman thermometry can contribute to warming the planet². The energy used in this stage can be measured by electron volts. Further discussion with the Speqqle team is required to clarify this topic.

Based on the energy intensity of each stage of the value chain, we estimate that the most critical phase contributing to the highest CO₂ emissions is software usage and data storage (as presented in the table above). This is highly dependent on the user's base country, as different countries use different sources for electricity production. The carbon intensity grams of CO₂ equivalent per kilowatt-hour (gCO₂eq/kWh) of each country can be found at the Electricity Data Platform³.

Addressing potential accusations of negative environmental impact is essential as the startup grows. Given the desirable rapid expansion, the increasing number of users and the need for larger servers will lead to exponentially higher electricity consumption, thereby amplifying the negative impact.

² Infrared Waves, NASA Science, 2010,

https://science.nasa.gov/ems/07_infraredwaves/#:~:text=Earth%20scientists%20study%20infrared%20as,surface%2C%20thereby%20warming%20the%20planet.

³ Electricity Maps | The world's most comprehensive electricity data platform. (n.d.).

<https://www.electricitymaps.com/platform>

Other categories such as thermal pollution, acidification and increased toxins in the water could be relevant depending on the type of computers used and how the consumed electricity is produced; however, for this project, it is more efficient to focus on GHG emission⁴.

5. The impact hotspot

CO₂ emission from the electricity consumption to ensure the data storage and usage of the software is the impact hotspot of Speqqle.

6. Databases that could help collect data on the hotspot indicators

Some of the hotspot indicators:

- Software industry is responsible for about 3% of global carbon emissions⁵.
- Data centers account for about 1% of global electricity usage.
- The carbon footprint of data storage and transmissions contribute about 330 megatons of carbon dioxide to the environment per year, making up 2% of global emissions⁶.

Useful databases for further data analysis:

- Electricity Maps: Live 24/7 CO₂ emissions of electricity consumption⁷.
- The Energy and Carbon Emissions Inventory Database. International Institute for Applied Systems Analysis⁸.
- GHG Emission Factors for Electricity Consumption. European Commission, Joint Research Centre⁹.

7. Recommendations: How to monitor, reduce and compensate the impact

- Continue hosting with providers like Microsoft Sweden that rely on clean energy, and ensure future expansion prioritizes data centers with strong renewable energy portfolios.
- Regularly assess Microsoft's environmental reports and carbon footprint metrics to ensure alignment with Speqqle's climate impact goals.
- Implement automated idle detection and hardware shutdown features to reduce unnecessary energy use during low-activity periods, particularly during the user stage (highest CO₂ intensity).

⁴ Environmental impact of IT: desktops, laptops and screens, University of Oxford, April 13, 2022, <https://www.it.ox.ac.uk/article/environment-and-it>

⁵ The tech industry's progress on carbon emissions has been mixed, Tech Monitor, April 25, 2022, <https://www.techmonitor.ai/focus/tech-industry-carbon-emissions-progress>

⁶ Data Centres and Data Transmission Networks, The International Energy Agency (IEA), <https://www.iea.org/energy-system/buildings/data-centres-and-data-transmission-networks>

⁷ ElectricityMaps | Live 24/7 CO₂ emissions of electricity consumption. (n.d.-b). <https://app.electricitymaps.com/map/72h/hourly>

⁸ The Energy and Carbon Emissions Inventory Database (ECDB). (n.d.-b). IIASA - International Institute for Applied Systems Analysis. <https://iiasa.ac.at/models-tools-data/ecdb>

⁹ Bastos, Joana; Monforti-Ferrario, Fabio; Melica, Giulia (2024): GHG Emission Factors for Electricity Consumption. European Commission, Joint Research Centre (JRC) [Dataset] PID: <http://data.europa.eu/89h/919df040-0252-4e4e-ad82-c054896e1641>

- Balance computing load by scaling resources according to real-time user demand to avoid overprovisioning, especially as user numbers grow.
- Favor data centers using advanced cooling methods such as outside-air cooling, immersion cooling, or liquid cooling to reduce thermal pollution and electricity use.
- Include water footprint analysis in lifecycle assessments if Speqqle expands beyond Sweden, where cooling practices may vary in sustainability.
- Apply compression algorithms, delete redundant or outdated data, and establish auto-deletion policies to reduce long-term storage loads.
- Audit and clean data archives regularly to limit CO₂ emissions during the post-use stage, currently identified as high impact.
- As the user base expands, publish annual reports detailing energy consumption, CO₂ emissions, and mitigation efforts. Clearly presenting trade-offs, such as performance versus environmental impact, can build greater trust with stakeholders than attempting to conceal them. Transparency fosters credibility and helps manage external expectations effectively.
- Adopt Software Carbon Intensity (SCI) framework, developed by the Green Software Foundation, to quantify and track the carbon footprint of Speqqle's software across all value chain stages.

$$SCI = ((E * I) + M) \text{ per } R$$

The diagram illustrates the Software Carbon Intensity (SCI) formula: $SCI = ((E * I) + M) \text{ per } R$. Four callout boxes point to the variables:

- E:** Energy consumed by software, in kWh
- I:** Functional unit; this is how software scales, for example by user, device or API request
- M:** Carbon emitted per kWh of energy, in gCO₂ / kWh
- R:** Embodied carbon emissions from the creation (and destruction) of hardware that the software is running on.

Provided is a formula for calculating the carbon intensity of a software, this formula can be used by enterprises to track and assess the sustainability of a given process and may be used to pursue lower carbon emissions in Speqqle's operations¹⁰.

¹⁰ Calculating software carbon intensity. (n.d.). Thoughtworks.

<https://www.thoughtworks.com/insights/blog/ethical-tech/calculating-software-carbon-intensity>

Annex. Software Development Lifecycle Guideline

The aim of the annex is to use industry and academic based research to apply tangible facts to address the software development (Stage 1) and data storage (Stage 4). According to IBM, “the software development life cycle (SDLC) is a step-by-step process that development teams use to create high-quality, cost-effective and secure software”. This methodology includes planning and analysis, design, development, testing, deployment and maintenance steps.¹¹ In the article “Uncovering the Environmental Impact of Software Life Cycle”, Simon et al used the following life cycle tree to demonstrate these stages.¹²

Regarding the relevant steps to development of Speqqle, further information for the sales, hosting and data storage is required, and it must be discussed whether the design step contributes to major environmental impacts. It is also interesting to note that the hosting architecture impact might differ depending on the number of users accommodated. The article used the “Gitlab hosting reference architecture for 50,000 users” to model the usage phase.

Storage size is another potential element to consider. Simon et al “used the default repository size limit of 10GB by project and considered 2 projects per user with a 3x data redundancy; thus obtaining a total of 3,000 TB of data to store”. The paper also indicates that the location of development and hosting has an impact on the life cycle analysis. The article assumes the development and hosting in France, and we know that Speqqle is developed in Switzerland, where according to www.electricitymaps.com, the carbon intensity for electricity production is 22 gCO₂eq/kWh. Unfortunately, the article focuses on a case study which is less impacted by the usage phase, whereas based on our understanding of Speqqle, the major stage of the value chain that results in CO₂ and ionizing radiation emission is the usage step. This can be further discussed with the Speqqle team.

Based on these specifications, and the article assuming 15 years for the run phase of their case study, the results show that 13,945 tonnes of CO₂ equivalent (tCO₂e) is emitted during the building phase, and 279 tCO₂e is emitted during the run phase, excluding the usage step. It is also important to note that the article included the hardware component production in the building phase, whereas our group decided to eliminate the hardware from the life cycle analysis as Speqqle itself does not produce these components. The article indicates that “when acknowledging the hardware’s complete life cycle, its manufacturing is one of the main emissions flows, and storage becomes one of the main hotspots on the overall project life cycle”.

Regardless of the differences between the article’s and our group’s methodologies, the following environmental impacts indicated in figure 2 may occur during the run phase as a result of hardware usage. Unfortunately, the information given regarding this figure is limited in the article and our group will be reaching Dr. Thibault Simon for further details.

¹¹ What is the software development lifecycle (SDLC), IBM, December 13, 2024,
<https://www.ibm.com/think/topics/sdlc>

¹² Uncovering the Environmental Impact of Software Life Cycle, Thibault Simon, Pierre Rust, Romain Rouvoy, Joël Penhoat, April 26, 2023, <https://inria.hal.science/hal-04082263/document>

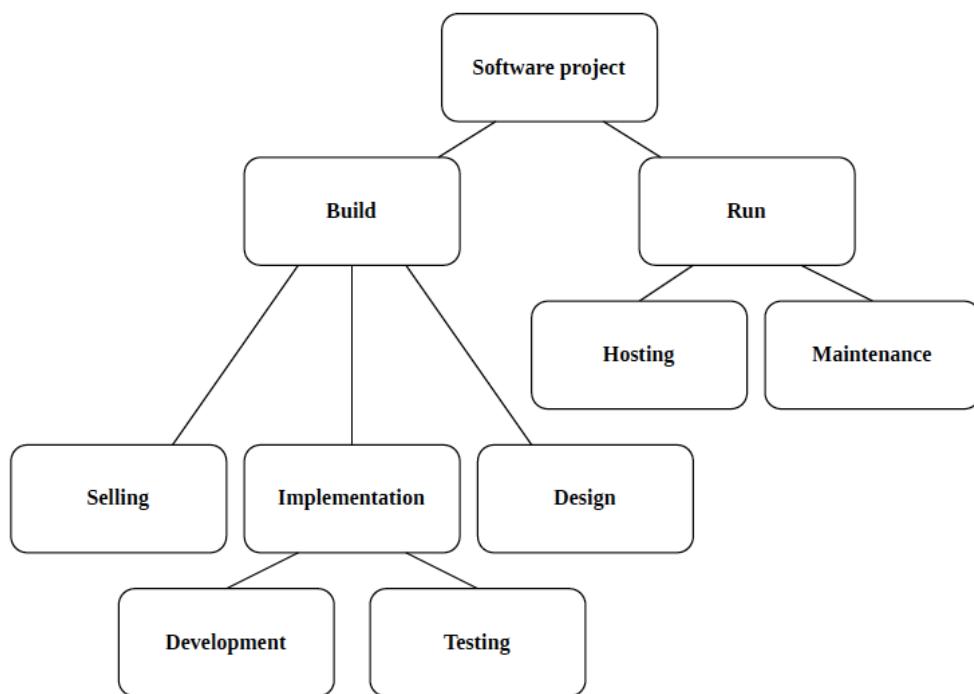


Figure 1. Software lifecycle tree example¹³

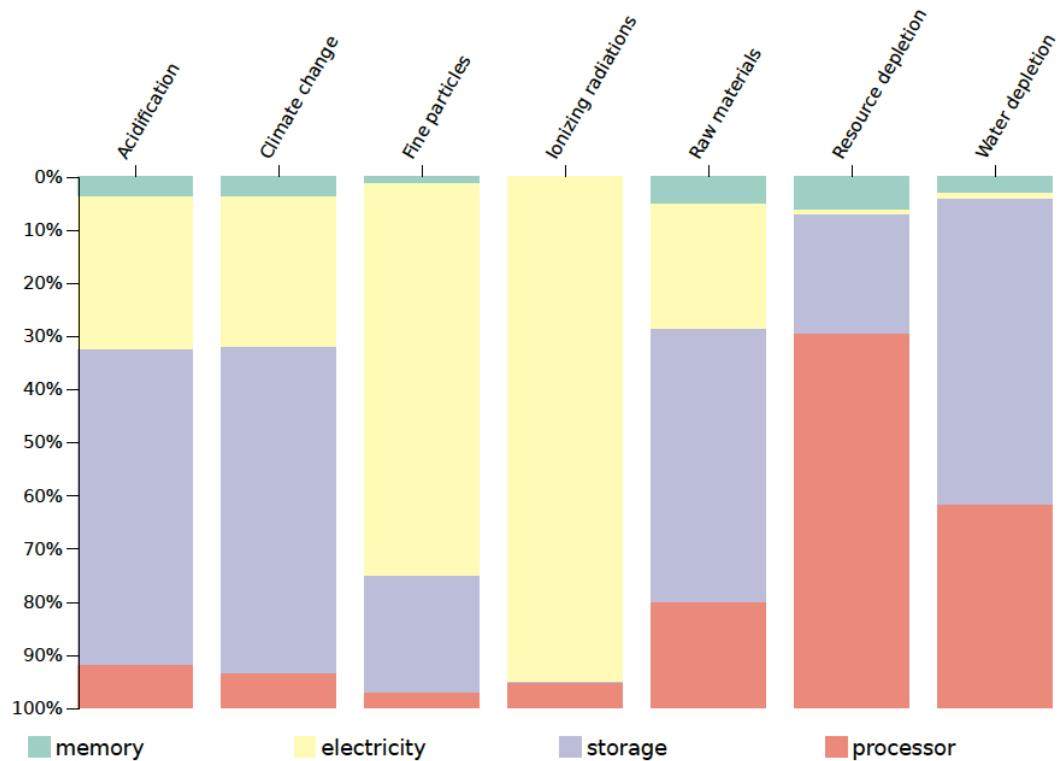


Figure 2. Run phase resources environmental impact¹⁴

¹³ Uncovering the Environmental Impact of Software Life Cycle, Thibault Simon, Pierre Rust, Romain Rouvoy, Joël Penhoat, April 26, 2023, <https://inria.hal.science/hal-04082263/document>

¹⁴ Uncovering the Environmental Impact of Software Life Cycle, Thibault Simon, Pierre Rust, Romain Rouvoy, Joël Penhoat, April 26, 2023, <https://inria.hal.science/hal-04082263/document>

GROUP 1.2.

Chapter 3. Life Cycle Analysis: Negative Environmental Impacts

1. Introduction:

To drive sustainable innovation, this study explores environmental hotspots using Life Cycle Assessment (LCA) methodology of Speqqle's key output. We analyze critical life cycle stages, from development to post-use, using a tailored functional unit, and define inputs (e.g., energy, materials) and outputs (e.g., emissions, waste) for each. From these, we identify relevant impact categories (e.g., energy consumption, carbon emissions, water usage) and, through desk research, pinpoint the most significant one, backed by explanations and credible sources. This reveals Speqqle's impact hotspot, the primary environmental burden. We then explore data sources to quantify this hotspot and propose strategies to monitor, reduce, and offset its effects. The end goal for this streamlined LCA is to highlight opportunities for environmental improvement and operational insight.

2. Speqqle's Life Cycle Stages:

Functional Unit = 1 (average) request to the algorithm. This was chosen because it reflects the smallest measurable unit of software interaction, is consistent across use cases, and allows estimation of environmental impact independent of material type or complexity, countering variability in sample conditions.

Table 1: Speqqle's life cycle stages, inputs, outputs, and impact categories

No.	Stage	Inputs	Outputs	Impact Categories
1	Software Development (including AI model training)	Energy, Hardware (computers), Water usage	CO2-e emissions (including heat dissipation)	Climate change
2	Hosting and Operation	Energy, Hardware (computers), Water usage	CO2-e emissions (including heat dissipation)	Climate change
3	Use	Energy, Hardware (computers), Water usage	CO2-e emissions (including heat dissipation)	Climate change
4	Post-use (including storage)	Energy, Hardware	CO2-e emissions (including heat dissipation)	Climate change

		(computers), Water usage		
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Table 2: Impact categories for Speqqle. Data is calculated based on averages for 6 similar companies (optical data software for material specification)

Impact Category	Software Development	Hosting and Operation	Use	Post-use
Energy Consumption	High	Low	High	Low
Carbon Emissions	High	Low	High	Low
Water Usage	High	Low	High	Low

3. Analysis:

In order to determine the energy used by one functional unit for Speqqle (which we have identified as being 1 average request to the algorithm), we identified six companies (optical data software for material specification) and calculated their average energy use (on a qualitative scale), as may be observed in Table 3. As a result, these values are approximate and derived from publicly available or inferred data. We estimate user-level energy use by dividing shared system load by estimated client volume, though these numbers may vary widely across applications. In addition, All six companies analyzed develop optical data analysis tools used in material science, with broadly similar compute demands for simulations and modeling. Speqqle should reflect on adopting any of the recommendations mentioned below to decrease their impact on climate change.

Table 3: Calculating Speqqle's average energy use based on data from 6 similar companies

Software	Developer	Energy Usage (Est.)	Number of Clients (Est.)	Average Energy Usage / CO ₂ emission
OpticStudio	Ansys, Inc.	300–500W/user	5,000–10,000 (shared)	266.67 w/user => in 1 hour there is 0.267 kWh (energy consumption) which creates 0.267 Kg CO ₂ .
Lumerical	Ansys, Inc.	300–500W/user	5,000–10,000 (shared)	
OptiLayer	OptiLayer GmbH	100–200W/user	50–200	

FilmStar	FTG Software Associates	100–150W/user	20–100 (paid), 100s (free)	
Solcore	Academic (Imperial College)	50–300W/user	200–500 (users)	
GSvit	Academic (Czech TU)	200–500W/user	50–200 (users)	

4. Recommendations for how the impact could be monitored, reduced, and compensated:

- **Optimize Energy Efficiency:** Since the estimated energy usage per user request is 266.67W, Speqgle should explore optimizing its algorithms and infrastructure to reduce energy consumption.
- **Leverage Lower Energy Alternatives:** Some software options in the table (e.g., OptiLayer and FilmStar) show lower energy consumption per user. Speqgle could analyze the methodologies these companies use to minimize power usage and adopt similar strategies.
- **Implement Green Computing Strategies:** Utilizing energy-efficient servers, renewable energy sources, and optimized load balancing can significantly reduce overall energy consumption.
- **Water Usage Optimization to Cool the System:** In order to minimize the usage of water, the company may like to consider utilizing any of the following sustainable practices: Efficient hardware selection, make use of shared servers, virtualization, renewable-powered facilities, data compression, recycling programs, or minimize their AI training.

5. Conclusion:

Based on an estimated analysis of energy consumption across comparable optical data software tools and based on the average consumption approximately **266.67 watts** per user, there is a potential for optimization. These results are indicative and highlight areas where further data collection could refine the impact estimations. Therefore, by adopting **energy-efficient computational methods, leveraging lower-power alternatives, implementing green computing strategies and water usage optimization to cool the system**, Speqgle can reduce its overall energy footprint. Moving forward, benchmarking against the most efficient solutions and optimizing infrastructure will be key steps toward enhancing sustainability while maintaining performance.

6. References: Data

1. Ansys, Inc. (Zemax OpticStudio and Lumerical)

- **Company** **Website:**
Ansys, Inc. (2025). *Ansys Zemax OpticStudio: Optical design and analysis software.* <https://www.ansys.com/products/optics-vr/ansys-zemax-opticstudio>
Note: General product information and system requirements (e.g., hardware specs implying energy use) are available here, but no specific energy calculations are provided.

- **Annual** Report:
 Ansys, Inc. (2024). *2023 annual report*. <https://investors.ansys.com/financials/annual-reports>
 _Note: Includes broad customer data (e.g., 50,000+ clients) and sustainability goals, but not product-specific energy usage. The 2023 report is the latest assumed available as of early 2025.
- **Sustainability** Report:
 Ansys, Inc. (2022). *Environmental, social, and governance (ESG) report 2022*. <https://www.ansys.com/about-ansys/sustainability>
 _Note: Mentions emissions reduction goals but lacks detailed energy breakdowns by product or stage. Used for inferring operational energy context.

4. Solcore (Imperial College London)

- **Project Website:**
 Imperial College London. (n.d.). *Solcore: Photovoltaic simulation software*. <https://www.imperial.ac.uk/photonics-and-quantum-technology/software/solcore/>
 _Note: Describes open-source tool and system requirements (e.g., Python-based), used to estimate energy for academic use, but no energy studies are linked.
- **Academic Publication:**
 Alonso-Álvarez, D., Wilson, T., Pearce, P., Führer, M., Farrell, D., & Ekins-Daukes, N. (2018). Solcore: A multi-scale, Python-based library for modelling solar cells and semiconductor materials. *Journal of Computational Electronics*, 17(4), 1099–1112. <https://doi.org/10.1007/s10825-018-1216-6>
 _Note: Introduces Solcore's capabilities; no energy usage data, but informs computational scope for estimates.

5. GSvit (Czech Technical University)

1. **Project Website:**
 Czech Technical University in Prague. (n.d.). *GSvit: Open source FDTD solver*. <https://gsvit.net>
 _Note: Details 2. OptiLayer GmbH (OptiLayer)
- **Company** Website:
 OptiLayer GmbH. (n.d.). *OptiLayer: Thin film software*. <https://www.optilayer.com>
 _Note: Provides software details and system requirements (e.g., modest PC specs), informing energy use estimates, but no explicit energy data.
- **Potential** Academic Reference:
 Tikhonravov, A. V., & Trubetskoy, M. K. (n.d.). *OptiLayer software documentation*. OptiLayer GmbH. <https://www.optilayer.com/documentation>
 _Note: Founders are optics researchers; documentation might discuss computational efficiency, but no public energy calculation study exists. This is a placeholder for proprietary info not directly cited.

3. FTG Software Associates (FilmStar)

- **Company** Website:
 FTG Software Associates. (n.d.). *FilmStar optical thin film software*. <https://www.ftgsoftware.com>
 _Note: Offers software specs (e.g., lightweight design) for energy estimates, but no energy usage or client data is published.

- **Technical** **Overview:**
 Goldstein, F. (n.d.). *FilmStar technical notes*. FTG Software Associates. <https://www.ftgsoftware.com/technical.htm>
Note: General resource for software operation; no specific energy calculations, but informs minimal hardware needs.
- 2. software and hardware needs (e.g., GPU support), used for energy estimates, but no specific energy analysis.
- 3. **Academic** **Publication:**
 Čtyroký, J., & Kwiecien, P. (2014). GSvit: A finite-difference time-domain solver for electromagnetic simulations. *Proceedings of the 16th International Conference on Transparent Optical Networks (ICTON)*. <https://doi.org/10.1109/ICTON.2014.6876498>
Note: Describes GSvit's development; no energy focus, but supports computational intensity estimates.

General Industry References

- **Software** **Energy** **Consumption** **Study:**
 Pereira, R., Couto, M., Ribeiro, F., Rua, R., Cunha, J., Fernandes, J. P., & Saraiva, J. (2021). Energy efficiency across programming languages: How do energy, time, and memory relate? *Proceedings of the 14th ACM SIGPLAN International Conference on Software Language Engineering*, 256–267. <https://doi.org/10.1145/3486608.3486906>
Note: Broad study on software energy use, used as a baseline for estimating simulation software energy (e.g., Python for Solcore, C++ for others).
- **Hardware** **Energy** **Context:**
 International Energy Agency. (2021). *Data centres and data transmission networks*. <https://www.iea.org/reports/data-centres-and-data-transmission-networks>

Chapter 4. Theory of Change: Unintended Negative Impacts

This chapter assesses potential unintended risks arising from Speqqle's operations. While these risks may occur independently of the company's intentions, recognizing them and developing appropriate mitigation strategies is essential to ensure responsible innovation. The analysis examines potential negative outcomes across key outputs, such as RefFit, the API, and consultancy services, each of which presents specific challenges that could hinder their effectiveness, accessibility, or sustainability.

Detailed descriptions of these risks outline the stakeholders potentially affected, the conditions under which the risks may materialize, and propose appropriate mitigation and monitoring measures. Where relevant, the analysis also reflects alignment with selected SDGs.

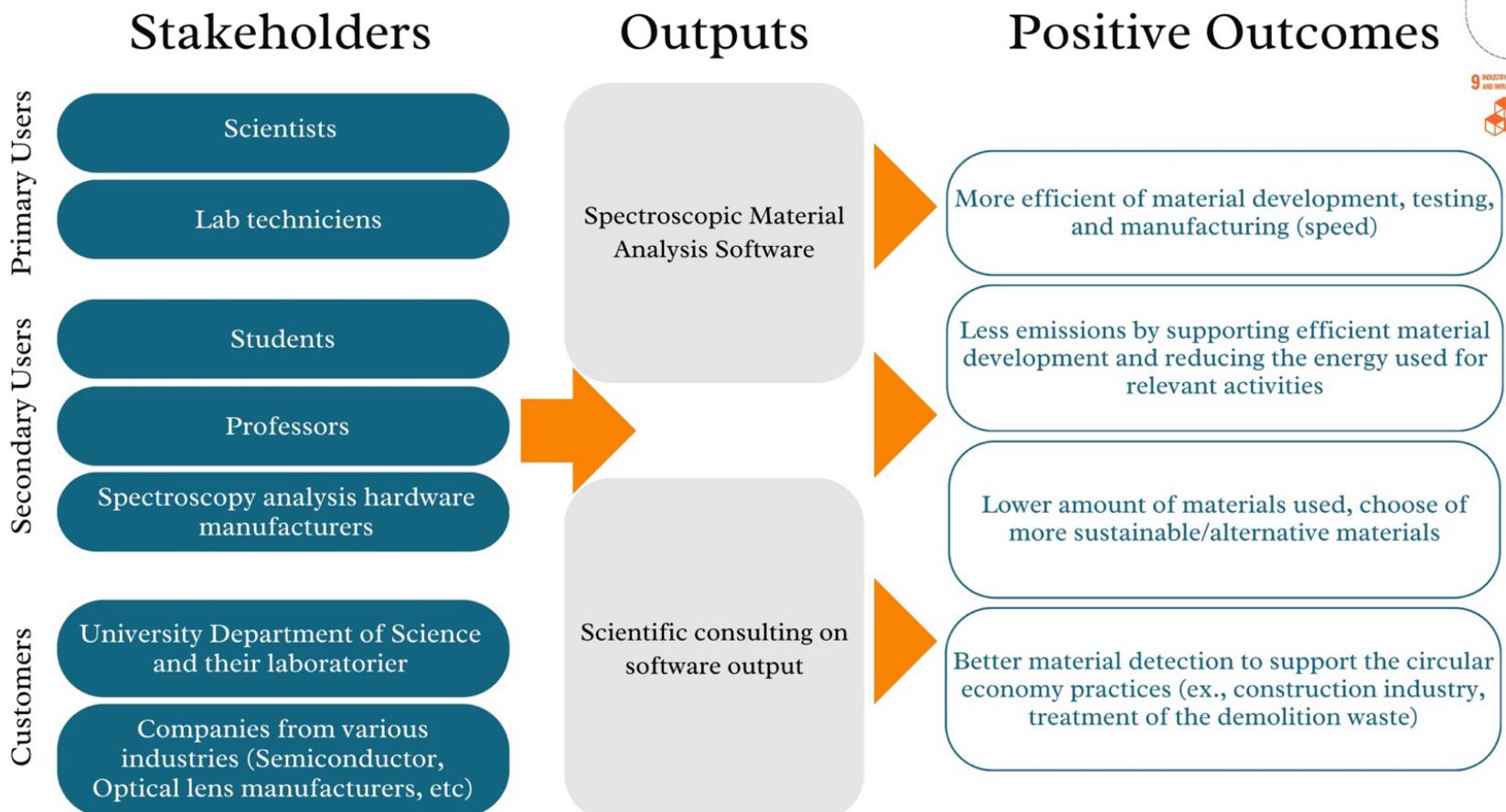
While this analysis provides indicative insights, it is strongly recommended that Speqqle develops a comprehensive materiality matrix. This matrix should assess risks using all internal information available to the company, which was not accessible to the students conducting the present study.

GROUP 1.1.

Chapter 4. Theory of Change: Unintended Negative Impacts

The beginning of this chapter includes visual elements summarizing the previous two chapters, presenting an overview of the complete Theory of change. This encompasses both positive and negative environmental implications of Speqqle's operational activities, as well as potential unintended risks. Detailed descriptions of these risks are provided in the annex.

Theory of Change: Results



Positive Impact
on SDGs



Theory of Change: Risk Analysis

Negative Impact
on SDGs in the Event
of a Risk

Data breach



● High

Sensitive user or client data may be leaked through cyberattacks or weak security

→ Encrypt data end-to-end → Apply secure coding & audits → Use intrusion detection

Extreme Mineral Exploitation



● Medium

Risk of accelerated, unethical mining harming communities & ecosystems

→ Ethical use policies → Support low-impact partners → Geospatial monitoring

Materials Misinterpretation



● High

Misread data can cause failure in research, construction, or healthcare

→ Double-check results → Train users → Peer review protocols

Ethical compliance



● Low-Medium

Software could be applied in weapons or harmful industries

→ Restrict use contractually → Monitor output use → Flag sensitive applications

Greenwashing



● Medium

Clients may falsely claim sustainability based on narrow efficiency gains

→ ESG disclaimers → Contract clauses → Monitor external claims

Potentially Affected Stakeholders



BROAD IMPACT

Environmental harm and community risks, especially indigenous communities



CLIENTS/INDUSTRIES

Affected by errors in data, material misidentification, and misclassified waste

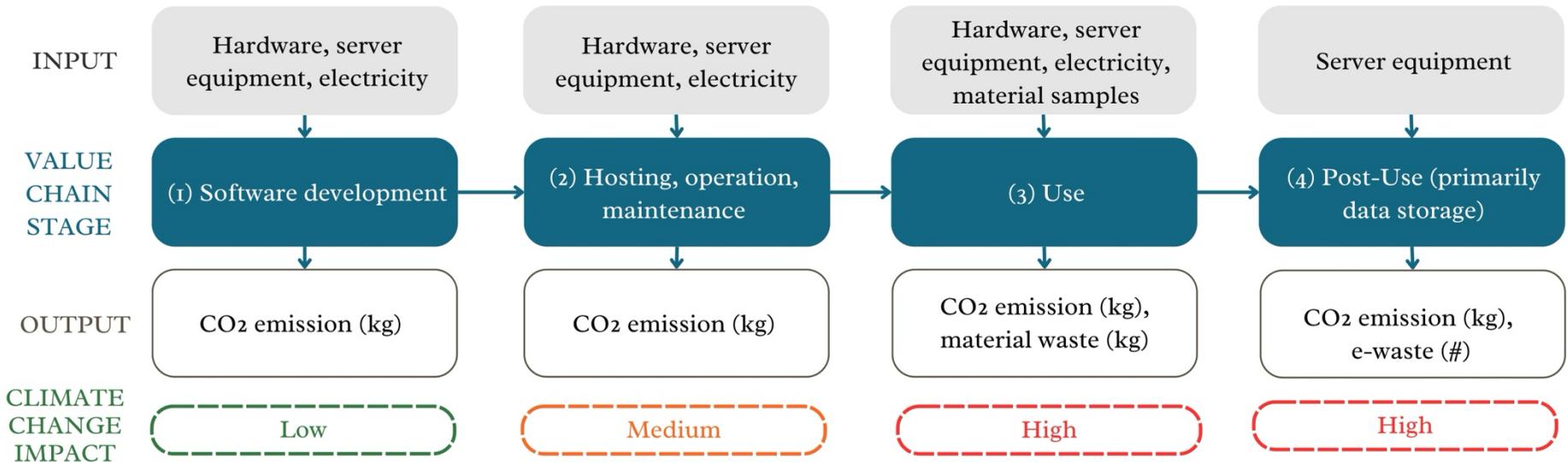


SPEQQLE/INTERNAL

Operational, legal, and reputational risks

See annex for more details on the unintended negative impacts (risks).

Life Cycle Assessment



- The most relevant impact category for Speqqle is climate change due to CO₂ emissions, caused by electricity consumption.
- Depending on the volume of samples used by the users during their experiment, material waste can impact the environment.
- Based on the energy intensity of each stage of the value chain, we estimate that the most critical phase contributing to the highest CO₂ emissions is software usage and data storage.
- This emission is highly dependent on the user's base and servers placement country/service providers. (www.electricitymaps.com)

Recommendations

Energy Efficiency

- 1** Continue using clean energy providers
- 2** Prioritize renewable-powered data centers in future expansions
- 3** Scale computing resources with demand to avoid overprovisioning
- 4** Enable idle-time detection & automatic hardware shutdown
- 5** Favor energy-efficient cooling

Monitoring & Transparency

- 1** Track emissions using the Software Carbon Intensity (SCI) framework
- 2** Regularly assess carbon reports and energy metrics of data centers that provide cloud storage (e.g., Microsoft)
- 3** Publish annual energy and emissions updates for stakeholders

Annex.

Table 1. Unintended Negative Impacts

Potential negative outcomes	Affected stakeholders	Conditions	Mitigation mechanisms	Monitoring mechanisms
Spectroscopic Material Analysis Software				
Unauthorized access to confidential research data	<ul style="list-style-type: none"> 1. Clients (especially those working on confidential or groundbreaking work). 2. Speqqle's own teams and leadership (reputational, operational, and legal consequences). 3. End users, e.g. lab technicians and analysts (research disruptions or data loss). 4. Regulators and data protection authorities (intervene if compliance obligations are not met). 5. Investors (loss of confidence in the software's security). 6. Governments or public institutions (if the leaked data were misused, e.g., in the development of harmful biotech or defence 	<ul style="list-style-type: none"> 1. Weak access controls. 2. Insufficient encryption. 3. The use of insecure open-source code. 4. Poor API protection, or integration with vulnerable third-party systems. 5. Inadequate internal security policies. 6. Failure to report breaches promptly. 7. Complex legal challenges related to cross-border data sharing. 	<ul style="list-style-type: none"> 1. Implement end-to-end encryption, multi-factor authentication, secure development practices, incident response plans. 2. Data must be regularly backed up and monitored using tamper-proof logs. 3. Oversee compliance with evolving legal standards. 4. Integration protocols should be evaluated through security audits, and all software components documented through SBOMs. 	<ul style="list-style-type: none"> 1. The use of SIEM platforms and intrusion detection systems to monitor real-time threats, supported by regular red team exercises, bug bounty programs, and third-party security reviews. 2. User activity should be tracked for anomalies, and compliance should be continuously assessed through automated dashboards and legal oversight.

Potential negative outcomes	Affected stakeholders	Conditions	Mitigation mechanisms	Monitoring mechanisms
	technologies, there could be serious consequences for public safety and ethical governance)			
Extreme Mineral Exploitation (due to quick characterization of a site based on surface minerals and identifying places of interest) [1]	<p>1. Communities especially indigenous people (they will be exposed to water and air pollution, land loss, and face forced displacement risk, violence and crime, if employed by the mining firms, local citizens might face labour exploitation).</p> <p>2. Wildlife and ecosystems (will be impacted by deforestation, erosion and soil degradation, biodiversity loss).</p> <p>3. Government (government employees</p>	<p>1. If the software is used in resource exploration to identify valuable sites, rapid and unethical mining and discovery of resources especially done in developing and underdeveloped countries with corrupted government system.</p>	<p>1. Partner with businesses and organizations that support soil and water treatment and rehabilitation [2].</p> <p>2. Establish stricter terms of use of software and include them in the contract.</p> <p>3. Partner and provide special prices for firm that develop new products or operational methods that lower their emissions [2].</p> <p>4. Favor to support and partner with local businesses instead of international players [3].</p>	<p>1. Field observation through scientific mechanisms, using geospatial data (satellite, drone, and aerial imagery) to monitor land use changes, track water quality, and assess the overall impact of mining operations [4].</p> <p>2. Government support and investment incentives.</p> <p>3. Tracking the “reconciliation and renewed relationship with indigenous people, based on recognition of rights,</p>

Potential negative outcomes	Affected stakeholders	Conditions	Mitigation mechanisms	Monitoring mechanisms
	might face pressure due to economic conditions).			respect, cooperation and partnership" [5].
	<p>Sources:</p> <ol style="list-style-type: none"> 1. Spectroscopy framework and review of characterization of energy resource sites, Tohm et al, volume 3, Issue 2, April 2022, Pages 147-159, Science Direct, https://www.sciencedirect.com/science/article/pii/S266675922100069X?ref=pdf_download&fr=RR-2&rr=9265ae4659343b64. 2. Five Ways to Promote Mitigation and Adaptation in the Mining Sector, Alec Crawford on June 5, 2019, IISD, https://www.iisd.org/articles/climate-change-mining. 3. Indigenous Communities and Mineral Development, Janeth Warden-Fernandez, April 2001, IIED, https://www.iied.org/sites/default/files/pdfs/migrate/G00550.pdf. 4. What is geospatial data?, IBM, https://www.ibm.com/think/topics/geospatial-data. 5. Reconciliation, Government of Canada, https://www.rcaanc-cirnac.gc.ca/eng/1400782178444/1529183710887. 			

Potential negative outcomes	Affected stakeholders	Conditions	Mitigation mechanisms	Monitoring mechanisms
	<p>2. Private sector (companies using the software). Industry example:</p> <ul style="list-style-type: none"> (a) Stakeholders in the construction industry in case of construction failures due to wrong material identification. (b) Stakeholders in the recycling industry in case of misclassified waste in recycling and demolition. (c) Stakeholders in the healthcare industry in case of healthcare catastrophe caused by the wrong material detection (patients, 	<p>1.3. Use of degraded or contaminated samples if the reference material is not pure or properly prepared.</p> <p>1.4. Pressure for fast results when mistakes occur if the team rushes analysis without proper verification.</p> <p>2.1. In case of the lack of expertise in material analyze, clients may misunderstand the spectroscopic data provided by Speqqle because they don't have scientists on their team to interpret it correctly.</p> <p>2.2. In case of no independent verification, a company relies solely on Speqqle's report without additional material testing.</p> <p>2.3. In case of supply chain fraud when material providers send incorrect</p>	<p>double-checking analysis results. Before issuing final reports, have another scientist review the data to catch any potential mistakes.</p> <p>4. Establish strict protocols for sample handling, storage, and preparation.</p> <p>5. Offer training sessions or educational resources to help clients understand spectroscopic data and its significance.</p> <p>6. As an add-on service, offer additional data verification or consulting to help clients cross-check your results and ensure that the analysis aligns with their expectations or standards.</p> <p>7. Create a feedback mechanism where both clients and internal teams can provide insights on how the analysis could be improved.</p>	

Potential negative outcomes	Affected stakeholders	Conditions	Mitigation mechanisms	Monitoring mechanisms
	doctors, medical device manufacturers, hospitals, regulatory bodies, insurance companies.	samples for testing, leading to inaccurate data.	8. Implement a system that records sample receipt, handling, analysis, and disposal steps with timestamps and personnel responsible.	
Contributing to ethically challenging industries (e.g., weapons manufacturing, off market stimulants production, etc.)	1. Negative impact for communities affected by potential conflicts, environmental fallout, infrastructure damage, political tensions, social welfare.	1. If the software is used by organizations from ethically challenging sectors, such as weapons or harmful technologies.	1. Establish stricter terms of use of software, monitoring user activity, creating expanded policy around usage terms to better understand the context in which materials consulting will be utilized.	1. Monitor user activity and data to better understand the implications of the software output and monitor data trends by industry. 2. “Flag” certain substances/molecules that raise concerns.
Scientific consulting on software output				
Contribution to Greenwashing (e.g., claiming that efficiency implies sustainability without considering long-term impacts)	1. Clients. 2. End consumers (indirectly affected, as they may be misled into believing products are sustainable when they're not). 3. The environment. 4. Speqqle (risks reputational harm if its tools enable environmentally	1. If the software overlooks environmental trade-offs, client companies may unintentionally adopt unsustainable practices that conflict with ESG goals, risking regulatory backlash and reputational damage. 2. If Speqqle's software focuses narrowly on technical efficiency, such as speed, purity, or	1. Generate sustainability disclaimer or data scope statements. 2. Insert clauses in contracts preventing misrepresentation. 3. Guide clients on broader environmental metrics.	1. Monitor clients' usage of software in marketing materials. 2. Establish a public reporting channel through which consumers, NGOs, or whistleblowers can flag potential misuse of Speqqle analysis in false or misleading sustainability claims.

Potential negative outcomes	Affected stakeholders	Conditions	Mitigation mechanisms	Monitoring mechanisms
	harmful decisions, as stakeholders may hold it accountable for contributing to unsustainable practices).	performance, without integrating broader environmental metrics. It's especially likely when clients are under pressure to cut costs or accelerate development, and when there are no built-in tools or guidance to evaluate sustainability trade-offs. In such cases, decisions may prioritize short-term gains over long-term environmental impact. (e.g., using lighter materials that are toxic on the long run like Asbestos).		

Source: Group 1.1.

Table 2. Unintended Negative Impacts and SDGs.

Potential negative outcome	Related SDG	Specification of effect
Unauthorized access to confidential research data	SDG 10 Reduce inequality within and among countries. SDG 6 Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels.	Cybersecurity breaches could compromise user data, research integrity, or even public safety, especially if the software is used in critical or confidential projects. A successful breach may disproportionately impact vulnerable stakeholders or marginalized institutions.

Potential negative outcome	Related SDG	Specification of effect
Extreme Mineral Exploitation	SDG 1 End poverty in all its forms everywhere. SDG 3 Ensure healthy lives and promote well-being for all at all ages. SDG 6 Ensure availability and sustainable management of water and sanitation for all. SDG 10 Reduce inequality within and among countries. SDG 12 Ensure sustainable consumption and production patterns. SDG 13 Take urgent action to combat climate change and its impacts. SDG 15 Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.	By enabling rapid resource discovery without safeguards, the software could accelerate environmentally destructive mining practices. This can lead to water and air pollution, forced displacement, and biodiversity loss, particularly in marginalized communities with limited regulatory protection, worsening poverty, inequality, and ecological degradation.
Materials Misinterpretation Risk	SDG 9 Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation. SDG 11 Make cities and human settlements inclusive, safe, resilient and sustainable. SDG 12 Ensure sustainable consumption and production patterns.	If spectroscopic data is misinterpreted or analysis errors go unchecked, critical design decisions, especially in infrastructure or healthcare, could be based on incorrect material assessments. This can result in unsafe buildings, failed products, or mismanaged construction waste, undermining resilience and sustainability goals.

Potential negative outcome	Related SDG	Specification of effect
Contributing to ethically challenging industries (e.g., weapons manufacturing, off market stimulants production, etc.)	SDG 3 Ensure healthy lives and promote well-being for all at all ages. SDG 10 Reduce inequality within and among countries.	If Speqqle's software is to support ethically controversial sectors (e.g., weapons or illicit stimulant production), this can directly harm public health and exacerbate global inequities. Providing expertise in such areas risks enabling products or systems that conflict with fundamental health and justice goals.
Contribution to Greenwashing (e.g., efficiency at the expense of sustainability)	SDG 9 Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation. SDG 12 Ensure sustainable consumption and production patterns.	If clients misuse Speqqle's efficiency metrics to falsely claim sustainability, it distorts market signals and consumer understanding. Greenwashing delays genuine climate progress by rewarding misleading ESG practices and masking the true environmental cost of production.

Source: Group 1.1.

GROUP 1.2.

Outputs	Potential negative outcomes	Affected stakeholders	Conditions	Mitigation mechanism	Monitoring mechanism
RefFit	<ul style="list-style-type: none"> 1. Limited scalability due to cloud dependency (e.g., poor internet access hampers usage in remote areas) 2. Increased digital carbon footprint (e.g., heavy cloud usage raises energy demands) 	<ul style="list-style-type: none"> 1. Research institutions 2. Hospital and Clinics 	<p>The occurrence of the outputs' negative outcomes, described in this table, depends on the following conditions:</p> <ul style="list-style-type: none"> 1. Limited scalability (e.g., unreliable internet in developing regions) 2. Inefficient server use 	<p>Speqkle can implement the following mitigation strategies to address:</p> <ul style="list-style-type: none"> 1. Offer offline mode or low-bandwidth version (e.g., cached analysis features) 2. Optimize algorithms for energy efficiency and use green hosting 	<p>To assess and address potential negative effects, the following monitoring mechanisms should be in place:</p> <ul style="list-style-type: none"> 1. Analyze subscription demographics by institution size 2. Measure server energy use and carbon emissions
	<ul style="list-style-type: none"> 1. Data misinterpretation or misuse 2. Security vulnerabilities (e.g., APIs may be targeted for data breaches, especially if they access sensitive research or clinical data) 	<ul style="list-style-type: none"> 1. Researchers and analysts (e.g., risk of misusing data due to lack of context) 2. Patients or affected communities (e.g., if API-driven outputs influence real-world 	<ul style="list-style-type: none"> 1. Lack of standardization or open protocols (E.g. leading to integration failures) 2. API outputs not being properly contextualized could 	<ul style="list-style-type: none"> 1. Ensure interoperability and clear documentation (E.g. OpenAPI standards, sandbox environments, and SDKs) 	<ul style="list-style-type: none"> 1. Track API usage by user type and region (E.g. Identify underused segments or integration problems) 2. Monitor error rates and support tickets

API		<p>decisions, like in healthcare or environmental analysis)</p> <p>3. Small institutions and NGOs</p>	<p>lead to flawed decisions)</p> <p>3. Limited tech capacity could prevent them from leveraging the API</p>	<p>2. Include contextual metadata and user warnings (E.g. Help users interpret results responsibly)</p>	<p>(E.g. Spot misuses or frequent confusion)</p> <p>3. Conduct periodic security audits of API (E.g. Ensure endpoints and access control remain safe)</p> <p>4. Survey users on accessibility and satisfaction (E.g. Improve documentation and equity of access)</p>
Consultancy services	<p>1. Inequitable access to services (ex: high costs may limit access for universities and hospitals in developing countries)</p>	<p>1. Universities and researchers (ex: limited access may hinder scientific progress)</p> <p>2. Patients and healthcare professionals</p>	<p>1. Inequitable access (ex: high service costs or lack of financial aid or grants)</p>	<p>1. Offer tiered pricing, or establish partnerships with universities in developing countries)</p>	<p>1. Inequitable access (ex: track usage by region, or monitor adoption rates in developing countries)</p>

IMPACTS

Potential negative outcome	Related SDG	Specification of effect
Limited scalability due to cloud dependency	SDG 9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation	SDG 9. The poor internet access in remote areas can limit the scalability and accessibility of cloud-dependent technologies, hindering innovation and infrastructure development.
Increased digital carbon footprint	SDG 12. Ensure sustainable consumption and production patterns	SDG 12. Higher energy use from cloud reliance could increase emissions, counteracting sustainable production goals.
Data misinterpretation or misuse	SDG 3. Good Health and Well-Being	SDG 3. Misinterpretation of health-related data provided by the API could lead to clinical errors and negatively impact patient care

Chapter 5. Sustainable Business Models

This chapter takes a close look at Speqkle's business model through a sustainability lens, using the Business Model Canvas to examine all key areas like partners, activities, value proposition, customers, costs, and revenues. The goal is to understand how sustainability factors affect the company's current operations and where improvements or new opportunities might exist.

The analysis points out challenges such as the environmental impact of spectroscopy processes, the need for clearer communication about resource use, and growing expectations around ESG compliance. In response, several strategies were suggested, including fairer pricing, more energy-efficient software, responsible partnerships, green hosting, and providing customers with environmental impact information. These efforts aim to help Speqkle grow responsibly while finding new ways to add value for its clients and reduce environmental harm.

GROUP 1.1.

Table 1. Business Model Canvas

Key Partners	Key Activities	Value Propositions	Customer Relationships	Customer Segments
<p>Current partners:</p> <ul style="list-style-type: none"> • Microsoft, as a data storage provider, offers cloud infrastructure compliant with the General Data Protection Regulation (GDPR) and ensures secure data hosting. Speqqle remains responsible for software-level compliance. • Investors (Kickfund, Venture Kick, Fongit, Innosuisse, Venture (Switzerland), SICTIC funding and go-to-market support. • University of Geneva (Lab access, academic validation, and collaboration). <p>Potential partners:</p> <ul style="list-style-type: none"> • Academic institutions (EPFL, ETH Zurich, and global universities for expanded research and training collaboration. 	<p>Before Product Delivery:</p> <ul style="list-style-type: none"> • Software development and refinement tailored to meet customer needs. • Niche expertise in spectroscopy hardware, software, and materials science. • Consultation services. • Grant writing, pitching, sales, marketing, and networking. <p>During Product Delivery:</p> <ul style="list-style-type: none"> • Training programs, and troubleshooting. <p>After Product Delivery:</p> <ul style="list-style-type: none"> • Technical support. • User feedback and product enhancement. <p>Sustainability:</p> <ul style="list-style-type: none"> • Operating efficiently and sustainably to minimize idle software usage, energy consumption from activities, wastes from materials testing, data storage impacts 	<ul style="list-style-type: none"> • Our advanced, hardware-agnostic spectroscopy analysis software empowers academic institutions and industries to conduct precise, sustainable material analysis and quality control. Unlike traditional AI-driven solutions that often lack scientific interpretation and human expertise, ensuring users can make informed, high-quality business and research decisions. <p>Sustainable development support:</p> <ul style="list-style-type: none"> • Speqqle provides efficient and more accurate analysis technique which reduces energy consumption during the material analysis compared to other available solutions. The accurate results also contribute to reduction of material waste produced 	<p>Scientists, Lab Techs, Students, Professors:</p> <ul style="list-style-type: none"> • Relationships established on a per need basis through training sessions or customer support for custom needs. • This segment is an end user and as a result is the anchor for the business model canvas. • As Microsoft absorbs the costs associated with data storage, this segment is not costly at this time. <p>Spectroscopy analysis hardware manufacturers:</p> <ul style="list-style-type: none"> • Relationship to facilitate API connectivity or co-create custom solutions. • There needs to be an ongoing relationship with the 10 main hardware manufacturers to ensure the software API is compatible and/or future collaborations can be produced for custom solutions. 	<ul style="list-style-type: none"> • B2B customers (university laboratories, companies from various industries), B2C customers (scientists, lab technicians, professors, spectroscopy analysis hardware manufacturers, students). • B2B clients need cost-effective, sustainable, and precise solutions for material analysis. Pain points: high costs, low precision, complexity, lengthy processes, and difficulty translating results into insights. • B2C customers need reliable, user-friendly, and accurate tools for research, product development, and education. Pain points: precision, ease of use, time efficiency, data interpretation, hardware-software compatibility,

Key Partners	Key Activities	Value Propositions	Customer Relationships	Customer Segments
<ul style="list-style-type: none"> OEM partnerships (done by another spectroscopic software provider: LabCognition). <p>Ethics and transparency in partnerships:</p> <ul style="list-style-type: none"> Choosing efficient and sustainable data storage provider. Universities and educational institutions are effective partners to support sustainable innovation and product development. OEM partnerships must include transparent due diligence and contracts. 	<ul style="list-style-type: none"> Providing sustainably focused consulting to help users and customers minimize their impacts in ongoing projects, operations, and materials testing and choices. Refrain from providing consulting services to ethically challenging companies or projects that do not align with the SDG's or company values. Adhere to strong labour standards and treat all employees and contractors equitably and fairly, encourage collaboration and facilitate an environment that is conducive to ongoing learning and growth. 	<p>during the customers' research and development steps.</p>	<ul style="list-style-type: none"> Provides training for end users. This segment has the potential to be costly as Speqqle needs access to hardware for ongoing business uses, depends on their access to UNIGE facilities. <p>University laboratories:</p> <ul style="list-style-type: none"> Software licensing relationship; provides troubleshooting for institutional IT and lab managers. <p>This segment is key for prospecting buyers once the paid solution is available, mainly consisting of academic institutions and users connected through it.</p>	<p>and access to quality data.</p> <p>For B2B, Speqqle will further segment industrial companies to target the following priority sectors: pharmaceuticals, semiconductors, renewable energy, construction, watchmaking, aerospace, mining, and defence.</p> <p>Public and certification bodies will also be considered part of B2B: greenhouse gas (GHG) certification authorities.</p> <ul style="list-style-type: none"> Given Speqqle's capacity, we suggest taking a more detailed approach to B2B customer segmentation, focusing on manufacturing companies and the construction sector (green building certifications, demolition or deconstruction, material recovery) as entry points (see:

Key Partners	Key Activities	Value Propositions	Customer Relationships	Customer Segments
				<p>Regulation (EU) 2024/3110 and Regulation (EU) 2024/1781). For other customer groups, it is better to target customers as indicated in point 1 without further segmentation.</p> <p>Sustainability:</p> <ul style="list-style-type: none"> As equity and accessibility initiatives Speqqle should provide discounted rates for students, as well as flexible pricing for B2C and B2B customers from developing markets. Speqqle enables sustainable practices like reducing test waste, selecting low-impact materials, and using low-energy devices. <p>Additional priority should be given to sustainability-focused researchers and organizations developing eco-friendly materials, working in circular economy projects, and</p>

Key Partners	Key Activities	Value Propositions	Customer Relationships	Customer Segments
				<p>measuring greenhouse gas (GHG) emissions.</p> <ul style="list-style-type: none"> • Providing clear guidelines, training sessions, and educational resources to help clients adopt sustainable and ethical practices while using the software. • Establishing stricter terms of use, monitor activity, and policies that prevent use in ethically challenging industries.

Table 1. Business Model Canvas (Continued)

Key Resources	Channels
<p>Physical:</p> <ul style="list-style-type: none"> • Spectroscopy hardware for software usage, materials for testing and demonstrating, laboratory facilities, PPE, Office, cloud hosting infrastructure. • Utilizing sustainable materials wherever possible, minimizing wastes, materials testing, or carbon intensive/environmentally damaging materials, environmentally friendly facilities and energy sources to power operations. <p>Intellectual property: (RefFit software, API infrastructure)</p> <ul style="list-style-type: none"> • Customer data, patents, copyrights, trademarks, trade secrets • Developing and measuring KPI's related to sustainability performance <p>Human:</p> <ul style="list-style-type: none"> • Scientists and SME's • Recruiting new talent with sustainability expertise to guide strategy and provide consultation support • Skilled personnel (developers, researchers, spectroscopy experts) • Partnership Networks: Academic and OEM collaborations, funding bodies (Fongit, Innosuisse). 	<p>Main Channels:</p> <ul style="list-style-type: none"> • Academic Conferences, Freemium Web Application (SaaS), Custom API Integration, and GitHub. <p>Outreach and Engagement:</p> <ul style="list-style-type: none"> • Email Outreach & LinkedIn, Tutorials & Webinars, Online Workshops & Company Visits and Networking & Strategic Partnership. <p>Reasoning:</p> <ul style="list-style-type: none"> • Conferences, GitHub, and the freemium app support visibility and self-onboarding for researchers. • Custom API integrations and company visits enable tailored enterprise solutions for OEMs and industry. • Email, LinkedIn, webinars, and tutorials help convert and educate users at scale. <p>This mix balances cost-efficiency with high-touch engagement for long-term adoption.</p> <p>Sustainability:</p> <ul style="list-style-type: none"> • Digital channels like SaaS, GitHub, webinars, and email outreach minimize travel and material waste. • Academic conferences and scientific journals build visibility and credibility within communities. • Targeted LinkedIn and email showing tangible environmental benefits. • Industry-specific conferences are used to engage buyers focused on ESG goals. • Monthly webinars and online workshops demonstrate Speqqle's value in real-world sustainability applications.

Cost Structure	Revenue Streams
<p>The most important costs inherent in our business model:</p> <ul style="list-style-type: none"> • Platform development and maintenance. • Salaries for the developers and researchers. • Marketing and sales. • Offices and data storage/infrastructure. <p>The most expensive key resources:</p> <ul style="list-style-type: none"> • Human capital (developers, researchers and data scientists). • Data processing and storage. <p>The most expensive key activities:</p> <ul style="list-style-type: none"> • R&D and platform development. • Client-specific consulting projects and client support. • Business development. • Marketing. <p>Speqkle business model is value driven:</p> <ul style="list-style-type: none"> • The business focuses on delivering high-quality spectroscopic analysis and consultation. • Emphasis is on reliability, accuracy, and interpretation. • Client/Material-specific tailoring is prioritized over full automation and lean costs. <p>Sample characteristics:</p> <ul style="list-style-type: none"> • Fixed Costs: Salaries of permanent staff, Equipment purchase and maintenance, Facility rent and utilities, Software licenses. • Variable costs: Energy costs per analysis, Marketing. • Economies of scale: The more data they have on samples the less time they require for consultations. 	<p>Revenue Streams</p> <ul style="list-style-type: none"> • SaaS Online subscription – RefFit (monthly, annually). • Licencing to/bundling with spectroscopy hardware providers. • Licencing to educational institutions and businesses. • Usage-based pricing. • Customizable API (e.g. specific to semiconductors, pharmaceuticals, and photonics sectors to make a multifaceted tool for material analysis). • Online spectroscopy training. • Consulting services. • OEM Partnerships. • Open-Source with paid add-ons. <p>To provide ethical pricing to ensure affordability and fairness:</p> <ul style="list-style-type: none"> • Industry based pricing (e.g. higher price for traditional mining firms). • Country based pricing. • Lower prices for educational use. <p>Effect: Depending on the level of integration and the industry and academic use in different countries, this might result in either increase in number of customers, therefore increase in revenue, or not being able to maximize the revenue, but rather focusing on the integrity.</p> <p>To support education:</p> <ul style="list-style-type: none"> • Partner with local institutions in developing countries to provide free training or highly discounted training and software access as a strategic market-building initiative. This can be achieved through engagement with Swiss authorities responsible for official development assistance, where Speqkle could be considered as an implementing partner in future technical assistance projects and potentially access public funding.

Cost Structure	Revenue Streams
<ul style="list-style-type: none"> Economies of scope: Leveraging the same equipment and staff across different industries. <p>How can we leverage sustainability to reduce costs?</p> <ul style="list-style-type: none"> Optimize energy efficiency in software design and cloud infrastructure; use renewable-powered data centers where possible. From an economic standpoint, renewable energy helps stabilize costs, protects businesses from fossil fuel price fluctuations, and delivers significant long-term savings, these are key advantages for maintaining competitive pricing and operational efficiency¹⁵. <p>Effect: Reduces long-term operational costs by minimizing energy consumption per analysis and leveraging green hosting solutions like Microsoft.</p> <p>How can we avoid exploitative cost-cutting measures (e.g., unfair wages, unsustainable sourcing)?</p> <ul style="list-style-type: none"> While Speqqle needs to reduce costs as it grows, this can be done responsibly by focusing on efficiency improvements, like optimizing infrastructure and workflows, rather than cutting corners on fair pay, inclusion, or ethical sourcing. Promote diversity and inclusion in hiring practices that prioritize long-term team retention. Ethical sourcing policies, especially for scientific instrumentation and hardware, signal a commitment to avoiding unsustainable or exploitative practices in the supply chain. By vetting suppliers for labour standards and environmental impact, Speqqle can prevent short-term savings from turning into long-term reputational or operational risks. <p>Effect: Increase fixed costs like salaries and instrumentation but avoids reputational risks and aligns with ESG expectations. However, it contributes to the long-term brand value and employee satisfaction.</p>	<p>Effect: Preparing the local workforce for the national and international firms that use the software while expanding future B2B and institutional market potential.</p>

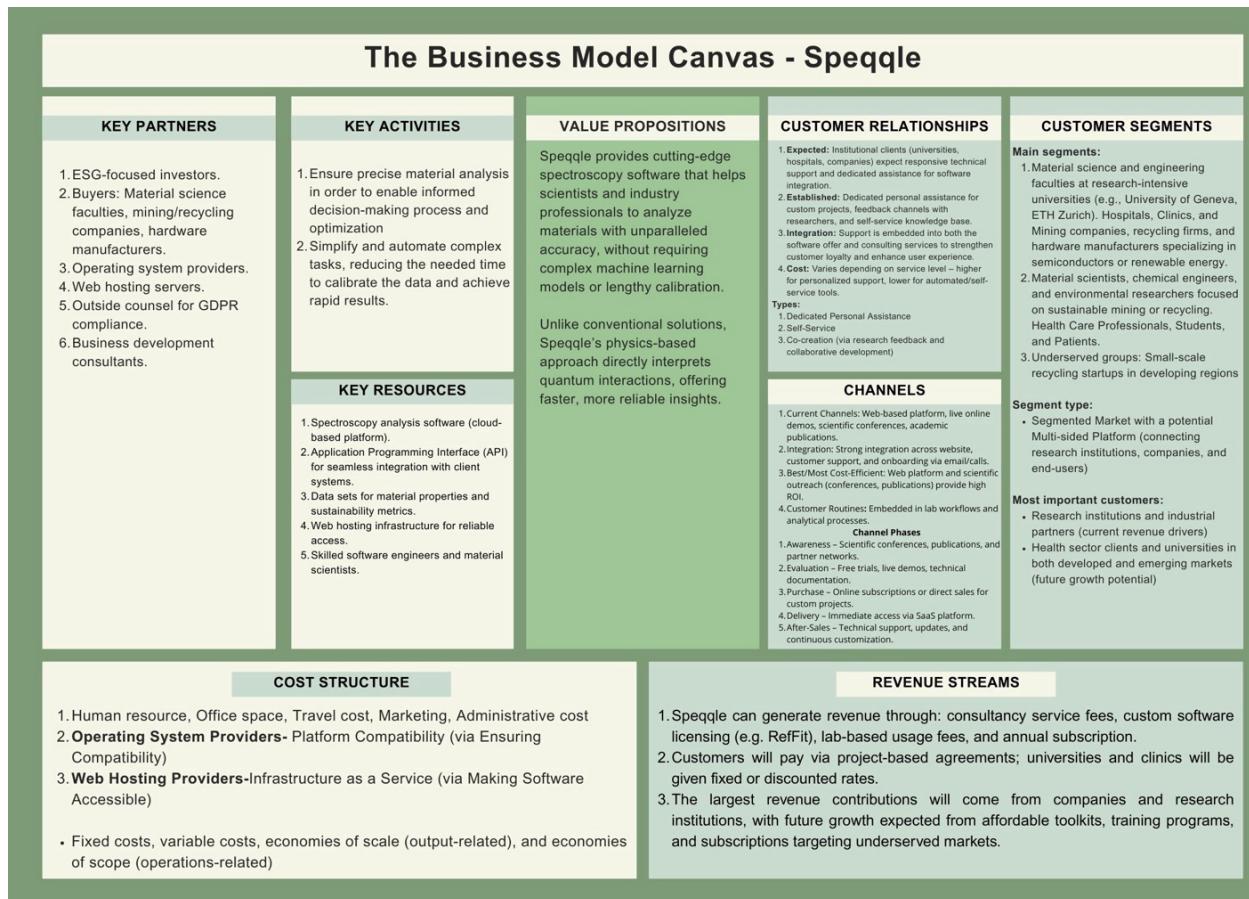
¹⁵ Beitman, K. (2025, March 12). Data Centers are Driving Renewable Energy Development. LandApp. <https://www.landapp.com/post/data-centers-are-driving-renewable-energy-development>

Cost Structure	Revenue Streams
<p>How can we raise funding from sources that share our values?</p> <ul style="list-style-type: none"> • Target sustainability driven clients that needs transparency and data-driven approach in running operations. • Target impact investors or green innovation grants aligned with sustainable technology. <p>Effect: Collect funds to reinvest in more sustainable technologies.</p> <p>How can we balance profitability with social and environmental responsibility?</p> <ul style="list-style-type: none"> • Reinvest profits into R&D for more sustainable technologies. • Offer discounted services to circular economy startups, or educational institutions. <p>Effect: R&D for sustainable technologies increases short-term development costs but has potential reduce long-term costs through the creation of economies of scope and future regulation requirements.</p>	

Source: Group 1.1.

GROUP 1.2

Chapter 5. Sustainable Business Models



The Business Model Canvas - Speqqle (Sustainability Input)

KEY PARTNERS	KEY ACTIVITIES	VALUE PROPOSITIONS	CUSTOMER RELATIONSHIPS	CUSTOMER SEGMENTS
<p>How can we reducing ecological impact and adopt green practices?</p> <ul style="list-style-type: none"> 1. Partnering with ESG Investors 2. Setting sustainable target 3. Making its users aware of product's sustainability benefits 	<p>How can SPEQQLE integrate eco-friendly practices in its material analysis and automation processes to minimize environmental impact while maintaining accuracy and efficiency?</p> <p>By Promoting circular economy principles in data processing. That would be the result of optimizing algorithms to minimize redundant computations, reducing storage needs, and improving energy efficiency by processing only necessary data.</p>	<p>What is the sustainability problem we have identified and how can our product help to minimize it?</p> <p>Problem 1: Mineral extraction often involves unsustainable labor practices, hazardous conditions, and environmental damage.</p> <p>Solution for Scientists: Speqqle's spectroscopy analysis software enables researchers to optimize material use in lab experiments, reducing reliance on ethically problematic minerals. Unlike competitors, Speqqle's cloud-based platform offers real-time data processing and sustainability metrics, cutting analysis time by 30%.</p> <p>Solution for Hardware Manufacturers: Speqqle helps manufacturers streamline supply chain processes by identifying sustainable material substitutes, reducing waste by up to 20% compared to traditional methods.</p> <p>Problem 2: Shortage of rare earth minerals threatens hardware production.</p> <p>Solution for Scientists: Speqqle identifies substitutes with equivalent material properties, enabling researchers to develop alternatives in renewable energy applications.</p> <p>Solution for Hardware Manufacturers: Speqqle's software provides predictive analytics to source alternative materials, ensuring production continuity. Unlike competitors, Speqqle integrates ESG scoring, helping manufacturers improve sustainability ratings.</p>	<p>How can we establish the relation where our customers understands the environmental value of our product?</p> <p>To establish relationships where customers understand the environmental value of our product, Speqqle will: (1) Provide customized environmental impact reports (e.g., material savings for solar panel coatings) via email and a dedicated customer portal, tailored to each industry (mining, recycling, hardware). (2) Offer 24/7 chatbot support for technical queries and monthly webinars for universities and researchers to share sustainability insights. (3) Implement service-level agreements (SLAs) with large corporations (e.g., TSMC, BHP) to ensure uptime and performance guarantees. (4) Engage hardware manufacturers (e.g., Intel) in co-development programs to refine software features, fostering collaborative innovation. (5) Conduct quarterly on-site visits for high-value clients to provide training on ESG integration.</p>	<p>How can Speqqle improve sustainability across customer section?</p> <p>To improve sustainability across customer segments, Speqqle targets: (1) material science and engineering faculties at research-intensive universities, (2) material scientists and chemical engineers in mining, recycling, and renewable energy sectors, (3) large corporations in mining, recycling, and hardware manufacturing, and (4) small-scale recycling startups in developing regions. Speqqle will develop affordable toolkits for underserved groups, collaborate with academic and industry partners to co-create ethical, open-source solutions, and implement a screening process to ensure clients align with environmental and social responsibility standards.</p>
COST STRUCTURE			REVENUE STREAMS	
<p>Do we require additional cost to make our product more sustainable and impactful?</p> <p>Speqqle's existing product supports sustainable practices without additional production costs. However, costs may increase for marketing sustainability benefits, ensuring fair wages for employees, and partnering with green energy providers for web hosting and office operations. These investments enhance Speqqle's ESG impact and align with customer expectations.</p>			<p>Do we generate revenue streams through sustainable approach ?</p> <p>Speqqle will generate revenue through subscription-based software licenses and premium sustainability services. Primary revenue sources will include large corporations and research-intensive universities. By demonstrating how Speqqle increases ESG scores and reduces carbon emissions, we can charge premium rates for sustainability consulting and ESG training, particularly for mining and hardware manufacturing clients.</p>	

Annex 1 - Key Partners

a. Who are our Key Partners?

- ESG-focused investors.
- Buyers: Material science faculties at universities, mining companies, recycling firms, hardware manufacturers.
- Outside counsel for GDPR compliance.
- Business development consultants.

b. Who are our Key Suppliers?

- Operating system providers.
- Web hosting servers.

c. Which key resources are we acquiring from partners?

- Investors: Financial resources, networks, expertise.
- Buyers: Revenue, data, feedback, market validation.
- Operating system providers: Platform compatibility, APIs, security.
- Web hosting servers: Bandwidth, storage, IaaS.
- Outside counsel: GDPR-compliant data security frameworks.
- Business development consultants: Market entry strategies, partnership networks.

d. Which key activities do partners perform?

- Investors: Funding, mentorship.
- Buyers: Purchasing, providing feedback.
- Operating system providers: Optimizing software compatibility.
- Web hosting servers: Ensuring accessibility.
- Outside counsel: Advising on GDPR compliance.
- Business development consultants: Facilitating partnerships and market expansion.

e. Motivation for partnership:

- Investors: Risk reduction, scalability.
- Buyers: Process optimization, sustainability.
- Operating system providers: Resource acquisition.
- Web hosting servers: Resource acquisition.
- Outside counsel: Regulatory compliance.
- Business development consultants: Market growth.

Annex 2 - Cost Structure

a. Most important costs:

- Human resources (fair wages for software engineers and scientists).
- Office space and utilities (powered by green energy providers).
- Operating system providers (platform compatibility).
- Web hosting providers.
- Marketing, travel, and administrative costs.

b. Most expensive key resources:

- Fair wages for skilled engineers and scientists.
- Greendesigned energy providers for web hosting and office operations.
- Operating system providers (platform compatibility).
- Web hosting servers.

c. Most expensive key activities:

- Software development and maintenance.
- Customer support and ESG training.
- Marketing for sustainability awareness.
- Ensuring GDPR compliance.

d. Business type: Cost-driven.

e. Sample Characteristics:

- Fixed costs: Fair wages, rent, green energy utilities.
- Variable costs: Marketing, travel.
- Economies of scale: Cloud-based software reduces per-user costs.
- Economies of scope: Shared infrastructure for multiple industries.

Chapter 6. Sustainability Strategy

This chapter evaluates Speqkle's sustainability strategy by analysing how the startup's business model and technological offerings align with broader environmental, social, and economic priorities. A STEEPLE analysis is used to assess the social, technological, economic, environmental, political, legal, and ethical factors shaping the company's external operating environment.

Complementing this, a comparative review of competitors, stakeholder expectations, value chain dynamics, and emerging sustainability trends provides additional context relevant to Speqkle's positioning within the software and materials analysis industry. By assessing how these broader environmental, regulatory, and market factors intersect with Speqkle's operations, the chapter highlights critical areas for differentiation and strategic focus.

Chapter 6. Sustainability Strategy

Part I

1. Prompt for Chat GPT

According to the class assignment, we tasked ChatGPT with conducting a STEEPLE analysis for Speqqle based on a detailed prompt describing the startup's operations and sustainability context. The following section presents the original prompt provided to ChatGPT, followed by an evaluation of its response in terms of accuracy, completeness, and relevance to Speqqle's sustainability strategy.

"Provide STEEPLE analysis for a startup in Geneva, Switzerland, that is developing software that enables users to analyze their materials for subsequent production processes across various industries. Based on the value chain analysis, we identified that, in terms of sustainability assessments for the startup, the most critical factors to evaluate are its resource inputs. First, energy (electricity) consumption is essential for software operations, data storage, and air conditioning to cool data servers. Second, water usage for data warehouse cooling must be considered. But currently a startup does not own servers, it rents a server from Microsoft in Sweden. The most relevant impact category for Speqqle is climate change due to CO₂ emissions from software, which are caused by high electricity consumption, the major input at all stages of the value chain.

A web application of the software is hosted on a startup rented server, its current version is outdated and buggy. A new, more user-friendly version with extended functionalities is in development. Once the new version is launched, the startup plans to gradually transition current users (thousands of them using the old version for free) to the updated, paid version. After the transition (preliminary in one month), the old application will be terminated.

The startup does not collect personal client data. The purpose of the free trial was to gauge user interest and understand behavioural patterns, such as usage frequency. All data is stored on Microsoft servers, physically located in Sweden. Around 40% of the startup's users are in Asia. In the future, they might consider having a server based in Asia, but no decision has been made yet. Speqqle does not use AI or machine learning, so it does not contribute to environmental impacts typically associated with those technologies."

2. STEEPLE analysis generated by Chat GPT

S – Social	Feedback:
<p>Global User Base: With 40% of users in Asia and thousands of users globally, Speqqle must consider cultural differences, user experience preferences, and time zone support.</p> <p>Free-to-Paid Transition: Moving users from a free to a paid model may face resistance. Effective communication, onboarding support, and value demonstration will be critical.</p>	<p>While the social factors are well analysed based on the prompt, the AI did not include other social factors from the external environment and only focused on internal considerations.</p> <p>Employee job security: without long term contracts and sustainable business revenue employees face job insecurity concerns</p>

<p>Digital Skills & Adoption: As the software is technical, social factors such as user education and digital literacy across various industries may affect adoption rates.</p>	
<p>T – Technological</p> <p>Outdated Web App: The current version of the software is buggy and outdated, which could harm user trust. The launch of the new version is crucial for credibility and competitiveness.</p> <p>Cloud Infrastructure: Relying on Microsoft's servers provides scalability and security benefits but also limits direct control over hardware-level sustainability improvements.</p> <p>Future Server Expansion: Considering server placement in Asia could improve latency and user experience but also has implications for data transfer regulations and environmental impact depending on energy sources used.</p>	<p>Feedback:</p> <p>The factors for technology are well analysed and ChatGPT considers the environmental impacts and implications of placement of the servers in Asia, which might have less regulations for energy production and use.</p> <p>The internet access and speed of internet in the target market could also be added to this list, for using the web application.</p>
<p>E – Economic</p> <p>Freemium to Paid Model: The monetization strategy could generate stable revenue but risks user drop-off. Pricing strategy will be vital, especially in cost-sensitive markets.</p> <p>Server Rental Costs: Renting from Microsoft likely offers predictable costs, but expanding server infrastructure (e.g., in Asia) will increase operational expenses.</p> <p>Scaling Challenges: As user demand grows, energy consumption and associated costs for server operations and data transfer will rise, potentially affecting margins.</p>	<p>Feedback:</p> <p>Missing lab rental costs and hardware rental costs from UNIGE.</p> <p>Missing mentions of secure access to funding or sustainable business revenue, as they are pre-revenue.</p>
<p>E – Environmental</p> <p>Key Impact Category: Climate Change</p> <p>Speqqle's primary environmental concern is electricity consumption:</p> <ul style="list-style-type: none"> • Server operations • Data storage • Cooling needs (particularly in data centers) 	<p>Feedback:</p> <p>Based on the prompt, the factors regarding how Speqqle might impact the environment are well articulated by ChatGPT, with action points provided to mitigate those risks. However, the missing aspect is the environmental trends that could impact Speqqle, based on the concept of double materiality.</p>

<p>Energy Source of Microsoft Servers (Sweden): Microsoft's Swedish data centers are known to use a mix of renewable energy, which may partially mitigate carbon impact. However, exact figures are needed for precise impact assessment.</p> <p>No AI or ML: Not using AI avoids the intensive resource demands typically associated with model training and inference.</p> <p>Water Usage for Cooling: Although Speqqle does not own data centers, it's still important to understand Microsoft's water-cooling approach to assess full environmental implications.</p>	
<p>P – Political</p> <p>Data Hosting in Sweden: Hosting in an EU country ensures compliance with GDPR-like data standards, even though Speqqle doesn't store personal data.</p> <p>Swiss Regulations: Operating from Geneva provides a stable political and legal environment, but Speqqle must stay up to date with local and EU digital regulations.</p> <p>International Presence: Future server expansion to Asia may bring geopolitical concerns, regulatory complexity, and trade restrictions (especially regarding cloud service providers and data localization laws).</p>	<p>Feedback:</p> <p>Political factors are well articulated.</p>
<p>L – Legal</p> <p>Data Privacy: Even though Speqqle doesn't collect personal data, it must remain compliant with relevant data protection laws (e.g., GDPR, Swiss FADP) due to its international user base.</p> <p>Licensing & IP: As a software company, proper licensing of tools, libraries, and IP protection are essential to avoid legal disputes.</p> <p>Terms of Use & Subscriptions: Clear, legally sound user agreements are needed for the upcoming transition to a paid version.</p>	<p>Feedback:</p> <p>Additional EU sustainability regulations are missing from the analysis. These regulations could present both opportunities and challenges for Speqqle, for example, offering services that enhance the sustainability of client companies while also requiring Speqqle to meet stricter compliance standards.</p>

<p>E – Ethical</p> <p>User Transition Ethics: Ethical considerations around switching users from a free to a paid version—transparency, fairness, and value delivery—are key.</p> <p>Sustainable Hosting: Choosing Microsoft Sweden, with relatively sustainable energy practices, reflects some ethical consideration for environmental responsibility.</p> <p>Data Ethics: Not collecting personal data reduces ethical risks related to surveillance or misuse of information.</p>	<p>Feedback:</p> <p>Missing ethical considerations of potential challenging industry use cases (weapons manufacturing, off market drugs, etc.)</p>
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General Feedback:

ChatGPT understood the details in the prompt and responded to the task of preparing STEEPLE analysis more by fitting the provided data into relevant categories than by elaborating on each factor. As a result, most external factors are missing, except for the political dimension.

3. Most Relevant Trends: Threats and Opportunity for Speqqle

Economic: 1. Transition from Freemium to Paid Model

This shift could generate a stable revenue stream (opportunity), but it also risks losing a portion of the user base if not managed well (threat). It requires strong communication, customer success strategies, and value demonstration to ensure user retention and growth.

Environmental: 2. Impact of Server Operations (Climate Change Focus)

Although Speqqle doesn't own servers, its reliance on Microsoft's data centers links its operations to significant energy consumption and associated CO₂ emissions. Microsoft's greenhouse gas emissions have increased by 29.1% since 2020 due to rising AI-related energy demand¹⁶. This could threaten Speqqle's credibility as a responsible tech provider, especially as sustainability reporting pressures increase. At the same time Speqqle can leverage Microsoft's initiatives to enhance its environmental credibility. For example, the company is investing in sustainability initiatives, such as a major carbon removal project aiming to capture and store 6.75 million metric tons of CO₂ over 15 years¹⁷.

Legal: 3. Data Ethics and Greenwashing Risk

Although Speqqle doesn't collect personal data, clients may misuse its outputs to support misleading sustainability claims (greenwashing). Greenwashing is increasingly a source of litigation and regulatory scrutiny¹⁸. This poses a reputational and ethical threat. However, it's also

¹⁶ Microsoft signs large carbon removal deal backing AtmosClear's Louisiana project. (2025, April 15). Reuters. https://www.reuters.com/sustainability/cop/microsoft-signs-large-carbon-removal-deal-backing-atmosclears-louisiana-project-2025-04-15/?utm_source=chatgpt.com

¹⁷ Ibid.

¹⁸ The Harvard Law School Forum on Corporate Governance. (2023, July 24). Greenwashing: Navigating the risk. https://corpgov.law.harvard.edu/2023/07/24/greenwashing-navigating-the-risk/?utm_source=chatgpt.com

an opportunity to lead the industry by developing strong ethical use policies, disclaimers, and partnerships with ESG standards bodies.

Technological: 4. Server Infrastructure Expansion (e.g., Asia)

Placing servers closer to major user bases, such as in Asia, can improve latency and enhance user experience, an opportunity for Speqqle. The capacity of data centers in Southeast Asia is planned to increase by approximately 1.5 times within the region¹⁹. However, it also introduces challenges, including data localization requirements, regulatory complexities, and environmental risks tied to regional energy sources. Even expansion within Europe presents significant sustainability and financial risks for Speqqle.

Part II

We identified Speqqle's competitors in detail in the Annex to this Chapter. Based on the collected data, we have identified six key value dimensions that distinguish Speqqle from its competitors: Software Customization, Consulting Services, Lack of AI-Based Data Analysis, User Interface/Accessibility, Sustainability Focus, and Absence of Hardware Offering. Compared to its competitors, these dimensions are represented as follows:

Table 1. Competitor Analysis Table*

Name	Software customization	Consulting services and Training	AI Based data Analysis	Sustainability focus (time efficiency and precision)	User interface/ accessibility	Hardware offer
Speqqle	✓	✓	✗	✓	Online (and offline in future)	✗
Special Industries	✓	✓	NA	✓	NA	✓
J.A. Woolam Japan	NA	✓	NA	✓	Offline	✓
Sentech	✓	NA	Possibly	✓	Offline	✓
Jas.co	NA	✓ (Depending on the package)	NA	✓	Offline	✓
Horiba	✓	✓	NA	✓	Offline, available for download, also compatible	✓

¹⁹ Harral, I., & Harral, I. (2025, March 24). Harnessing ASEAN's data center boom- ARC Group. ARC Group - Global financial services with deep roots in Asia. https://arc-group.com/asean-data-center-boom-opportunities/?utm_source=chatgpt.com

Name	Software customization	Consulting services and Training	AI Based data Analysis	Sustainability focus (time efficiency and precision)	User interface/ accessibility	Hardware offer
					with LabView	
lumtek	NA	NA	✗	✓	Offline, "under development"	✓
Oxford Instruments (Andor)	✓	✓	NA	✓	Offline, Available for download	✓
Thermo Fisher Scientific	NA	✓	Possibly	✓	Offline (66 softwares and libraries)	✓
Neal Spec	NA	NA	NA	NA	NA	✓
Ocean Insight	✓	NA	NA	✓	Offline	✓
AR Optix	✗	✗	✗	✗	✗	✓
Sensirion	✗	✗	✗	✓	✗	✓
SciAps	✗	✗	✗	✓	✗	✓
Bruker	NA	✓	NA	✓	Online and Offline	✓
SpectraBase (Bio-Rad)	NA	NA	NA	✓	Online	✗
Balzer	NA	NA	NA	NA	NA	NA

Source: Group 1.1.

*Based on data presented in Annex. The list of competitors to analyse is taken from the Speqqle's pitch deck.

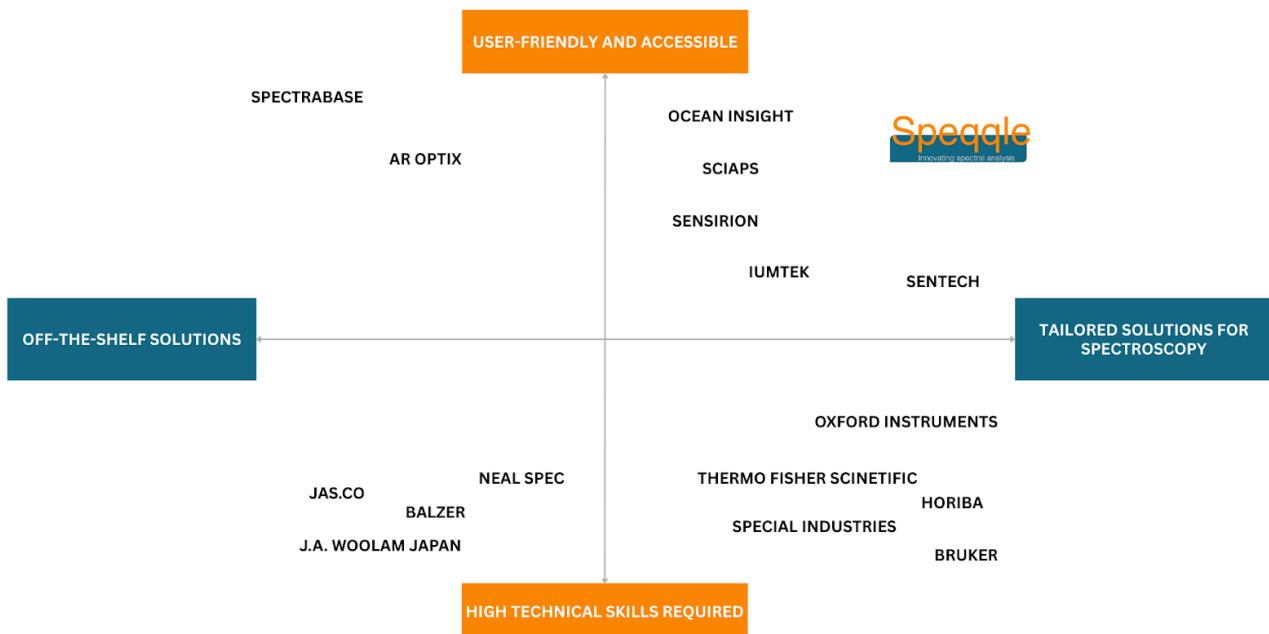


Figure 1. Competitor Matrix.

Source: Group 1.1.

Part III

Based on the refined data and analyses conducted over the previous weeks of work, we have updated the vision, mission, purpose statement, and value proposition. Please note that these represent one of the working versions discussed during the process. The final versions can be found in Chapter 1 of this report.

The Value Proposition Statement

Our advanced, hardware-agnostic spectroscopy analysis software empowers academic institutions and industries to conduct precise, sustainable material analysis and quality control. Unlike traditional AI-driven solutions that often lack scientific interpretation and human expertise, ensuring users can make informed, high-quality business and research decisions.

Vision Statement

To be the trusted bridge between science and industry, where businesses and researchers can unlock the full potential of materials while caring for the planet.

Mission Statement

At Speqqle, our mission is to make advanced spectroscopy material analysis universally accessible, scientifically rigorous, and sustainable. We empower businesses and academic researchers to conduct precise material assessments. We commit to sustainability by choosing low-carbon infrastructure and to transparency by ensuring compliance with international regulations, enabling users to innovate responsibly and confidently across industries.

Purpose Statement

To deliver scientifically validated, transparent spectroscopy analysis that supports responsible innovation, helping businesses, researchers, and industries transition towards higher sustainability standards, informed decision-making, and stronger product excellence.

Annex.

Table 1. Speqqle Competitors

Name	Origin	Offer	Strength	Industry Application	Comment
Special Industries	Netherlands	Laser-induced breakdown spectroscopy On-line chemical analysis	Design and manufacture (through manufacturing partner) chemical detection systems for clients according to customer requirements.	Mining, recycling, metal processing.	Potentially similar business model but in a different area. Not a direct competitor to Speqqle, as, according to the last interview with Speqqle, it does not have chemistry experts and does not offer analytical services in this field.
J.A. Woolam Japan	Japan	Hardware manufacturing of spectroscopic ellipsometers that measure and analyze thin films and bulk materials non-contact and non-destructively. Sample measurement service as a stopgap until implementation for customers who are on a tight budget.	Has 25 years of experience and owns patents for its highly sophisticated hardware. Has 19 offices around the world, including in the EU (France, Germany, Italy, Ireland).	Sector-agnostic	At present, it does not pose a high threat to Speqqle, as it primarily focuses on hardware manufacturing and data collection. In the very long term, it might present some level of competition, but for now, it could be a potential partner

Name	Origin	Offer	Strength	Industry Application	Comment
					in collecting data for Speqqle's client companies.
Sentech	Germany	<p>Low-damage plasma etches and deposition systems.</p> <p>Thin film metrology tools for repeatable and accurate results.</p>	<p>30 years of experience.</p> <p>Focus on thin film deposition, patterning, and characterisation in semiconductor technology, microsystems technology, photovoltaics, nanotechnology, and materials research.</p>	<p>Aerospace, space, automotive, consumer electronics, information technology, healthcare, data communication, biomedical imaging, optics, coatings, production.</p>	No comment
Jas.co	Japan	<p>Comprehensive range of molecular spectroscopy and chromatography instruments, including FTIR, UV-Vis/NIR, Raman, Circular Dichroism, Fluorescence, Polarimetry, HPLC, UHPLC, SFC, and associated software.</p>	<p>Over 60 years of experience; global presence in over 57 countries; innovative technologies in optical spectroscopy and chromatography; extensive product line.</p>	<p>Pharmaceuticals, biotechnology, materials science, environmental analysis, food safety, academic research.</p>	<p>At present, it does not pose a high threat to Speqqle, as it primarily focuses on hardware manufacturing and data collection. In the very long term, it might present some level of competition, but for now, it could</p>

Name	Origin	Offer	Strength	Industry Application	Comment
					be a potential partner in collecting data for Speqqle's client companies.
Horiba	Kyoto, Japan	Spectroscopy hardware and software: core.	Comprehensive system control, and advanced data acquisition/analysis routines, including fast mapping, kinetic studies, high throughput screening, programmed high temperature and high-pressure analysis. Regulatory Compliance by ensuring security and data integrity controls.	Energy, food, healthcare, cosmetics, Industrial, life science, transportation, water, waste management, Materials, IT, Education and R&D.	Would call them direct competitor.
lumtek	France	Laser Induced Breakdown Spectroscopy, a real-time elementary analysis method (instrument and software).	Real-time analysis, used for matter's state (liquid, solid, gaseous) and without sample preparation, safe and easy to use.	Environment, monitoring industrial processes, quality control monitoring and traceability, different fields of R&D, food industry, heritage protection, biomedical analysis,	No comment

Name	Origin	Offer	Strength	Industry Application	Comment
			<p>The analyses can be done in ambient air outside the laboratory</p> <p>Optical ability to perform a remote analysis (from several meters away), which may be mandatory in hazardous environments (radioactivity, molten metal bath).</p>	defence and national security, aerospace.	
Oxford Instruments	UK	Provider of academic and commercial organisations worldwide with market-leading scientific technology and expertise (Instrument and software).	Andor's portfolio of optical spectrometers offer intelligent, modular, multi-modal, high-resolution, and compact spectrometers suitable for a range of spectroscopy applications such as Raman, luminescence, absorption, OES & LIBS, micro spectroscopy, non-linear spectroscopy.	Material science, chemical processes, plasma studies and biomedical/life science.	No comment

Name	Origin	Offer	Strength	Industry Application	Comment
Thermo Scientific	USA	7 different Spectroscopic related products/equipment/analysers as well as Spectroscopy consulting via Unity Lab Services.	Comprehensive product range; trusted brand; global presence; extensive customer support and training resources. Publicly listed (NYSE: TMO).	Pharma/biotech, environmental, food and beverage, industrial and manufacturing. academia and research, chemical industries.	Competitor, but primarily focuses on hardware; less flexible than Speqkle. Large-scale presence and funding may be challenging for Speqkle.
Neal Spec/attocube	Germany	Develops and manufactures components and systems for nanoscale applications, including nano positioners, cryogenic microscopes, and precision measurement tools.	Expertise in nanotechnology and precision engineering.	Nanotech	Experts in nanotechnology, different field, not considered a competitor.
Ocean Insight	USA and Netherlands/Germany	Modular optical sensing solutions: spectrometers, and analysis software.	Innovation in compact and customizable spectrometers; real-time analysis tools; user-friendly software interfaces.	Optical Sensing	Competitor: Already present in Europe.
ARc Optix	Neuchatel Switzerland	Manufacturer of optical measurement systems, including FTIR and FT-NIR spectrometers,	Swiss-made precision; compact; focus on Raman and FT-IR devices.	Spectroscopy Hardware / OEM Solutions	Not a competitor; manufactures hardware, possible partner.

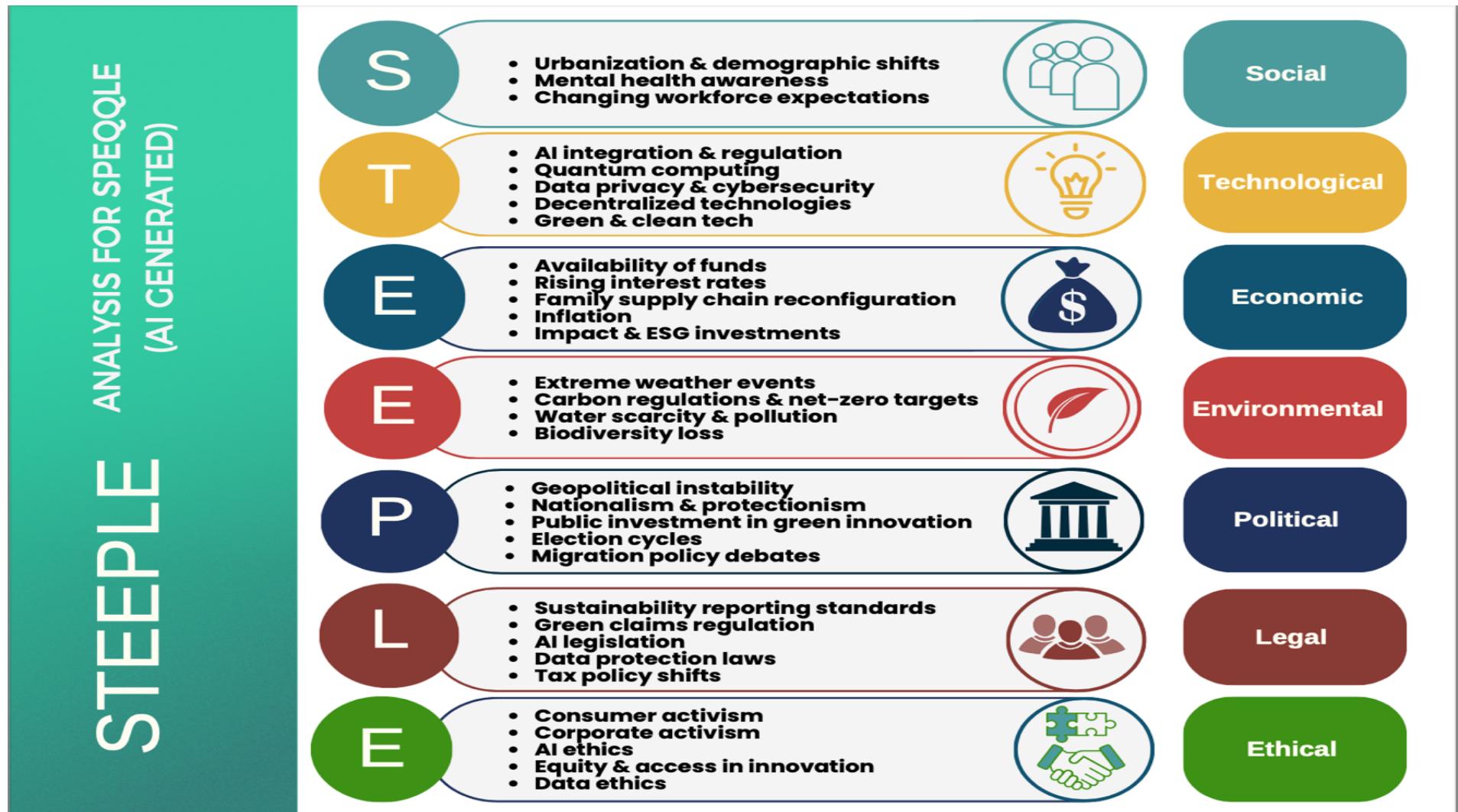
Name	Origin	Offer	Strength	Industry Application	Comment
		gas analysers, and polarization optics.			
Sensirion	Switzerland	Digital microsensors for environmental and flow measurement, gas sensors (CO ₂ , VOCs), particulate matter sensors, humidity and temp, and liquid flow sensors.	High-precision, reliable sensor technology, miniaturization and integration capabilities, and strong reputation for quality.	Sensor Manufacturing, Electronics, IoT, Industrial Automation.	Sensirion provides components (sensors) that could feed data into analysis software. More likely a component provider to software platforms.
SciAps	USA	Portable analytical instruments, LIBS (Laser-Induced Breakdown Spectroscopy) for elemental analysis, XRF (X-ray Fluorescence) for elemental analysis and Raman spectroscopy for molecular analysis.	Portable, rugged devices for field analysis, rapid, on-site material identification, and specialized for elemental and chemical composition.	Scientific instruments, mining, recycling, inspection.	SciAps provides tools for material identification and analysis in the field. Not direct competition.
Bruker	Germany	Scientific instruments for materials research, life science, and diagnostics, spectrometers (NMR, EPR, Mass Spectrometers), Microscopes	Wide range of high-performance analytical instruments, strong reputation for innovation and quality and	Scientific instruments, analytical equipment, research.	Bruker provides tools for detailed material characterization, but their software is often tied to the instrument.

Name	Origin	Offer	Strength	Industry Application	Comment
		(AFM, Optical), and X-ray analysis systems.	established in research and industrial markets.		Competition is in high-end analytical instrumentation, with some software overlap in data processing.
SpectraBase (Bio-Rad)	USA	Software, database, instruments (NOT spectroscopic hardware). Cloud-based database that offers millions of spectra data points (graphical representations of how different chemical compounds respond to various forms of spectroscopy).	Software uses rule-based algorithms, pattern matching, and advanced statistical techniques for spectral analysis.	Pharmaceuticals, environmental testing, food and beverage, academic research.	No consulting services, not AI-based, just the extensive database.
Balzer	Germany	Atomic Force Microscopy, Single Molecular Force Spectroscopy, Tribology.	Research, publications, talks and videos.	Materials Science	Unclear whether they offer commercial solutions.

Source: Group 1.1.

GROUP 1.2

Chapter 6. Sustainability Strategy



STEEPLE- Explanation I (AI Generated)

S

- **Urbanization & demographic shifts:** Speqqle serves diverse global stakeholders (universities, hospitals, industries like mining and recycling), but high costs may exclude smaller institutions in developing regions.
- **Mental health awareness:** Not directly applicable, but user errors due to lack of training could increase stress for professionals relying on accurate results.
- **Changing workforce expectations:** Professionals expect fast, precise, and accessible tools. Speqqle addresses this with real-time analysis but risks exclusion due to technical barriers.

T

- **AI integration & regulation:** Speqqle's physics-based approach avoids AI training, differentiating it from competitors, but API integration issues could hinder adoption.
- **Quantum computing:** Not directly applicable, but Speqqle's focus on quantum light-material interactions positions it as a leader in advanced spectroscopy.
- **Data privacy & cybersecurity:** APIs handling sensitive data face security risks (e.g., breaches), requiring robust measures like encryption and rate limits.
- **Decentralized technologies:** Not applicable, as Speqqle relies on centralized cloud infrastructure, which limits scalability in areas with poor internet.
- **Green & clean tech:** Speqqle can adopt green hosting and optimize algorithms to reduce energy use, aligning with sustainability goals.

E

- **Availability of funds:** Partnerships with investors provide financial resources, but transitioning to a subscription model may strain smaller clients.
- **Rising interest rates:** Not directly addressed, but higher costs could deter adoption by cost-sensitive institutions.
- **Family supply chain reconfiguration:** Speqqle's solutions optimize material use across supply chains, reducing waste and costs for industries like recycling.
- **Inflation:** High subscription costs could become a barrier in inflationary environments, impacting smaller institutions.
- **Impact & ESG investments:** Speqqle can attract ESG investors by emphasizing sustainability benefits, potentially charging premiums for ESG-focused offerings.

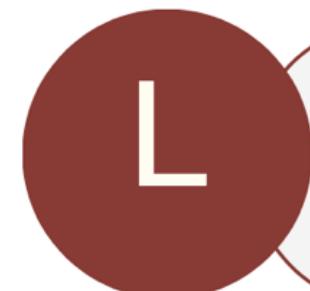
E

- **Extreme weather events:** Not directly applicable, but poor internet access in remote areas (potentially worsened by weather) limits cloud-dependent scalability.
- **Carbon regulations & net-zero targets:** Speqqle's cloud usage increases its digital carbon footprint, conflicting with net-zero goals (SDG 12).
- **Water scarcity & pollution:** Not directly applicable, though LCA highlights water usage as an input, which could be optimized.
- **Biodiversity loss:** Not directly applicable, but electronic waste from spectroscopy equipment could indirectly impact ecosystems.

STEEPLE- Explanation II (AI Generated)



- **Geopolitical instability:** Political instability in some regions could disrupt internet access, limiting RefFit's scalability.
- **Nationalism & protectionism:** Not directly applicable, but protectionist policies could affect international partnerships or data-sharing.
- **Public investment in green innovation:** Alignment with global green innovation agendas (e.g., SDG 9, SDG 17) creates opportunities for funding and partnerships.
- **Election cycles:** Not directly applicable, but shifts in policy (e.g., data or environmental regulations) could impact operations.
- **Migration policy debates:** Not directly applicable, though Speqqle's global reach may benefit from policies supporting international collaboration.

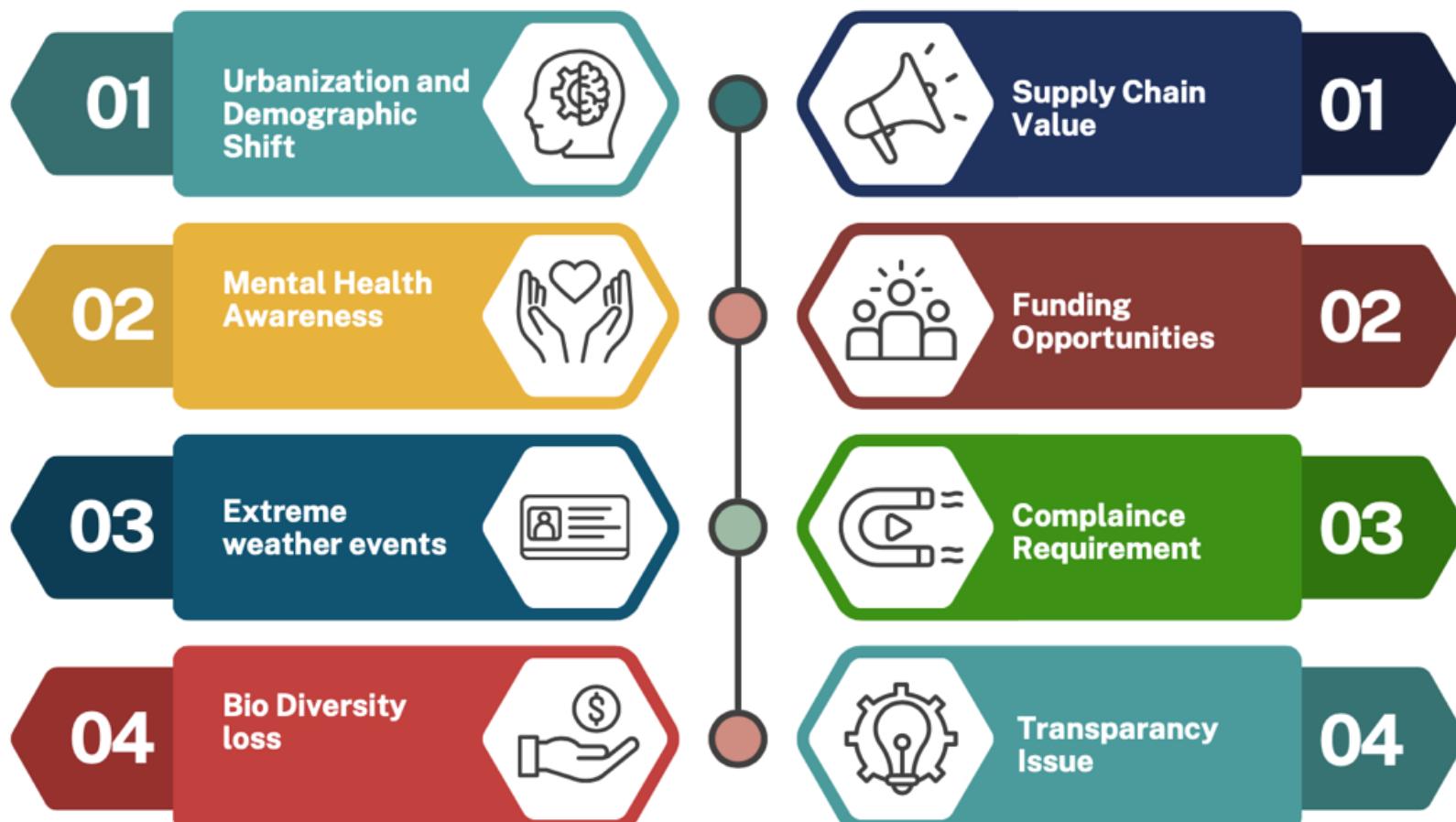


- **Sustainability reporting standards:** Speqqle must transparently report its environmental impact (e.g., carbon footprint) to meet emerging standards.
- **Green claims regulation:** Claims about sustainability benefits must be substantiated to avoid legal risks.
- **AI legislation:** Not directly applicable, as Speqqle avoids AI training, but API security must comply with data protection laws.
- **Data protection laws:** Compliance with GDPR and HIPAA is critical for handling sensitive research and healthcare data.
- **Tax policy shifts:** Not directly addressed, but changes in tax policies could affect subscription pricing or operational costs.



- **Consumer activism:** Customers increasingly demand ethical practices; Speqqle's lack of transparency on resource choices could erode trust.
- **Corporate activism:** Speqqle can lead in ethical innovation by developing affordable toolkits for underserved groups, aligning with SDG 10.
- **AI ethics:** Not directly applicable, but over-reliance on automation without human validation raises ethical concerns in critical applications like healthcare.
- **Equity & access in innovation:** High costs and technical barriers exclude low-resource users, posing ethical challenges.
- **Data ethics:** Misinterpretation or misuse of API data, especially in healthcare, could lead to harmful decisions, requiring ethical safeguards.

Irrelevant VS Relevant Trend



How these relevant trends threaten or present opportunities for Speeqle?

Speeqle faces significant threats across multiple dimensions that could hamper its growth and sustainability. The high-cost structure excludes smaller institutions in developing regions, creating market penetration barriers while API integration issues and security vulnerabilities could damage trust and adoption rates. Reliance on centralized cloud infrastructure limits functionality in areas with poor connectivity, restricting global scalability. The subscription model risks alienating price-sensitive customers in inflationary environments, while the company's digital carbon footprint potentially contradicts its sustainability messaging. Additionally, regulatory non-compliance, unsubstantiated green claims, and exclusionary pricing create legal vulnerabilities and reputational risks in increasingly conscious markets.

However, Speeqle can leverage substantial opportunities to strengthen its position. Its physics-based approach offers clear differentiation from AI-dependent competitors, while alignment with green innovation agendas opens access to public funding and ESG investment. The technology delivers measurable cost savings through material optimization across industries, creating compelling value propositions. By developing tiered pricing models, offline functionality, and affordable solutions for underserved markets, Speeqle could expand its reach while addressing ethical concerns. Adopting green hosting, optimizing algorithms for lower energy consumption, and implementing transparent sustainability reporting would strengthen brand credibility with both regulators and environmentally conscious customers, establishing Speeqle as an ethical leader in advanced spectroscopy.

Questions to Ask

- Who are my direct and indirect competitors?

Speqkle's direct competitors are companies offering advanced spectroscopy solutions, particularly those combining hardware and AI-driven software for material analysis:

- Bruker
- Thermo Fisher Scientific
- Wasatch Photonics

Indirect competitors include companies focusing on lower-cost, more accessible, or emerging technologies:

- SCiO (Consumer Physics)

- ZelosDx

- **Where do they operate?**

- Bruker: Operates globally, with a strong presence in Europe, North America, and Asia, focusing mainly on scientific research institutions, industrial sectors, and academia.
- Thermo Fisher Scientific: A global company active in healthcare, life sciences, and industrial applications, with a major presence in North America, Europe, and expanding rapidly in Asia-Pacific.
- Wasatch Photonics: Primarily active in the US and Europe, targeting both industrial and research markets with modular and customizable spectrometers.
- SCiO (Consumer Physics): Based in Israel, SCiO targets consumer and field applications globally, especially in agriculture, food, and personal wellness sectors.
- ZelosDx: A startup mainly operating in North America, focusing on healthcare diagnostics through embedded smart sensors.

- **What do they offer?**

- Bruker: High-end, laboratory-grade spectroscopy systems with AI-assisted analysis capabilities.
- Thermo Fisher Scientific: Integrated chemical analysis platforms with strong data analytics and machine learning components, tailored for complex and high-throughput applications.
- Wasatch Photonics: Compact, modular spectrometers designed for flexibility and easy integration, often paired with customizable, developer-friendly software.
- SCiO (Consumer Physics): Low-cost, portable NIR spectroscopy devices for quick, everyday material analysis in non-laboratory settings.
- ZelosDx: Embedded smart sensors using real-time AI processing to deliver immediate diagnostic insights, with a focus on scalability and point-of-care health applications.

- **What are their strengths? What are their weaknesses?**

Competitor	Strengths	Weaknesses
Bruker	Unmatched precision, brand reputation, strong R&D investment	High cost, complex systems requiring expertise and heavy infrastructure
Thermo Fisher Scientific	Advanced AI integration, wide product range, robust client support	Expensive, sometimes opaque AI models, heavy computational demands
Wasatch Photonics	Flexibility, modular design, open APIs for developers	Limited high-end capabilities, less well-known brand compared to giants
SCiO (Consumer Physics)	Affordability, portability, mass-market accessibility	Lower precision, limited applicability for complex scientific needs
ZelosDx	Innovative use of embedded AI, real-time diagnostics	Early-stage development, less proven reliability in critical settings

- **How close are they to my own offer? How “dangerous” are they—now and in the future?**

- Bruker and Thermo Fisher Scientific are strong direct competitors, offering advanced technologies and a well-established presence in academia and industry. They are especially “dangerous” due to their heavy R&D investments and the high level of trust they’ve built with demanding clients.
- Wasatch Photonics is a highly technical competitor, known for compact and modular solutions. It’s a threat for customers seeking flexibility and quick integration, especially in OEM contexts or for startups.
- SCiO operates more in the consumer and field-application space (e.g., agritech, food, etc.). It’s an indirect competitor, but potentially very disruptive in the long term due to its affordability and scalability.
- ZelosDx is an emerging competitor using AI-driven embedded diagnostic sensors. While less threatening today, it has strong future potential, especially if embedded AI becomes an industry standard.

So, *Bruker / Thermo Fisher* show an High present threat, but difficult to challenge head-on, while *Wasatch / SCiO / ZelosDx* present a Medium to high future threat, more agile and innovation-driven.

- **How can I learn from them?**

- Study how they integrate AI into chemical analysis and how they communicate the reliability and precision of their systems
- Learn from their modular approach, open APIs, and customizable software. Strong model for flexible, user-friendly design.
- Understand how they drastically lowered costs and made chemical sensing more accessible to a broader audience. Their direct-to-consumer marketing is also worth studying.
- Analyze how they apply real-time machine learning and how they present the value of “smart” diagnostics in a clear and compelling way.
- Study of their communication and marketing channel, to understand how they speak to their audience and what makes them appealing.

- Benchmarking of features and user experience, to identify strengths and weaknesses compared to our own offering.

- **How can I differentiate myself from them?**

User-centric experience, offering a more intuitive interface and easier-to-interpret analytics compared to the complex systems of Bruker or Thermo Fisher.

Flexible business model, Offering subscription-based services, pay-per-use, or developer-friendly APIs.

- **How can I best communicate my competitive advantages?**

Using product demos, side-by-side comparisons, and real-life case studies that show how SPEQQLE outperforms competitors in efficiency, speed, or cost, demonstrating its value

Emphasize innovation, accessibility, openness (APIs/open data), and social impact (e.g., environment, education, precision agriculture).

Through Human Storytelling, Highlight the people who use SPEQQLE, not just the specs, building a community around the brand.

- **Identify your startup's most relevant competitors**

Speqqle operates in the advanced spectroscopy and materials analysis space, where it offers a unique, machine learning-free, physics-based software solution. The most relevant competitors are companies that combine hardware and software for spectral analysis, particularly those relying on AI for calibration and interpretation. Notable competitors include:

Bruker, a leader in high-precision lab-based spectroscopy systems widely used in industry and academia.

Thermo Fisher Scientific, known for its AI-powered chemical analysis platforms tailored to complex research and industrial applications.

Wasatch Photonics, which provides compact and modular spectrometers, often bundled with customizable software.

SCiO by Consumer Physics, which offers highly portable, low-cost near-infrared (NIR) sensors for consumer and field use.

ZelosDx, an emerging competitor focusing on embedded smart diagnostic sensors that use machine learning to deliver real-time insights.

- **Identify 4-5 relevant value dimensions. Can you identify at least 1-2 that relate to Sustainability?**

Speqqle creates value across several important dimensions that reflect both its technological strengths and its broader commitment to sustainability. One key dimension is speed and precision, the software enables scientists, engineers, and industry professionals to analyze materials rapidly and accurately without relying on machine learning models or lengthy calibration processes. This not only accelerates discovery and decision-making but also makes high-performance analysis more accessible to those outside elite research institutions. Another important value dimension is ease of use and integration. Speqqle's physics-based system is user-friendly, plug-and-play, and compatible with existing hardware, reducing onboarding time and making it ideal for fast-paced lab or industrial environments. It also performs well in terms of scalability and accessibility, with its upcoming web-based interface designed to reach users

across geographies and income levels, supporting inclusive innovation in fields such as healthcare, mining, and recycling. In addition, Speqqle contributes to cleaner, smarter industrial processes by enabling precise, real-time material analysis that reduces waste, energy use, and production errors. This facilitates more sustainable manufacturing and supports compliance with environmental standards, aligning with SDG 9 and SDG 12. Speqqle also advances sustainable scientific research by allowing non-invasive, low-resource analysis that limits the use of harmful reagents and disposable materials. This fosters cleaner, more responsible research practices in healthcare, energy, and technology, further supporting SDG 9 and SDG 12.

Evaluate how you perform on these dimensions compared to your competitors. Summarize your findings in a Competitor Analysis Table and at least one Matrix.

Competitor	What they offer	Closeness to Speqqle Offer	Danger Level (Now)	Danger Level (Future)
Bruker	High-end, laboratory-grade spectroscopy systems with AI-assisted analysis	High	High	Medium
Thermo Fisher Scientific	Integrated chemical analysis platforms with advanced AI capabilities	High	High	Medium
Wasatch Photonics	Compact, modular spectrometers with <u>customizable</u> software	Medium	Medium	High
SCIO (Consumer Physics)	Portable, low-cost NIR spectroscopy devices for consumers	Low	Low	Medium
ZelosDx	Embedded smart diagnostic sensors with real-time AI	Low	Low	Medium High

Value Proposition Statement

Speqqle provides cutting-edge spectroscopy software that enables scientists, engineers, and industry professionals to analyze materials with exceptional speed and precision, without the need for complex machine learning or lengthy calibration.

Unlike conventional tools that rely on complex, opaque setups, Speqqle's physics-based approach directly interprets quantum interactions, delivering fast, transparent, and reliable results.

- **For scientists and researchers:** Speqqle offers fast, user-friendly, and accessible tools to accelerate discovery, reduce lab waste, and avoid costly trial-and-error.
- **For hardware manufacturers:** Speqqle adds value through plug-and-play compatibility, minimal setup, and lower computational demand, helping to extend product life cycles and reduce environmental impact.

Speqqle's upcoming web-based interface will make high-performance spectroscopy available across geographies and income levels, helping to support sustainable innovation in fields like healthcare, mining, and recycling.

Purpose (The Why)

To empower responsible science and technology by making material intelligence accessible to everyone, to help create a future where resources are used wisely and innovation serves both people and planet.

Vision (The What)

We envision a world where fast, accurate material analysis is available to all, and helps fuel smarter decisions, resource efficiency, and a global shift toward sustainable, data-driven innovation.

Mission (The How)

We provide intuitive, physics-driven spectroscopy tools that:

- Simplify material analysis across sectors,
- Reduce waste and overproduction through cloud-based insights,
- Support underserved researchers and institutions through accessible, scalable solutions, and
- Collaborate with partners to co-create ethical, sustainable innovations.

Chapter 7. Exploring Market Opportunities

This chapter explores how to identify opportunities for new products, services, and markets. The findings of such opportunities, assets, offerings, and markets should be investigated in detail. The most efficient approach is to start on a broad level, then narrow the findings down to drive the best solutions.

Step 1: Generating the Market Opportunity Set

In this step, the venture's core abilities and technological elements were listed, the three applications that can be offered according to the firm's core capabilities were defined, and relevant customers and users were listed under each application.

Based on the findings in this step, the "market opportunity set" basket in the Market Opportunity Navigator was filled.

Step 2: Evaluating the Market Opportunity Attractiveness

This step explores the three most appealing market opportunities through ranking the detailed list of potential and challenges the firm might face pursuing each market. Using the results from this practice, the Attractiveness Map in the Market Opportunity Navigator was filled.

Step 3: Designing the Agile Focus Strategy

In this step, the primary market opportunity found based on the Attractiveness Map, and the three identifies attractive market opportunities from step 2 were listed. Then each market was evaluated based on product readiness and market relatedness in relation to the primary market. Then the markets were ranked as "pursue now", "keep open" and "place in storage" and placed in the Agile Focus Dashboard in the Market Opportunity Navigator.

Chapter 7. Alternative Market Opportunities

Step 1: Generating the Market Opportunity Set

Initially, the market opportunity set was generated based on the material development & testing capabilities of Speqqle and the consulting offering based on the expertise of the team. Then, after distinguishing the three most attractive markets, specific market opportunities were defined based on the following reasonings:

- **GHG emissions measurement in the energy industry:** Although GHG emissions measurement, specifically identifying the types of gasses emitted, is an identical practice in different industries, due to the severity of the pollutant activities of the energy industry, as well as their familiarity with the material identification based on the engineering background of the managers in this industry, entering this market will be less challenging and has the highest potential for Speqqle.
- **Tablet coating development in the pharmaceuticals industry:** Tablet coating is one of the highly researched and innovative aspects of drug development in the pharmaceuticals industry. In fact, the scientists are constantly attempting to enhance the properties of tablet coatings, such as their taste, colour, protection to external environment, and release properties²⁰. Although the strict regulations will challenge Speqqle, it is important to work towards offering the material development & testing services in this industry.
- **Alloy development in the watchmaking industry:** One of the most innovative elements of watches is the use of alloys. The alloy development process requires precise steps such as following specific alloying temperatures, refining, and finishing of the surface texture²¹. Speqqle brings efficiency to such practices in this industry; however, since the luxury players have demanding standards, it is crucial for Speqqle to establish its brand by attracting well known customers in the other two markets before entering the watchmaking market.

²⁰ ScienceDirect. (n.d.). Tablet coating. In ScienceDirect Topics. Retrieved May 24, 2025, from <https://www.sciencedirect.com/topics/chemistry/tablet-coating>

²¹ AllTi Alloys. (2023, November 8). Precision and craftsmanship: Alloys in Swiss watchmaking. <https://www.alltialloys.com/blog-posts/precision-and-craftsmanship-alloys-in-swiss-watchmaking>

THE MARKET OPPORTUNITY NAVIGATOR

NAME _____

DATE _____

SPEQQLE



MATERIAL OPPORTUNITY SET

Use Worksheet 1 to identify potential market opportunities, and place them in the set

ATTRACTIVENESS MAP

Use Worksheet 2 to evaluate the attractiveness of each market opportunity, and place each one on the map

Overall, the consulting services are more challenging to offer prior to establishing the customers for material development & testing; hence, they are placed on the right side of the development & testing opportunities.

AGILE FOCUS DARTBOARD

Use Worksheet 3 to design your Agile Focus strategy, and mark it on the dartboard



market opportunity = any combination of application + customer
Use sticky-notes™ to represent each market opportunity

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1

WORKSHEET 1 GENERATE YOUR MARKET OPPORTUNITY SET

List the venture's core abilities or technological elements

Characterize them based on their functions and properties. Describe them in a general manner, independent from your (envisioned) product.

ABILITIES

High-Precision Material Analysis

Deep knowledge and practical skills in using spectroscopy to analyze the properties of materials and gases

Materials Science Expertise (Data analysis & Consultation)

Ability to convert complex spectroscopy data into practical insights and provide consulting services

Advanced data algorithms

Develop Software Platform for Spectral Data Visualization and analysis

Customization and User Adaptability

Ability to tailor software to different user needs in the industry

APPLICATIONS



Identify your market opportunities
Which applications can you offer with your core abilities? Which customers may need them? Zoom in to further segment each customer group.



Conducting research experiments and material analyses in an academic environment



Measuring GHG emissions, Certification Support



Consulting services for material analysis, helping clients optimize their materials for performance, quality, and sustainability

CUSTOMERS



University laboratorier (funds from the Professors' budget, the departments of Materials Science, Chemistry, Mechanical, Life Science, Energy, and Sustainability)

Students, professors, researchers/scientists, universities, labs & lab techs (the departments of Materials Science, Chemistry, Mechanical, Life Science, Energy, and Sustainability)



Private and public companies (including pharmaceuticals, dentistry and medical, construction, aerospace and defence, renewable energy (solar panels), semiconductors, electronics, and watchmaking), governments, NGO's, international certification bodies



Manufacturing companies and organisations from different industries (including pharmaceuticals, dentistry and medical, construction, aerospace and defence, renewable energy (solar panels), semiconductors, electronics, and watchmaking)



application



+ customer



market opportunity



Place the market opportunities that you would like to evaluate in the Market Opportunity Set.

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Step 2: Evaluating the Market Opportunity Attractiveness

**WORKSHEET 2
EVALUATE MARKET OPPORTUNITY ATTRACTIVENESS**

Use this worksheet for every market opportunity you would like to evaluate.

Market Opportunity: Alloy development in Watchmaking

POTENTIAL		CHALLENGE	
	COMPELLING REASON TO BUY Unmet need Effective solution Better than current solutions		IMPLEMENTATION OBSTACLES Product development difficulties Sales and distribution difficulties Funding challenges
	MARKET VOLUME Current market size Expected growth		TIME TO REVENUE Development time Time between product and market readiness Length of sale cycle
	ECONOMIC VIABILITY Margins (value vs. cost) Customers' ability to pay Customer stickiness		EXTERNAL RISKS Competitive threat 3rd party dependencies Barriers to adoption
OVERALL POTENTIAL		OVERALL CHALLENGE	
<input type="checkbox"/> Use the overall ratings to situate each market opportunity on the Attractiveness Map.		www.wheretoplay.co	

**WORKSHEET 2
EVALUATE MARKET OPPORTUNITY ATTRACTIVENESS**

Use this worksheet for every market opportunity you would like to evaluate.

Market Opportunity: Tablet coating development in Pharmaceuticals

POTENTIAL		CHALLENGE	
	COMPELLING REASON TO BUY Unmet need Effective solution Better than current solutions		IMPLEMENTATION OBSTACLES Product development difficulties Sales and distribution difficulties Funding challenges
	MARKET VOLUME Current market size Expected growth		TIME TO REVENUE Development time Time between product and market readiness Length of sale cycle
	ECONOMIC VIABILITY Margins (value vs. cost) Customers' ability to pay Customer stickiness		EXTERNAL RISKS Competitive threat 3rd party dependencies Barriers to adoption
OVERALL POTENTIAL		OVERALL CHALLENGE	
<input type="checkbox"/> Use the overall ratings to situate each market opportunity on the Attractiveness Map.		www.wheretoplay.co	

WORKSHEET 2

EVALUATE MARKET OPPORTUNITY ATTRACTIVENESS

Use this worksheet for every market opportunity you would like to evaluate.

Market Opportunity: GHG emissions measurements in Energy industry

POTENTIAL		CHALLENGE	
	COMPELLING REASON TO BUY Unmet need Effective solution Better than current solutions		IMPLEMENTATION OBSTACLES Product development difficulties Sales and distribution difficulties Funding challenges
	MARKET VOLUME Current market size Expected growth		TIME TO REVENUE Development time Time between product and market readiness Length of sale cycle
	ECONOMIC VIABILITY Margins (value vs. cost) Customers' ability to pay Customer stickiness		EXTERNAL RISKS Competitive threat 3rd party dependencies Barriers to adoption
OVERALL POTENTIAL		OVERALL CHALLENGE	
<input type="button" value="LOW"/> <input type="button" value="MID"/> <input checked="" type="button" value="HIGH"/> <input type="button" value="SUPER HIGH"/>		<input type="button" value="LOW"/> <input checked="" type="button" value="MID"/> <input type="button" value="HIGH"/> <input type="button" value="SUPER HIGH"/>	
 <input type="checkbox"/> Use the overall ratings to situate each market opportunity on the Attractiveness Map.			

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Step 3: Designing the Agile Focus Strategy

WORKSHEET 3

DESIGN YOUR AGILE FOCUS STRATEGY

Build a smart portfolio around your Primary Market Opportunity to mitigate your risk and increase your value.

- Choose a Primary Market Opportunity to focus on (based on the Attractiveness Map).
- Pick other attractive market opportunities from your set to examine possible Backup and Growth options.

Academia/Research			
	GHG emissions measurements in Energy industry		Tablet coating development in Pharmaceuticals
	Alloy development in Watchmaking		
Relatedness to your Primary Market Opportunity: PRODUCT RELATEDNESS To what extent do the products share: technological competencies, required resources, necessary networks			
<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
MARKET RELATEDNESS To what extent do the customers share: values and benefits, sales channels, word-of-mouth			
<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
Suitable as: BACKUP OPTION Attractive market opportunities that do not share major risks with your Primary Market Opportunity to allow for a change in direction			
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
GROWTH OPTION Attractive market opportunities that allow your business to create additional value			
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> Pursue now <input checked="" type="checkbox"/> Keep open <input type="checkbox"/> Place in storage <input type="checkbox"/> Pursue now <input checked="" type="checkbox"/> Keep open <input type="checkbox"/> Place in storage <input type="checkbox"/> Pursue now <input checked="" type="checkbox"/> Keep open <input type="checkbox"/> Place in storage			

Mark your strategy on the Agile Focus Dartboard.

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GROUP 1.2

Chapter 7. Alternative Market Opportunities

Step 1: Generating the Market Opportunity Set

1 WORKSHEET 1
GENERATE YOUR MARKET OPPORTUNITY SET

List the core assets (technologies, abilities, resources held by your venture).
Describe them in a general manner (unrelated to your current product) and consider assets that may become relevant in light of STEEPLE trends.

SOFTWARE- TO ACHIEVE PRECISION AND EFFICIENCY	CONSULTANCY SERVICES	ADOPTING SUSTAINABLE PRACTICE	EASY ACCESSIBILITY
Provide the SaaS platform to analyse the materials using the spectroscopic analysis.	Provide consultancy services to users who encounter difficulties with the SPEQQLE application through expert guidance and personalized support, helping users resolve issues efficiently and optimize their experience	Assist business in adopting resources more efficiently, reducing waste, and watching for harmful emissions, in line with goals for sustainable development.	As the Speqqle software uses an intuitive no-code interface, it makes it easy for even the non-experts to use it

Identify potential market opportunities.
Which applications can you offer with your assets? Which customers may need them?

APPLICATIONS	CUSTOMERS	
SPECTROSCOPIC ANALYSIS	CONSULTANCY SERVICES	SUSTAINABILITY PRACTICE
<ul style="list-style-type: none">1. Hospitals2. Mining Industry3. Hardware Manufacturers4. Dental Industry5. Recycling/Waste Management6. Engineers7. Pharmaceutical	<ul style="list-style-type: none">1. Hardware Manufacturers2. Hospitals3. Universities4. Engineers	<ul style="list-style-type: none">1. Companies (mining, recycling, refining, collection, hardware manufacturing)2. Healthcare

*NUMBERED ACCORDING TO PRIORITY

application + customer = market opportunity

Place the market opportunities that you would like to evaluate in the Market Opportunity Set.

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Step 2: Evaluating the Market Opportunity Attractiveness

WORKSHEET 2 EVALUATE MARKET OPPORTUNITY ATTRACTIVENESS

Use this worksheet for every market opportunity you would like to evaluate.

Market Opportunity: SPECTROSCOPIC ANALYSIS IN HOSPITALS

POTENTIAL		CHALLENGE	
	COMPELLING REASON TO BUY Unmet need Effective solution Better than current solutions		IMPLEMENTATION OBSTACLES Product development difficulties Sales and distribution difficulties Funding challenges
	MARKET VOLUME Current market size Expected growth		TIME TO REVENUE Development time Time between product and market readiness Length of sale cycle
	ECONOMIC VIABILITY Margins (value vs. cost) Customers' ability to pay Customer stickiness		EXTERNAL RISKS Competitive threat 3rd party dependencies Barriers to adoption
OVERALL POTENTIAL		OVERALL CHALLENGE	
<input type="checkbox"/> Additional potential category: Societal impact HIGH		<input type="checkbox"/> Overall challenge rating: 	
<input type="checkbox"/> Use the overall ratings to situate each market opportunity on the Attractiveness Map.			
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WORKSHEET 2 EVALUATE MARKET OPPORTUNITY ATTRACTIVENESS

Use this worksheet for every market opportunity you would like to evaluate.

Market Opportunity: CONSULTANCY SERVICES IN HARDWARE MANUFACTURING

POTENTIAL		CHALLENGE	
	COMPELLING REASON TO BUY Unmet need Effective solution Better than current solutions		IMPLEMENTATION OBSTACLES Product development difficulties Sales and distribution difficulties Funding challenges
	MARKET VOLUME Current market size Expected growth		TIME TO REVENUE Development time Time between product and market readiness Length of sale cycle
	ECONOMIC VIABILITY Margins (value vs. cost) Customers' ability to pay Customer stickiness		EXTERNAL RISKS Competitive threat 3rd party dependencies Barriers to adoption
OVERALL POTENTIAL		OVERALL CHALLENGE	
<input type="checkbox"/> Additional potential category: Societal impact HIGH		<input type="checkbox"/> Overall challenge rating: 	
<input type="checkbox"/> Use the overall ratings to situate each market opportunity on the Attractiveness Map.			
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WORKSHEET 2

EVALUATE MARKET OPPORTUNITY ATTRACTIVENESS

Use this worksheet for every market opportunity you would like to evaluate.

Market Opportunity: SPECTROSCOPIC ANALYSIS IN MINING INDUSTRY

POTENTIAL		CHALLENGE	
	COMPELLING REASON TO BUY Unmet need Effective solution Better than current solutions		IMPLEMENTATION OBSTACLES Product development difficulties Sales and distribution difficulties Funding challenges
	MARKET VOLUME Current market size Expected growth		TIME TO REVENUE Development time Time between product and market readiness Length of sale cycle
	ECONOMIC VIABILITY Margins (value vs. cost) Customers' ability to pay Customer stickiness		EXTERNAL RISKS Competitive threat 3rd party dependencies Barriers to adoption
OVERALL POTENTIAL		OVERALL CHALLENGE	
<p> Use the overall ratings to situate each market opportunity on the Attractiveness Map.</p> <p>www.wheretoplay.co This work is licensed under Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International license.</p>			

Step 3: Designing the Agile Focus Strategy

WORKSHEET 3

DESIGN YOUR AGILE FOCUS STRATEGY

Build a smart portfolio around your Primary Market Opportunity to mitigate your risk and increase your value.

- Insert your current market opportunity.
- Pick 3 attractive alternative market opportunities.
- Design your Agile Focus Strategy:

SPECTROSCOPIC ANALYSIS IN MINING INDUSTRY

	Mineral Exploration and Real-Time Ore Mapping	Environmental Monitoring and Mine Site Remediation	Process Optimization and Ore Grade Control
Relatedness to your Primary Market Opportunity:			
PRODUCT RELATEDNESS To what extent do the products share technological competencies, required resources, necessary networks	<input type="radio"/> <input type="radio"/> <input checked="" type="radio"/>	<input checked="" type="radio"/> <input type="radio"/> <input type="radio"/>	<input type="radio"/> <input type="radio"/> <input checked="" type="radio"/>
MARKET RELATEDNESS To what extent do the customers share values and benefits, sales channels, word-of-mouth	<input type="radio"/> <input checked="" type="radio"/> <input type="radio"/>	<input type="radio"/> <input checked="" type="radio"/> <input type="radio"/>	<input type="radio"/> <input type="radio"/> <input checked="" type="radio"/>
Suitable as:			
BACKUP OPTION Attractive market opportunities that do not share major risks with your Primary Market Opportunity to allow for a change in direction	<input checked="" type="checkbox"/> Backup	<input checked="" type="checkbox"/> Backup	<input type="checkbox"/> Backup
GROWTH OPTION Attractive market opportunities that allow your business to create additional value	<input checked="" type="checkbox"/> Growth	<input type="checkbox"/> Growth	<input checked="" type="checkbox"/> Growth
III. Design your Agile Focus Strategy:	<input checked="" type="checkbox"/> Pursue now	<input checked="" type="checkbox"/> Keep open	<input type="checkbox"/> Place in storage
	<input checked="" type="checkbox"/> Pursue now	<input checked="" type="checkbox"/> Keep open	<input type="checkbox"/> Place in storage
	<input checked="" type="checkbox"/> Pursue now	<input checked="" type="checkbox"/> Keep open	<input checked="" type="checkbox"/> Place in storage

Mark your strategy on the Agile Focus Dartboard.

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WORKSHEET 3

DESIGN YOUR AGILE FOCUS STRATEGY

NAME _____

DATE _____

Build a smart portfolio around your Primary Market Opportunity to mitigate your risk and increase your value.

- I. Insert your current market opportunity.



SPECTROSCOPIC ANALYSIS IN HOSPITALS

- II. Pick 3 attractive alternative market opportunities.



Spotting infections early in wounds



Cancer Biopsy Enhancement



Monitoring Infection Progression

Relatedness to your Primary Market Opportunity:

PRODUCT RELATEDNESS

To what extent do the products share: technological competences, required resources, necessary networks



OO



OO



OO



OO



OO



OO



OO



OO

MARKET RELATEDNESS

To what extent do the customers share: values and benefits, sales channels, word-of-mouth



OO



OO



OO



OO



OO



OO



OO



OO

Suitable as:

BACKUP OPTION

Attractive market opportunities that do not share major risks with your Primary Market Opportunity to allow for a change in direction



Backup



Backup



Backup

GROWTH OPTION

Attractive market opportunities that allow your business to create additional value



Growth



Growth



Growth

- III. Design your Agile Focus Strategy:

- Keep at least one Backup and one Growth Option open
- Decide if any option is worth pursuing now
- Place the rest in storage



Pursue now



Keep open



Place in storage



Pursue now



Keep open



Place in storage



Pursue now



Keep open



Place in storage

Mark your strategy on the Agile Focus Dartboard.

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WORKSHEET 3

DESIGN YOUR AGILE FOCUS STRATEGY

NAME _____

DATE _____

Build a smart portfolio around your Primary Market Opportunity to mitigate your risk and increase your value.

- I. Insert your current market opportunity.



CONSULTANCY SERVICES IN HARDWARE MANUFACTURING

- II. Pick 3 attractive alternative market opportunities.



Circular Economy Consulting



Sustainable Supply Chain Auditing



Smart Manufacturing & Energy Efficiency Optimization

Relatedness to your Primary Market Opportunity:

PRODUCT RELATEDNESS

To what extent do the products share: technological competences, required resources, necessary networks



OO



OO



OO



OO



OO



OO



OO



OO

MARKET RELATEDNESS

To what extent do the customers share: values and benefits, sales channels, word-of-mouth



OO



OO



OO



OO



OO



OO



OO



OO

Suitable as:

BACKUP OPTION

Attractive market opportunities that do not share major risks with your Primary Market Opportunity to allow for a change in direction



Backup



Backup



Backup

GROWTH OPTION

Attractive market opportunities that allow your business to create additional value



Growth



Growth



Growth

- III. Design your Agile Focus Strategy:

- Keep at least one Backup and one Growth Option open
- Decide if any option is worth pursuing now
- Place the rest in storage



Pursue now



Keep open



Place in storage



Pursue now



Keep open



Place in storage



Pursue now



Keep open



Place in storage

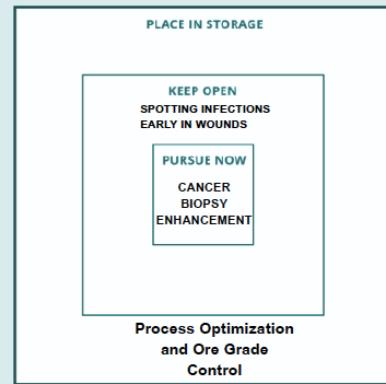
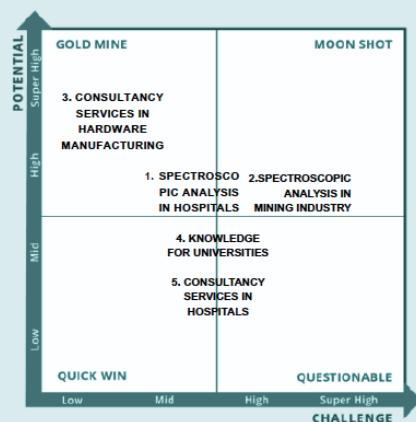
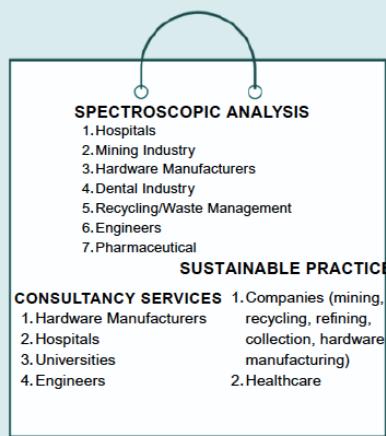
Mark your strategy on the Agile Focus Dartboard.

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THE MARKET OPPORTUNITY NAVIGATOR

NAME _____ DATE _____



MARKET OPPORTUNITY SET

- 1 Use Worksheet 1 to identify potential market opportunities, and place them in the set

ATTRACTIVENESS MAP

- 2 Use Worksheet 2 to evaluate the attractiveness of each market opportunity, and place each one on the map

AGILE FOCUS DARTBOARD

- 3 Use Worksheet 3 to design your Agile Focus strategy, and mark it on the dartboard



market opportunity = any combination of application + customer
Use sticky-notes™ to represent each market opportunity

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