due2grow

Don´t waste the seed!

Feasibility Report

[redacted]

Co-Founders (Group 30):

[redacted]

Assignment No. 2 |
Submitted to: [redacted]

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Prelude

After conducting an initial examination of an automated seed germination capacity testing device (also see the concept sheet in the appendix), the goal of this document is to evaluate *due2grow's* (d2g) *Germinator* for feasibility based on product, industry, organisational and financial considerations. Furthermore, the design of d2g's value proposition has been extensively researched. The team has undertaken ten interviews and research across different fields to obtain valuable insights. Knowledge from experts in the seed industry, data scientists, as well as mechanical and manufacturing engineers, has been collected and utilised to include new perspectives.

1. Product Feasibility

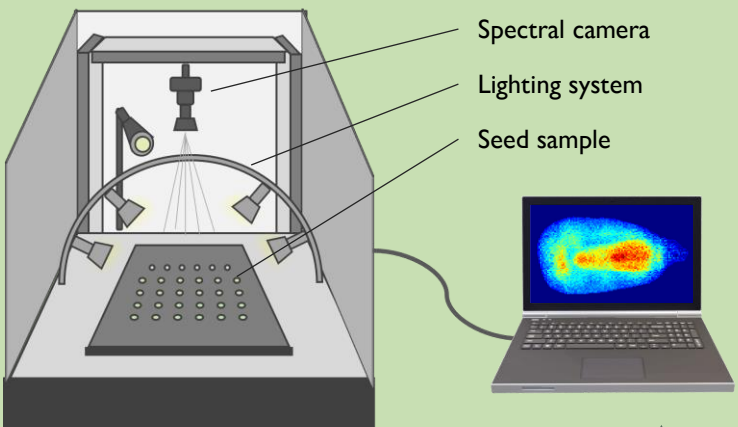
In the following, we examine the product's feasibility by reviewing the technical evaluation of the hardware and software. This is followed by an overview of the development stages and concluded with a pricing model.

Business Model

As previously outlined in the concept paper, the *Germinator* shall be sold in a razor and blade model together with its complementary software. This strategy guarantees a steady income from monthly software subscriptions as the device can only function in tandem with the software [PF1]. Once the *Germinator* gains industry recognition, it is worthwhile to consider issuing certificates that confirm that germination capacity testing has been carried out by the *Germinator*.

Hardware

The *Germinator* technology is underpinned by prior research. Scholarly works confirm the practicality and effectiveness of spectral imaging for evaluating seed germination capacity [PF2, PF3]. Essential characteristics of the seed's physical composition become observable by utilising near infrared spectroscopy (NIRS) and can subsequently be classified by the complementary software [PF2]. Alternative spectral imaging systems exist besides NIRS that can evaluate seeds for similar parameters. Nevertheless, research has revealed, NIRS has demonstrated the greatest efficacy and precision in forecasting [PF3]. This principle is not only grounded in academic research but has also received endorsement from a professor of the School of Mechanical & Manufacturing Engineering at Dublin City University. Although more elaborate methods exist for seed analysis, experts have confirmed that this technique is perfectly suitable for commercial purposes. It achieves a sweet spot between quality and cost efficiency.



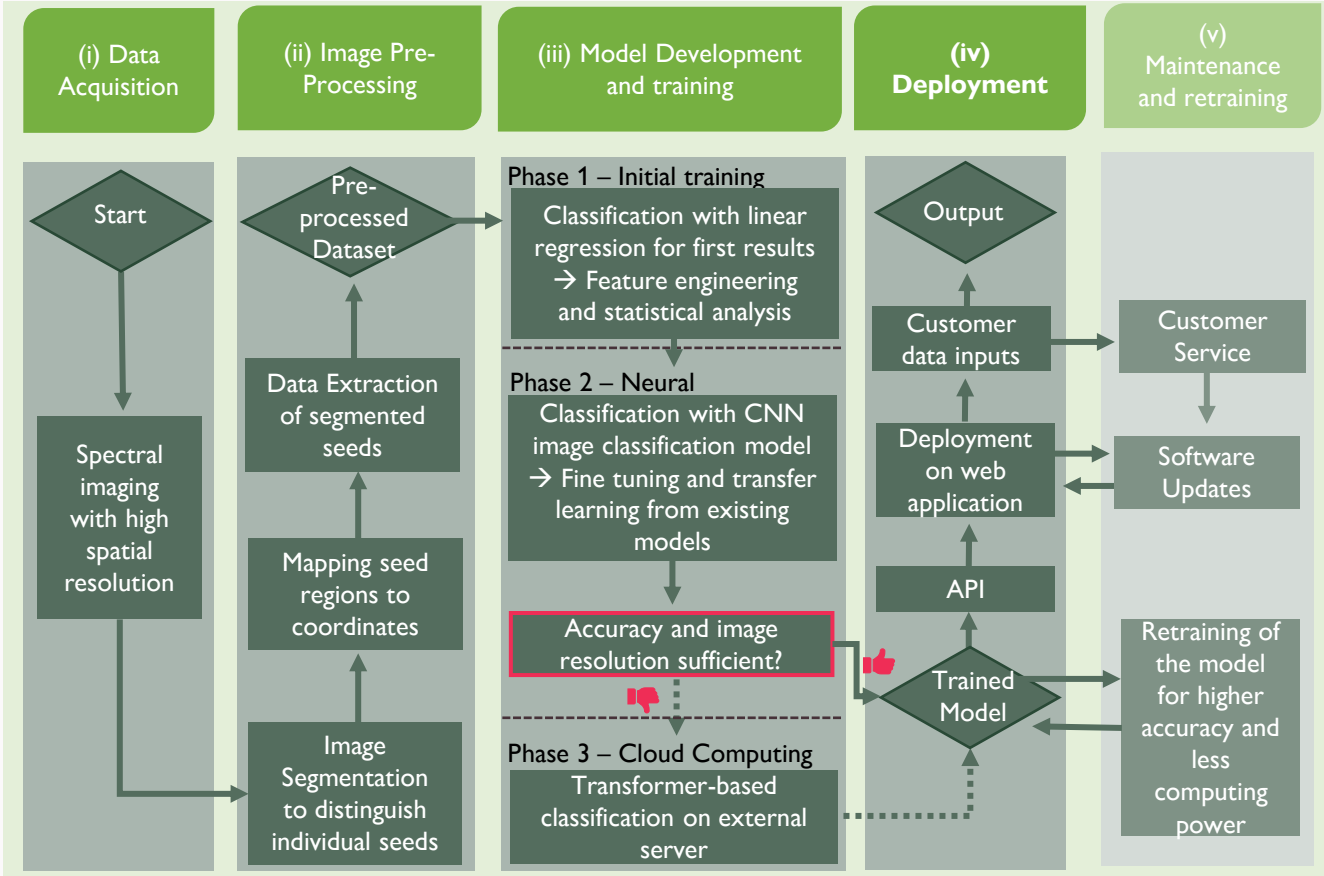
Model of the interior of the *Germinator* [PF4, PF5]

Model of the exterior of the *Germinator*

The *Germinator* comprises an NIRS system with a camera, LED lighting systems, and an imaging chamber. The decision to exclude an additional colour imaging camera was made after considering the features outlined in the concept paper due to its requirement for additional computing power and the sufficiency provided by NIRS alone [PF2]. In addition to this, industry experts have confirmed that spectral imaging is a valid option. The (raw) materials utilised in producing the *Germinator* are currently indeterminate and necessitate evaluation for suitability by an engineer. Prospective materials comprise of steel, aluminium, and plastics. The possibility to procure ready NIRS systems and their components makes it needless to engineer and develop the camera and system that underlies it ourselves.

Software - Set up

After closely assessing the feasibility of our product offering's hardware, the implementation of the software constitutes a major unique selling proposition for d2g. Engineered for optimal performance, it seamlessly integrates spectral imaging data, ensuring a robust foundation for efficient seed germination analysis. The ultimate outcome of our workflow answers the question: Will the seeds germinate or not? More specifically, it will divide the seeds into classes, according to industry classification. Normal, Abnormal, Hard, Weak or Dead. For that, we will apply a classification algorithm to our data to receive a result on the overall germination capacity of the seed lot. Our key metric in determining this is the accuracy.



Process map for software development and retraining

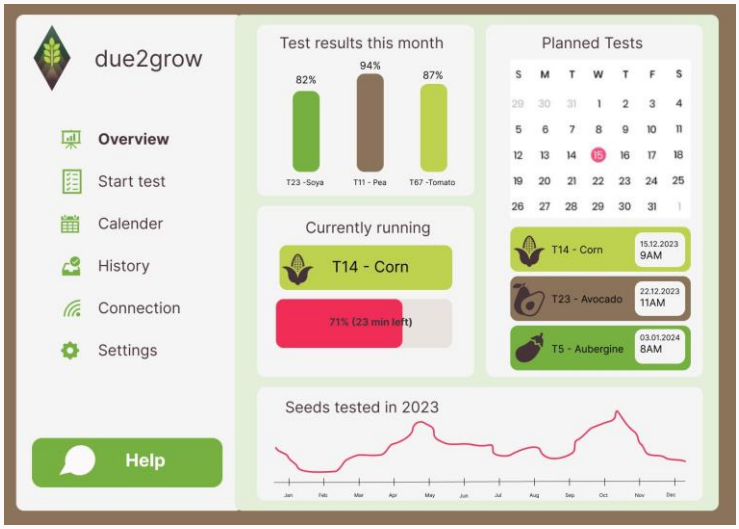
The depicted process was developed from interviewing data scientists, refining our initial data science concept deprived from secondary research, and will offer a comprehensive overview for our data scientist to work with, once we have a prototype of our *Germinator*. It is a supervised learning approach which uses an image classifier model to predict whether a seed will germinate or not. As soon as we can process the imagery generated from the machine, the models can be developed and trained accordingly. The three phases of development and model training serve to cover different scopes of accuracy, improving its accuracy but at the same time becoming more resource-intensive.

Open-source data banks may suffice at the initial stages, but getting closer to market entry, genuine industry data should be gathered. That said, it is imperative to select an original seed type to commence. Eventually, with the accumulation of varied data, the *Germinator* will have the capability to test any seed. Our data science process can be applied to the different potential seed types that d2g will offer in the future, making our business model scalable for different industry branches. Relating to this, an integral part of our product offering is retraining and maintenance. Our customers can easily reach out to our team via the web application to suggest new crop varieties which we will implement to offer broad variety of requested test options. We are continuously running software updates and improving the algorithm and application's performance to guarantee the highest standard and satisfactory test accuracy. With this we are making sure to offer substantial value to our customers and keep customer retention high.

Customer usage

Once the images of the seeds have been taken by the *Germinator*, the image data is transferred to the customer's laptop, on which they will use our machine learning workflow via a web application to determine its germination capacity. Our algorithms can be deployed as needed via an API. Our data scientist interviewee described the process as follows: "[…]if your business model is a cloud application, […] when you want to make available the germination classification model, you would put it into a 'container'. You'd make this API available and you will put a version of this model into that 'container' and you would start it up and shut it down as was needed.". This way, we are ensuring a smooth and accurate process while at the same time, making sure that the end user can easily operate and interpret the results we provide.

In the dashboard, users can have an overview of their completed and planned tests. Furthermore, we are focusing on an intuitive, easy-to-understand usability to meet the target users' needs. Customers can reach out in case of hardware and software problems via the application, where they find extensive help documentation but can also reach out to our customer service via the provided contact information in the application.



Web application mock-up

Technology Readiness Levels (TRL)

1. Define basic properties
2. Analytical study / concept formulated

Research and work in NED module

3. Proof of concept
4. Technology validated in lab

Engineering process of hardware and software

5. Technology validated in relevant environment
6. Technology demonstrated in relevant environment

Collaboration with seed industry to obtain data and test prototype

7. Prototype demonstration in operational environment
8. System complete and qualified

Collaboration with seed industry to test device in real circumstances

9. Product on market

Broad scope market launch

Definition & application of TRLs to d2g's [PF7]

Technological Route to Market

Referring to the Technology Readiness Levels (TRL) concept, the development of the *Germinator* is currently at level 2. TRLs were first introduced by NASA to classify the development stages of new technologies and were later adopted by the European Union [PF6] and were pointed out as an important parameter by engineers. As the fundamental technology already exists and only requires adaptation for its intended purpose, achieving level 4 at the earliest is a realistic goal for the hardware. In order to improve our ranking, we require lab space and equipment for constructing the device. Thus, it is prudent to contemplate collaborations with academic institutions or specialised machinery manufacturers. Following the completion of the prototype, the algorithm can be trained utilising spectral imaging results. Partnerships can be formed with seed testing labs or seed breeding facilities to acquire pertinent data for the algorithm. By providing indispensable data for the software, our partners can already take advantage of the benefits offered by the *Germinator*. Additionally, with these partnerships, we can now achieve levels 5 and 6. Our partners are entitled to a free trial of the software during the initial year. The collaborations will play a crucial role in facilitating the device's progression to levels 7 and 8. Widespread distribution of the *Germinator* will enable us to achieve level 9. Ultimately, these partnerships will also form d2g's primary route to market, with the aim of gaining momentum in the highly networked industry through customers sharing their experiences.

Pricing

Our pricing strategy comprises two components in line with our business model. It consists of a one-time fixed charge for the assembly and set up of the hardware, which becomes operational upon the commencement of the purchase contract, and a recurrent revenue stream comprising payments for our software. These monthly payments include customer service and regular software and crop variety updates in line with the SaaS concept. The hardware price is calculated at €72,000. This initial price is set relatively low to gain customers more easily and matches the pricing of one of the indirect competitors. The software will sell for €3,600 a month. Continuing, it will generally be easier to retain these customers than gaining new ones. In line with the razor and blade model, the initial hurdle is lower and the reoccurring software payment is higher priced. The pricing strategy for the *Germinator* and its accompanying software is a value-based approach, commonly implemented for premium products with limited competition[PF8].

The pricing structure aligns with the *Germinator's* ability to deliver significant benefits to customers, cater to a value-appreciative customer segment, and distinguish itself from other market options. Therefore, the prices are justifiably anchored on the provided benefits and added value. Furthermore, we have carried out a break-even analysis for a typical customer representative in our target group. This analysis is conducted to determine the precise moment when the device investment matches the current testing costs. It has revealed that our *Germinator's* non-destructive testing capabilities can save customers a considerable amount of money and hundreds of test seeds per propagation within the first year of use. Even though we adopt a value-based approach to pricing, our customers can still reach an early break-even point. This results in long-term cost savings and contributes to the added value of their operations. As the *Germinator* will not initially replace International Seed Testing Association (ISTA) tests, it is still necessary to comply with the regulations by conducting one ISTA test per propagation batch.

To illustrate this approach, we are providing an example of a fictional seed breeding company whose profile is drafted with facts and figures from industry insiders to compare the planned pricing of d2g, once fully entering the market, with our potential customer's current expenses occurring because of the ISTA tests.

Exemplary Customer Profile

*SME Seed producer
*Turnover of €20 mio/year
*Testing expenses of €180 k/year (excl. personell costs)

Currently, the customer tests the seeds approx. four times per propagation batch. There are approximately 1,250 propagations each year. Thus, one test as per ISTA regulation costs the company about €40 + four batches of test seeds.

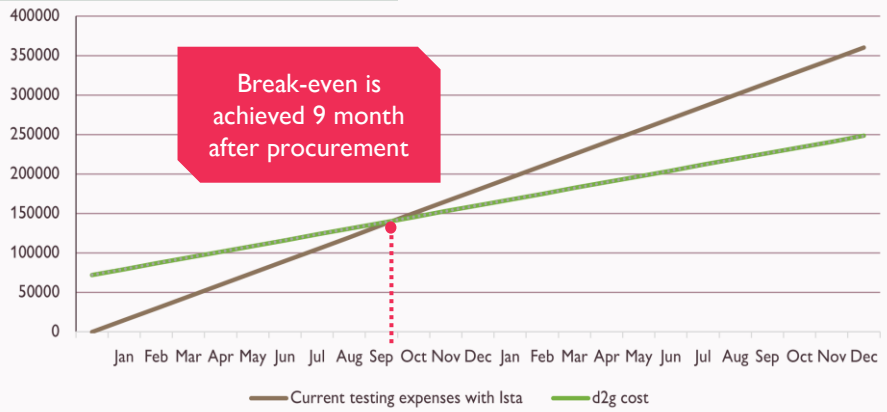
Pricing Calculations

Fixed costs for the customer:
One official ISTA test per propagation to meet regulations.
1,250 * €40 = €45,000 / year

Hardware Pricing:
(for details see *Financial Feas.*)
Estimated production costs:
€36,000
Selling price:
€ 72,000

Total costs for customer in year one (in €):
45,000 + 72,000 + 43,200 =
160,200

Software Pricing:
Monthly subscription of €3,600
€3,600 * 12 =
€43,200 / year



2-year pricing break-even analysis for exemplary customer profile

Decision – Product and Service Feasibility

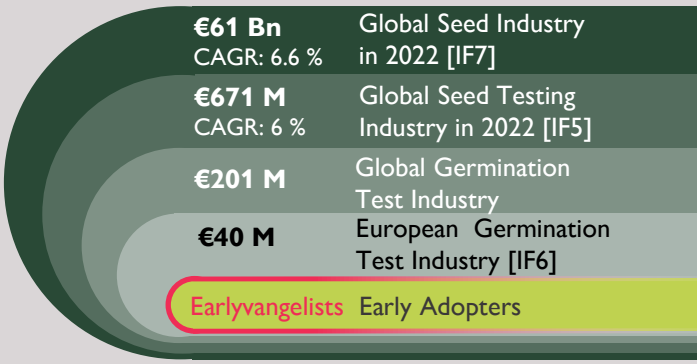
In summary, d2g's combination of proven NIRS technology and a detailed data analysis provides a solid development plan for achieving technical maturity. We therefore consider the product and its related services feasible.

2. Industry Feasibility

To evaluate the industry feasibility, we first evaluated the market and competitors for seed germination tests, then specified our targeted industry and lastly, put particular emphasis on analysing the customers themselves.

Market Analysis

The history of seed germination tests is closely connected to the seed industry as a whole. Broadly known as 'vigor testing', germination tests were introduced following inconsistent and divergent metrics [IF1]. Thus, to create uniformity, ISTA was founded globally driving standardisation and reliability of results. Soon after, ISTA´s guidelines largely became industry norm [IF2]. However, still few companies offer viable alternatives to ISTA- certified laboratories which is all the more astonishing given our interviewees have repeatedly confirmed the current test´s shortcomings. Nonetheless, two indirect competitors have entered the market in the last decades. Seed-X GeNee Detect uses computer vision combined with AI to analyse seed quality mainly targeting scientific use cases [IF3]. Also focusing on scientific applications, VideometerLab´s spectral imaging solutions can be utilised to analyse a range of biological subjects, such as food, grains and seeds [IF4]. Yet, both products lack specificity for wide range usage in the seed industry´s production function because no direct statements are made about germination capacity. Hence, alternatives to ISTA are still highly demanded as will become clear in d2g´s value proposition. Focusing on the market as a whole, the public market for seed testing is estimated at around €671 Million (using current exchange rates form USD to EUR), estimated to grow at around 6 % until 2027 [IF5]. Based on expert indications, d2g estimates the germination tests to be around 30 % of the overall testing market. As Europe accounts for 20 % of the global seed market [IF6], d2g approximates the European market for seed germination tests at €40 Million. Given this size, projected growth rate and unchallenged nature of the market, it is highly attractive. However, identifying possible earlyvangelists will be key to d2g´s success.



Potential Market Size

Industry Analysis

Going back to the seed industry as a whole, germination capacities tests find application in many industries and functions which became evident during expert interviews. Namely, the ones depicted below. In science and R&D, the focus lies less upon the germination capacity alone and more broadly on chemical and morphological features. Our indirect competitors already penetrate this market. Thus, we will not focus on these processes. The seed industry´s customers are highly diverse, ranging from farmers to the canned goods industry. In particular, this group tests arbitrarily, relying mostly on the seed industry´s provided test results rendering this market quantitatively unattractive. Thus, d2g will primarily focus on the seeds industry´s production and sales functions in its first business years. Here, propagation units are tested continuously after harvest, conditioning or processing. In sum, each propagation unit, basically each harvested field, is tested around three to five times according to our interviews. Considering the large amounts of testing required, an attractive market opens up for d2g´s *Germinator*.

Scientific Research		Organisations:	Universities & Research Institutes
		Customers:	DCU Faculty of Science, Frauenhofer
		Processes:	Scientific knowledge gain
		Requirements:	Highly accurate testing procedures about various seed parameters
Seed Industry		Organisations:	Micro to large private companies
		Customers:	Rijk Zwaan, KWS, Syngenta
	R&D	Processes:	Breeding and testing of new varieties
		Requirements:	Highly accurate testing procedures about various seed parameters
	Production & Sales	Processes:	Reproduction of seed varieties and conditioning
		Requirements:	Accurate and fast test results regarding seed germination capacity
Seed Customers		Organisations:	Highly varied depending on crop / culture Ranging from sole traders to larger industries
		Customers:	Mainly random sampling of the received deliveries
		Processes:	Accurate and fast test results regarding seed germination capacity
		Requirements:	

Current & Potential Customers of Seed Germination Tests [IF8; IF9]

Customer Analysis

To identify d2g´s possible earlyvangelists, a light will be shed on the seed industry´s structure which can be divided into three tiers. Few large multinational corporations are controlling much of the market. Thus, specifically targeting tier 1 and 2 would result in large buyer power which we aim to avoid [IF10]. To alleviate this possibility, we will focus our attention on the highly fragmented landscape of SMEs, part of the tier 3. Additionally, tier 3 companies often lack in-house laboratories and, thus, depend even more on unreliable ISTA-certified laboratories. Therefore, they are especially in need of a new solution, making them the perfect target, and possible earlyvangelists, for our *Germinator*. Of course, this tier could be further divided into cultures such as cereals or vegetable seeds. However, talking to industry experts, we concluded that all seed companies, regardless of specification, experience the same issue regarding current germination tests. Broadly speaking, tier 3 companies have less than €100 Million in sales. Combining this information with the fact that seed companies make roughly €100,000 to 200,000 in sales per employee annually [IF11], our target customer would have below 500 employees. Budget-wise, the seed company should have a large enough production volume each year to make seed testing expenditure relevant. Therefore, they should spend at least 0.5 % of sales on germination tests annually. Market-wise, we will focus on Europe which has a large density of tier 3 companies compared to a concentrated North American market [IF8]. The Ideal Customer (or Earlyvangelists) Profile is depicted below:

Focus of d2g

	Tier 1	Tier 2	**Tier 3**
Sales Range in USD Million	> 500	100 - 500	< 100
Market Share	69 %	15 %	16 %
Profitability (EBIT % of Sales)	15 %	10 %	5 %
Number of Companies	10 globally	circa 40 globally	circa 7000 in Europe

Classification of companies in the seed industry [IF6; IF11]

Industry
Seed Industry.

Geography
European Union.

Company Size
< €100m in sales.
< 500 employees.

Budget
> 0.5 % of sales spent on germination tests annually.

Buying Process
Reliance on past experience and on referrals.

Decision Makers
CEO, COO.

Pain Points
- Lacking timely information. about germination capacity
- No personal laboratory.
- Shortage of qualified labour.

Business Goals
Short-term: Delivering goods on time leading to happy customers.
Long-term: High reputation leading to increased numbers of orders.

Technologies
- Goods Management Systems.
- Internal auditing systems.
- MS Applications.

Attributes (Traits, Strategies, Goals)
- Huge Buyer Power and thus reputation-dependent.
- Looking to satistfy growing demands of seeds by closing capacity bottlenecks within the internal value chain.
- Relying on external partners for seed quality tests.

Decision – Industry Feasibility

We conclude that the seed industry´s production and sales function is a feasible and attractive market for our product, but the competition should be closely monitored.

3. Organisational Feasibility

To assess the viability of d2g as an organisation, the following pages will touch on the company's structure, the skills and expertise of the team, and identify areas where further development may be required.

Set Up

due2grow is a European start-up company based in Dublin, Ireland.
With growth, the company has the potential to establish additional sites across Europe to provide better service to non-Irish customers and enhance customer experience by offering proximity in terms of geography.
To operate successfully as a business, d2g prioritises excelling in commercial success and high-quality technology, while ensuring an exceptional customer experience throughout the process.

Meet the team!

[redacted], *CEO*
Having experience in venture development for a corporate web application start-up and in product management for a data analytics cloud application, Anika understands the significance of creating a user-friendly, data-oriented automation application.

due2grow's founding team impresses with a global perspective on underexplored issues. Drawing upon diverse professional backgrounds, the young team is highly motivated to share their expertise and develop new skills. With an emphasis on exceptional work ethic and a strong commitment to customer satisfaction, the team strives to create novel and innovative value for the agricultural sector.

[redacted], *COO*
Being the son of two agricultural scientists in rural Germany, Sebastian knows agriculture´s pain points. From his internships in Strategy Departments, he learned what it takes to steer a business in the right direction.

[redacted], *CFO*
Having been brought up on a farm and working in landscaping, William has a knowledge of Irish agriculture and their needs. With experience in Accounting and Sales roles, his skills provide knowledge on financial problems.

Leonie Röskam, *CCO*
With experience spanning sales, sustainability and consulting, Leonie offers valuable skills in tackling modern business challenges, equipped to navigate complexity and provide strategic solutions.

[redacted], *CTO*
With a strong track record in project management, Maxime excels in successful delivery and leadership, reaching milestones such as co-founding a SaaS company. His adaptability and commitment underline his problem-solving skills.

The establishment of a successful start-up demands a founding team that possesses a diverse range of core competencies. Despite the fact that the d2g's founding team holds a wealth of knowledge and experience, certain tasks cannot be executed by the team alone. Consequently, a skills gap analysis was conducted to determine the team's acquired skills and the knowledge required to propel the business forward.
The skills detailed in the table are founded on research, which identified fundamental competencies for start-up creation [OF1]. All abilities are ranked between 1 and 5, with the Business column receiving a standard score of 3, signifying competencies acquired during university studies.

Skills Gap Analysis

	[redacted]	[redacted]	[redacted]	Leonie	[redacted]
Business					
Financial Management	3	3	4	3	3
Human Capital Management	4	3	2	3	4
Marketing	3	1	2	3	3
Business Management	3	3	3	4	4
Entrepreneurial*	4	3	3	3	3
Technical					
Data Science	2	2	2	2	2
Software Development	2	2	2	2	2
Hardware Engineering	1	1	1	1	1
Soft Skills					
Social*	3	3	3	4	3
Leadership*	4	3	3	3	3
Personal*	3	3	3	3	4

1	Limited understanding
2	Able to perform under instruction, lack of experience
3	Comfortable with the skill
4	Strong understanding and experience
5	Mastery of the skill

*Entrepreneurial: Opportunity recognition, creativity, innovation, proactivity

*Social: Emotional intelligence, communication & negotiation, collaboration, networking

*Leadership: Visionary, empathy, coordination

*Personal: Accountability, responsibility, self-reflection, confidence

Skills Gap Analysis [OF1]

The analysis of skills gaps demonstrates that the team possesses a solid groundwork to fulfil the necessary business tasks since its members have unique strengths and valuable professional experience. The team members' soft skills are already well-developed, for instance through their experience in consulting and established industry networks. As all members are currently majoring in data analytics, they can perform basic **data science** tasks under instruction. However, for **software development**, a software engineer needs to be hired who can also instruct the team. In addition, a **hardware engineer** needs to be hired to compensate for the team's lack of knowledge.

Decision – Organisational Feasibility

Based on our analysis, organisational feasibility is guaranteed as long as competent hardware and software engineers are hired and the team delegates tasks in accordance with each team member's strengths.

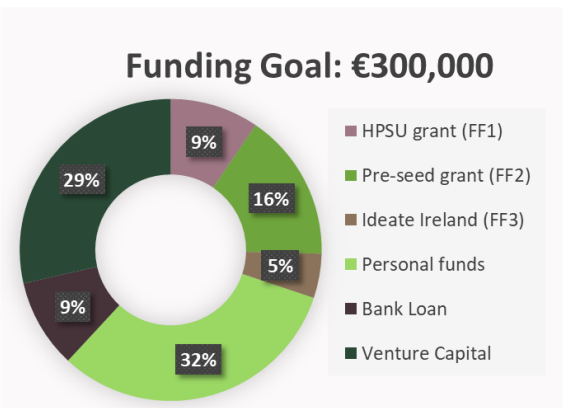
4. Financial Feasibility

In order to evaluate the feasibility of our enterprise, a thorough examination of the financial feasibility was needed. This section provides us with the necessary insight to make important business decisions for our enterprise and creates the information needed for future investors. By analysing the funding, start-up costs and estimated financial accounts for year 1 we can understand the financial viability of our enterprise.

To reach our initial funding goal of €300,000, we intend to avail of Enterprise Ireland resources, personal funding, new enterprise competitions and borrowings.

Initial Funding				
Goal	€	300,000		
Enterprise Ireland Grants				
- HPSU Feasibility Study grant			€	30,000
- Pre-seed start Fund			€	50,000
New enterprise competition prize				
- Ideate Ireland winner			€	15,000
Personal Funding			€	100,000
Total Capital Contributions	€	195,000		
Remainder	€	105,000		
Loan/investment			€	30,000
Angel investor or Venture capital			€	90,000
Total funding			€	315,000

Setting up the business		
Accountant's fees	€	1,500.00
Solicitor's fees	€	3,000.00
Business registration	€	125.00
Domain name registration	€	15.00
Insurance premiums	€	200.00
Licences	€	150.00
Workers compensation	€	2,700.00
Setting up the premises		
Lease deposit and advance rent	€	3,200.00
Fitout	€	3,000.00
Utility bonds and connection	€	1,500.00
Stationery and office supplies	€	500.00
Plant and equipment		
Equipment	€	51,000.00
Vehicles	€	-
Telecommunications	€	100.00
Computers and software	€	10,000.00
Web App Creation	€	15,000.00
Starting operations		
Advertising and promotion	€	2,000.00
Raw materials and supplies	€	15,000.00
Unplanned Expenses	€	15,000.00
Staff	€	50,946.00
Start-up capital		
Equity investment	€	195,000.00
Borrowings	€	120,000.00
Total	€	315,000.00
The result		
Total set-up costs	€	**174,936.00**
Surplus funds	€	**140,064.00**



As we explore the financial feasibility of our enterprise, the importance of potential investors became apparent. We hope to attract investors that will not only provide capital but also expertise with a vested interest in our product and success.

The initial investment required for startup costs and capital stands at €174,936 covering essential elements such as equipment, technology, licenses, and initial operating expenses. Cost that are vital to the operation of our enterprise are the web app and prototype creation at €42,000 and €15,000 respectively.
A reserve of €15,000 will be made for all other unplanned expenses.

After considering all start-up costs our initial funding left a surplus funds of €140,064, this will provide us the starting cash balance we need for operational costs and other expenses within our first year.

Profit and loss forecast

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Totals
Sales													
Sales (invoiced)	€ 66,600.00	€ -	€ -	€ 66,600.00	€ -	€ -	€ -	€ 72,000.00	€ 144,000.00	€ -	€ -	€ -	**€ 349,200.00**
Cost of goods sold	€ 36,000.00	€ -	€ -	€ 36,000.00	€ -	€ -	€ -	€ 36,000.00	€ 72,000.00	€ -	€ -		**€ 180,000.00**
Gross profit	€ 30,600.00	€ -	€ -	€ 30,600.00	€ -	€ -	€ -	€ 36,000.00	€ 72,000.00	€ -	€ -	€ -	**€ 169,200.00**
Expenses													
Accounting fees	€ -	€ -	€ -	€ -	€ -	€ -	€ -	€ -	€ -	€ -	€ -	€ 1,500.00	€ 1,500.00
Advertising	€ 167.00	€ 167.00	€ 167.00	€ 167.00	€ 167.00	€ 167.00	€ 167.00	€ 167.00	€ 167.00	€ 167.00	€ 167.00	€ 163.00	€ 2,000.00
Bank charges	€ -	€ -	€ 15.00	€ -	€ -	€ 15.00	€ -	€ -	€ 15.00	€ -	€ -	€ 40.00	€ 85.00
Bank interest	€ 96.37	€ 96.37	€ 96.37	€ 96.37	€ 96.37	€ 96.37	€ 96.37	€ 96.37	€ 96.37	€ 96.37	€ 96.37	€ 96.37	€ 1,156.45
Depreciation	€ -	€ -	€ -	€ -	€ -	€ -	€ -	€ -	€ -	€ -	€ -	€ -	€ -
Electricity and gas	€ 1,800.00	€ 1,800.00	€ 1,800.00	€ 1,800.00	€ 1,800.00	€ 1,800.00	€ 1,800.00	€ 1,800.00	€ 1,800.00	€ 1,800.00	€ 1,800.00	€ 1,800.00	€ 21,600.00
Insurance	€ 200.00	€ -	€ -	€ -	€ -	€ -	€ -	€ -	€ -	€ -	€ -	€ -	€ 200.00
Legal fees	€ 250.00	€ 250.00	€ 250.00	€ 250.00	€ 250.00	€ 250.00	€ 250.00	€ 250.00	€ 250.00	€ 250.00	€ 250.00	€ 250.00	€ 3,000.00
Motor vehicle expenses	€ 450.00	€ 450.00	€ 450.00	€ 450.00	€ 450.00	€ 450.00	€ 450.00	€ 450.00	€ 450.00	€ 450.00	€ 450.00	€ 450.00	€ 5,400.00
Stationery	€ 42.00	€ 42.00	€ 42.00	€ 42.00	€ 42.00	€ 42.00	€ 42.00	€ 42.00	€ 42.00	€ 42.00	€ 42.00	€ 38.00	€ 500.00
Rent	€ 800.00	€ 800.00	€ 800.00	€ 800.00	€ 800.00	€ 800.00	€ 800.00	€ 800.00	€ 800.00	€ 800.00	€ 800.00	€ 800.00	€ 9,600.00
Repairs and maintenance	€ 1,332.00	€ -	€ -	€ 1,332.00	€ -	€ -	€ -	€ 1,440.00	€ 2,880.00	€ -	€ -	€ -	€ 6,984.00
Security	€ 164.00	€ 164.00	€ 164.00	€ 164.00	€ 164.00	€ 164.00	€ 164.00	€ 164.00	€ 164.00	€ 164.00	€ 164.00	€ 164.00	€ 1,968.00
Sundries	€ 300.00	€ 300.00	€ 300.00	€ 300.00	€ 300.00	€ 300.00	€ 300.00	€ 300.00	€ 300.00	€ 300.00	€ 300.00	€ 300.00	€ 3,600.00
Superannuation	€ -	€ -	€ -	€ -	€ -	€ -	€ -	€ -	€ -	€ -	€ -	€ -	€ -
Transport/courier costs	€ 1,332.00	€ -	€ -	€ 1,332.00	€ -	€ -	€ -	€ 1,440.00	€ 2,880.00	€ -	€ -	€ -	€ 6,984.00
Wages	€ 8,491.00	€ 8,491.00	€ 8,491.00	€ 8,491.00	€ 8,491.00	€ 8,491.00	€ 8,491.00	€ 8,491.00	€ 8,491.00	€ 8,491.00	€ 8,491.00	€ 8,491.00	€ 101,892.00
Workers compensation	€ 225.00	€ 225.00	€ 225.00	€ 225.00	€ 225.00	€ 225.00	€ 225.00	€ 225.00	€ 225.00	€ 225.00	€ 225.00	€ 225.00	€ 2,700.00
Web app maintenance	€ 250.00	€ 250.00	€ 250.00	€ 250.00	€ 250.00	€ 250.00	€ 250.00	€ 250.00	€ 250.00	€ 250.00	€ 250.00	€ 250.00	€ 3,000.00
Total	€ 15,899.37	€ 13,035.37	€ 13,050.37	€ 15,699.37	€ 13,035.37	€ 13,050.37	€ 13,035.37	€ 15,915.37	€ 18,810.37	€ 13,035.37	€ 13,035.37	€ 14,567.37	**€ 172,169.45**
Result													
Net profit	€ 14,700.63	-€ 13,035.37	-€ 13,050.37	€ 14,900.63	-€ 13,035.37	-€ 13,050.37	-€ 13,035.37	€ 20,084.63	€ 53,189.63	-€ 13,035.37	-€ 13,035.37	-€ 14,567.37	**-€ 2,969.45**
Gross profit margin	46%			46%				50%	50%				**48%**
Net profit margin	22%			22%				28%	37%				**-1%**

As many of the figures are estimated, some assumptions were made about the future of our business. Costs such as the web app maintenance were input to account for the average 15% initial cost of web app creation. With our intended business loan of €30,000, the repayments offered by Bank of Ireland would be over 84 months at an interest of 7.05%, these costs recorded across our accounts. Due to the increasing cost of property and rental income, we decided to make use of modern day working from home spaces while also renting a small space outside of Dublin to provide for regular operations. As we expect to make a loss within our first year, the corporation tax paid will be claimed back resulting in a 0 tax liability. Our transport costs for all goods sold will be accounted for at 2% of the gross sale amount to cover any unplanned costs.

The hiring of hardware and software developers will be necessary to the creation of our system and its continued success. To ensure prototype creation we will hire them for the 6 months before beginning year 1. This work will be supplemented by our executive team's experience in data science and software development to reduce the high cost of these roles.

Revenue and business strategy

Cash flow forecast

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Totals
Starting cash position	€ 140,064.00	€ 155,981.74	€ 144,163.47	€ 132,330.21	€ 148,447.94	€ 136,629.68	€ 124,796.42	€ 112,978.15	€ 134,279.89	€ 188,686.62	€ 176,868.36	€ 165,050.10	
Incoming													
Cash sales	€ 66,600.00	€ -	€ -	€ -	€ -	€ -	€ -	€ 72,000.00	€ 72,000.00	€ -	€ -	€ -	€ 210,600.00
Accounts receivable collections	€ -	€ -	€ -	€ 66,600.00	€ -	€ -	€ -	€ -	€ 72,000.00	€ -	€ -	€ -	€ 138,600.00
Other cash receipts	€ -	€ -	€ -	€ -	€ -	€ -	€ -	€ -	€ -	€ -	€ -	€ -	€ -
Total	€ 66,600.00	€ -	€ -	€ 66,600.00	€ -	€ -	€ -	€ 72,000.00	€ 144,000.00	€ -	€ -	€ -	€ 349,200.00
Outgoing													
Fixed costs	€ 2,159.26	€ 827.26	€ 827.26	€ 2,159.26	€ 827.26	€ 827.26	€ 827.26	€ 2,267.26	€ 3,707.26	€ 827.26	€ 827.26	€ 827.26	€ 16,911.17
Administration	€ 68.08	€ 68.08	€ 68.08	€ 68.08	€ 68.08	€ 68.08	€ 68.08	€ 68.08	€ 68.08	€ 68.08	€ 68.08	€ 68.08	€ 816.96
Marketing	€ 167.00	€ 167.00	€ 167.00	€ 167.00	€ 167.00	€ 167.00	€ 167.00	€ 167.00	€ 167.00	€ 167.00	€ 167.00	€ 167.00	€ 2,004.00
Operations	€ 1,470.67	€ 138.67	€ 138.67	€ 1,470.67	€ 138.67	€ 138.67	€ 138.67	€ 1,578.67	€ 3,018.67	€ 138.67	€ 138.67	€ 138.67	€ 8,648.04
Loan Repayments	€ 453.51	€ 453.51	€ 453.51	€ 453.51	€ 453.51	€ 453.51	€ 453.51	€ 453.51	€ 453.51	€ 453.51	€ 453.51	€ 453.51	€ 5,442.17
Variable costs	€ 48,523.00	€ 10,991.00	€ 11,006.00	€ 48,323.00	€ 10,991.00	€ 11,006.00	€ 10,991.00	€ 48,431.00	€ 85,886.00	€ 10,991.00	€ 10,991.00	€ 12,531.00	€ 320,661.00
Administration	€ 200.00	€ -	€ 15.00	€ -	€ -	€ 15.00	€ -	€ -	€ 15.00	€ -	€ -	€ 1,540.00	€ 1,785.00
Marketing	€ -	€ -	€ -	€ -	€ -	€ -	€ -	€ -	€ -	€ -	€ -	€ -	€ -
Operations	€ 3,832.00	€ 2,500.00	€ 2,500.00	€ 3,832.00	€ 2,500.00	€ 2,500.00	€ 2,500.00	€ 3,940.00	€ 5,380.00	€ 2,500.00	€ 2,500.00	€ 2,500.00	€ 36,984.00
Wages	€ 8,491.00	€ 8,491.00	€ 8,491.00	€ 8,491.00	€ 8,491.00	€ 8,491.00	€ 8,491.00	€ 8,491.00	€ 8,491.00	€ 8,491.00	€ 8,491.00	€ 8,491.00	€ 101,892.00
Production	€ 36,000.00	€ -	€ -	€ 36,000.00	€ -	€ -	€ -	€ 36,000.00	€ 72,000.00	€ -	€ -	€ -	€ 180,000.00
Total	€ 50,682.26	€ 11,818.26	€ 11,833.26	€ 50,482.26	€ 11,818.26	€ 11,833.26	€ 11,818.26	€ 50,698.26	€ 89,593.26	€ 11,818.26	€ 11,818.26	€ 13,358.26	€ 337,572.17
Result													
Change during month	€ 15,917.74	-€ 11,818.26	-€ 11,833.26	€ 16,117.74	-€ 11,818.26	-€ 11,833.26	-€ 11,818.26	€ 21,301.74	€ 54,406.74	-€ 11,818.26	-€ 11,818.26	-€ 13,358.26	
Closing cash position	€ 155,981.74	€ 144,163.47	€ 132,330.21	€ 148,447.94	€ 136,629.68	€ 124,796.42	€ 112,978.15	€ 134,279.89	€ 188,686.62	€ 176,868.36	€ 165,050.10	€ 151,691.83	

Balance sheet forecast

As at: December 2025

Assets		
Current assets	€	151,691.83
Cash	€	151,691.83
Petty cash	€	-
Accounts receivable	€	-
Stock	€	-
Investment	€	-
Prepaid expenses	€	-
Fixed assets	€	61,000.00
Land	€	-
Buildings	€	-
Equipment	€	51,000.00
Motor/vehicles	€	-
Software	€	10,000.00
Total assets	€	212,691.83
Liabilities		
Current liabilities	€	6,938.73
Accounts payable	€	-
Interest payable	€	6,938.73
Corporation tax	€	-
Long-term liabilities	€	120,000.00
Borrowings	€	30,000.00
Financing	€	90,000.00
Total liabilities	€	126,938.73
Net assets	€	85,753.11
Owner's equity		
Retained earnings		$88,723
Current year earnings	-€	2,969.45
Total equity	€	85,753.11

Due to the high cost of NIR systems and our software development, we will use a lower gross margin percentage of about 48% in order to stay competitive but also cover costs. By maintaining a lower cost for our hardware, we can create partnerships and ensure returning revenue of subscriptions for our software. We will base our software subscription at 5% of initial cost price per month, using this we can hope to gain a high market share while there are minimal competitors in the market.

As ISTA (Irish seed testing association) recognises 15 key seed producers within Ireland [FF4], our goal would be to secure a couple key partnerships within the first year to help us expand further. The wider market of Europe would create a much greater opportunity for expansion within the first year and after, our links to the German market would be our main focus for additional sales in the early stages of our enterprise.

To gain valuable clients we will offer the first year of software free with the purchase of our hardware. We can make use of these partnerships to gain valuable data and continue to improve our system over the first year. This will be crucial to the creation of our image classification system. The first purchase is €72000 for hardware and one year subscription software including installation, consulting and training.
Monthly subscription will be charged after that to update and maintain use of the software at €43200 yearly, in order to maintain a stream of revenue we will push to lock these contracts down for a year or more.

7.5% Off

For all early-stage data partners

Financial Conclusion

To evaluate the financial performance of our business, ratio analysis was used. The ratio of gross margin to customer acquisition costs enabled us to compare our performance with other industry benchmarks. Although our gross margin is low at 48%, we will be able to see the future benefits of this given our two-component business model. Also, as our customer acquisition cost are quite high at €400, they could cause issues for a new enterprise in a larger market. However, due to the niche scale and large expenditures of our target market, these ratios are positive and provide opportunities to grow.

Customer Acquisition cost

Cost of marketing to gain 1 new customer (marketing/new customers)

Marketing		New customers
€	2,004	5
CAC:	€ 400.80	

Break-even analysis

Average selling price per unit	€	69,840.00
Average cost of each unit	€	36,000.00
Gross profit margin		48%
Fixed costs	€	172,169.45
Dollar sales to break even	€	355,328.45
Number of unit sales to break even		5

48.45%

Gross Margin

€400

Customer Acquisition Cost

€340,000

Total Revenue

This investigation will provide us the guidance to plan for future risks in the pursuit of success in the seed industry. The financial accounts made will help us make informed decisions for potential investors and our executive team. By using sensitivity models and ratio analysis we can account for future changes and adapt when needed. Some of the key competitive advantages our enterprise holds, lay in the size of the market and the lack of current competitors. Now, with a firm understanding of financial changes, we are well-equipped to capitalise on opportunities and deal with challenges.

The use of sensitivity analysis models allows us to forecast the performance of our enterprise by using historical and variable data. These will provide us with the necessary information on possible outcomes to make important decisions. Just a sample of the analysis we made was in the 'quantity vs price' and 'cost per unit vs price' metrics, which show the potential breakeven points of operating profit.

Price vs Quantity

		Quantity					
	€ 7,831	3	4	5	6	7
	€ 82,000	-€ 34,169	€ 11,831	€ 57,831	€ 103,831	€ 149,831
	€ 77,000	-€ 49,169	-€ 8,169	€ 32,831	€ 73,831	€ 114,831
Price	€ 72,000	-€ 64,169	-€ 28,169	€ 7,831	€ 43,831	€ 79,831
	€ 67,000	-€ 79,169	-€ 48,169	-€ 17,169	€ 13,831	€ 44,831
	€ 62,000	-€ 94,169	-€ 68,169	-€ 42,169	-€ 16,169	€ 9,831
	€ 57,000	-€ 109,169	-€ 88,169	-€ 67,169	-€ 46,169	-€ 25,169

Price vs Cost

		Variable cost per unit				
	€ 7,831	€ 28,000	€ 32,000	€ 36,000	€ 40,000	€ 44,000
	€ 82,000	€ 97,831	€ 77,831	€ 57,831	€ 37,831	€ 17,831
	€ 77,000	€ 72,831	€ 52,831	€ 32,831	€ 12,831	-€ 7,169
Price	€ 72,000	€ 47,831	€ 27,831	€ 7,831	-€ 12,169	-€ 32,169
	€ 67,000	€ 22,831	€ 2,831	-€ 17,169	-€ 37,169	-€ 57,169
	€ 62,000	-€ 2,169	-€ 22,169	-€ 42,169	-€ 62,169	-€ 82,169
	€ 57,000	-€ 27,169	-€ 47,169	-€ 67,169	-€ 87,169	-€ 107,169

The comprehensive analysis of our financial feasibility reveals both the challenges and opportunities of our new enterprise, while providing an understanding of the required intricacies of our product and business plan. By using realistic assumptions and estimates for our financial forecasting, it shows a promising trajectory for *due2grow* and our future investors.

Decision – Financial Feasibility

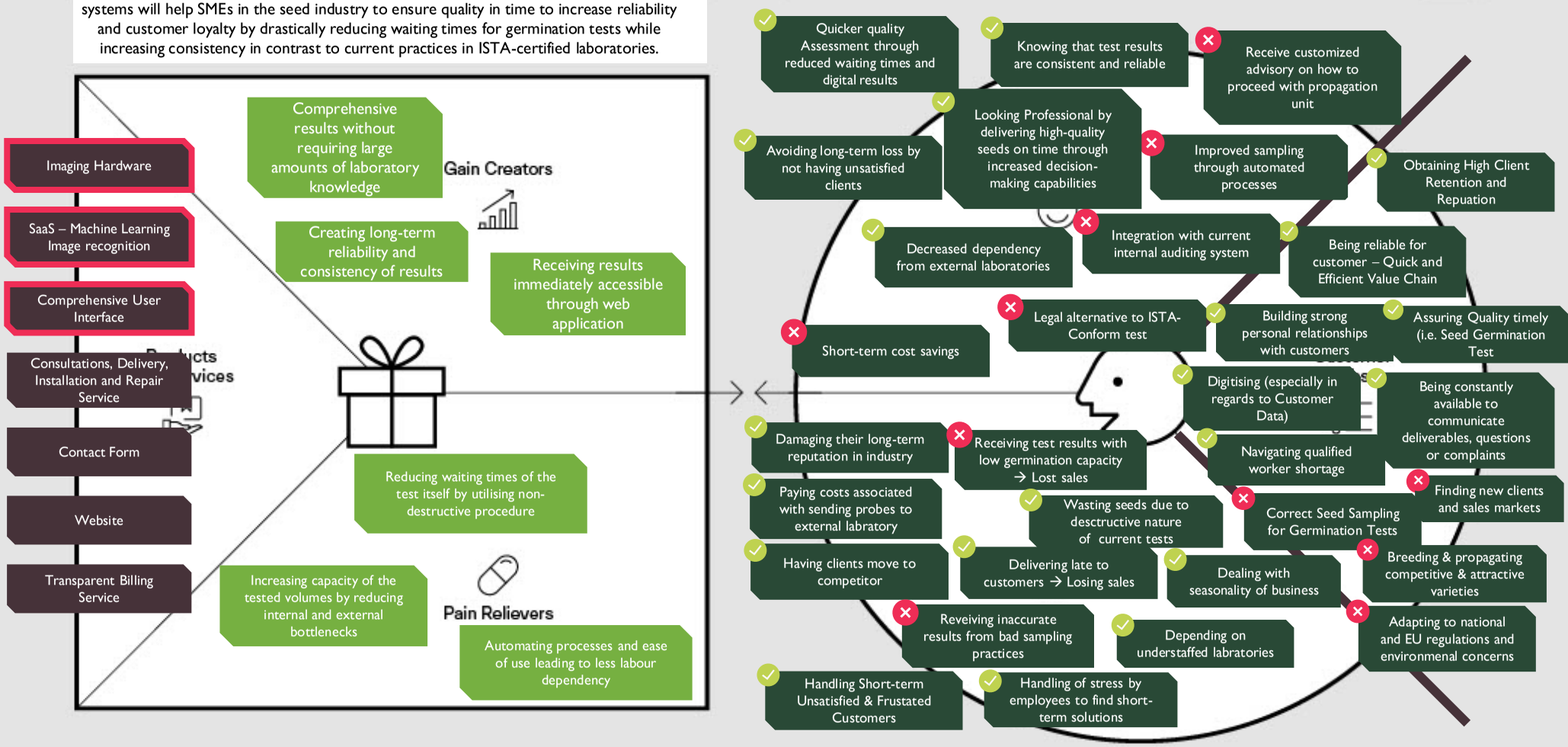
Based on our investigation into the estimated financial accounts of d2g, we conclude that our enterprise is financially feasible but will require continued monitoring of the pricing strategy and the industry to ensure a strong market entry.

5. Value Proposition Design

Value Proposition:

The imaging hardware of our d2g *Germinator* combined with machine image recognition systems will help SMEs in the seed industry to ensure quality in time to increase reliability and customer loyalty by drastically reducing waiting times for germination tests while increasing consistency in contrast to current practices in ISTA-certified laboratories.

Customer Segment: SME Seed Companies | Function of Production & Sales



Strategyzer
strategyzer.com

Sources used for this chapter:
[VP1; VP2]

✓ Addressed by d2g ✕ Unaddressed by d2g Core Product

Jobs

This next section will elaborate on customer jobs, by integrating statements from the interviews with seed industry experts. Based on these we ranked the importance. The underlying questionnaire for the semi-structured interviews can be found in the appendix.

Important

- **Obtaining High Client Retention and Reputation** – "Ultimately, we are satisfied when we have a good reputation and can do our business relatively more easily than lesser-known competitors. Customers are more likely to trust us when we say that a new variety is going into cultivation, simply because they have never actually been disappointed."
- **Being reliable for customer – Quick and Efficient Value Chain** – "Our major customers have developed different audit systems in which they ultimately evaluate variety availability, general availability, processing speed and reliability and, of course, the quality has a consistent longevity of the harvested and processed products […]"
- **Breeding & propagating competitive & attractive varieties** – "First of all, our function is that we are a vegetable seed breeder that, in addition to breeding, also produces the seeds and then supplies our customers, which are ultimately frozen and canned food producers worldwide, with varieties that meet their needs."
- **Assuring Quality timely (i.e. Seed Germination Test)** – "And [quality assurance] plays an absolutely major role, because the customers do not accept any compromises, because they have to prove it themselves. And that's why we have a basic division according to customer and country"
- **Building strong personal relationships with customers** – "Let's say the most important thing for customers is that our logistics work. Customers are informed in good time when goods are on their way." In addition, the industry is relatively small, therefore events such as trade fares are often taken as an opportunity to build strong relationship with customers.
- **Being constantly available to communicate deliverables, questions or complaints** – "Finally, we are also known for finding unconventional solutions relatively quickly. There are also a wide variety of questions, particularly with regard to customs issues, if something has to be imported to England at short notice or to other countries in which the EU is not so keen." – Highlighting the necessity of be constantly availability and flexible for customer.
- **Navigating qualified worker shortage** – Of course, this is an important aspect to every industry. However, particularly in some markets such as Germany, it appears to bind a lot of capital and time to find qualified workers. This also applies for ISTA laboratories leading to long waiting times, leading to one interviewee saying that even ISTA is asking the market for new solutions as ISTA is "reaching the limits of their capacity."
- **Correct Seed Sampling for Germination Tests** – "So, sampling for the subsequent germination analysis is also essential." This refers to the necessary sampling before the sample is tested as wrong sampling procedures can directly impact the results validity.
- **Finding new clients and sales markets** – "[T]he partners are always the same. It's not a business with a high turnover of customers or new customer business." Thus, it seems less relevant in this industry as no new players enter the market.
- **Digitising (especially in regards to Customer Data)** – "[T]he self-benefit is incredibly high because they generate a volume of data that they themselves collect for their breeding and further development of the products, which they would never have access to elsewhere and the various business units ultimately interlock." – Interview partner talking about large seed companies.
- **Adapting to national and EU regulations and environmental concerns** – Many individuals and companies in the agricultural sector are affected by climate change, environmental concerns and corresponding regulations, e.g, the usage of pesticides. The industry is trying to find solutions.

Insignificant

Addressed by d2g | Unaddressed by d2g

Products & Services

Essential

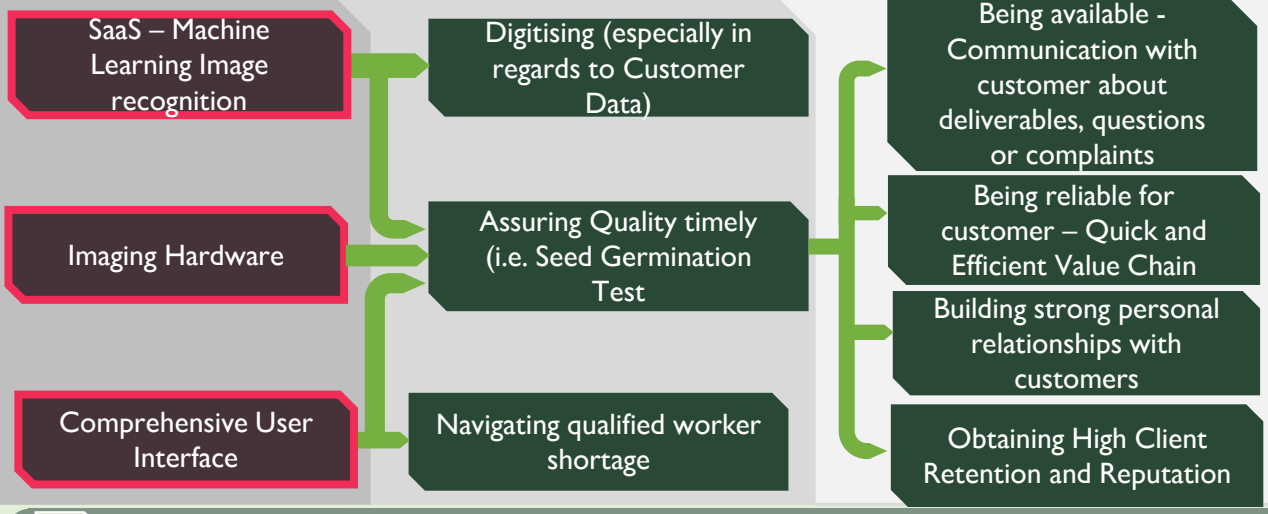
Our Products and Services are ranked based on their necessity to be included in our product.

Imaging Hardware	Imaging chamber which enables standardized imaging of seeds and forms the backbone of our service offering.
SaaS – Machine Learning Image recognition	Images are sent to server on which our machine learning (ML) algorithm is stored, which augments and processes the images to predict a germination capacity.
Comprehensive User Interface	Results are made available on necessary software which will be comprehensive and easy to use even for non-scientific staff.
Consultations, Delivery, Installation and Repair Service	Since our product is new, the customer journey needs to be closely accompanied from consultancy, purchase to problems later on.
Contact Form	Similar to our competitors, the seed industry does not require flashy websites or social media. A contact form and phone number should be sufficient
Website	A website should comprhensible visualise d2g´s product and value proposition. Its main function lies in enabling visibility and customer acquisition
Transparent Billing Service	This relates to a smooth customer journey. Our financial services are limited to ensuring customer satisfaction through quick and transparent billing.

Nice to have

Core Product

Value Proposition Fit: Jobs vs Products & Services



"This product/service leads to" / "Fulfilling this job also means"

Mapping the value proposition for the customer jobs versus our provided offering of the core product, the impact can be divided into a direct impact and indirect impact. It has to be highlighted that assuring quality quickly leads to high customer satisfaction through reliability in the short-term and reputation in the long-term. Looking at competitors, ISTA laboratories lack quick results leading to potentially unsatisfied customers due to delays if the seed company waits for results or by risking delivering inferior seeds if the company does not wait for the results. Indirect competitors lack metrics to assess germination quality and thus, are inappropriate to address many customer jobs.

Pains

Important

The following section will elaborate on the customer pains, integrating statements from the interviews with seed industry experts. Based on these, we ranked pain relievers.

Damaging their long-term reputation in industry	"It's a relatively small industry and. That's why resources are limited to make gross mistakes. […] there are two or three competitors in our market who have now built up this negative reputation. And it's very difficult to make up for that."
Having clients move to competitor	"[…]because of course the customer will not leave the fields unprocessed or uncultivated but will opt for a competitor's product. And convincing the customer the following year to drop the competitor product and reintroduce our variety is of course all the more costly."
Receiving test results with low germination capacity → Lost sales	"Our mission is clearly to make [sustainable food production] even more efficient and better for people. […]we conclude sales contracts and if the goods do not correspond to the specified values, you have to pay compensation."
Delivering late to customers → Losing sales	"[…]we are still waiting for germination results of a critical batch, thus have reduced sales by 3,000 units, […] an equivalent of €100,000"
Receiving inaccurate results from bad sampling practices	" […] in addition, because human errors also happen again and again during sampling." This customer expressed his frustrations about sampling practices talking about the effort involved in correctly taking probes. He raised suspicions, that some employees are maybe too "lazy".
Depending on understaffed laboratories	"simply because ISTA also sees that they are reaching the limits of their capacity[…] if all the testing mechanisms reach their limits, this cannot result in us restricting our food production."
Dealing with seasonality of business	"it is a seasonal business and the goods have to be with the farmer at time X in order to be sown."
Handling short-term unsatisfied & frustrated customers	"The customer is annoyed. They may reduce their orders for next year. We have to pay partial compensation in a complaint, we have to pay for return transportation."
Handling of stress by employees to find short-term solutions	"[…]we could be turning over at least €50,000 to €100,000 more […], but are foregoing this because we are still waiting for results of a critical batch
Paying costs associated with sending probes to external laboratory	"Our company has a turnover of €20 million and we spend over €180,000 a year on sampling alone. You can imagine what other companies and other institutions spend."
Wasting seeds due to destructive nature of current tests	Current tests require the germination of the seed, therefore make it unusable afterwards. Hundreds of seeds are destroyed during each batch testing.

Insignificant

Addressed by d2g | Unaddressed by d2g

Pain Relievers

The listed pain relievers elaborate how d2g will alleviate pains customers are currently facing.

Essential

Reducing waiting times of the test itself by utilising non-destructive procedure

Our machine provides timely information within minutes which is crucial in the competitive, seasonal set up of the seed breeding industry. Not having to wait for days to receive test results allows for quick decision-making and a faster distribution process to our customers' customers.

Automating processes leading to less labour dependency

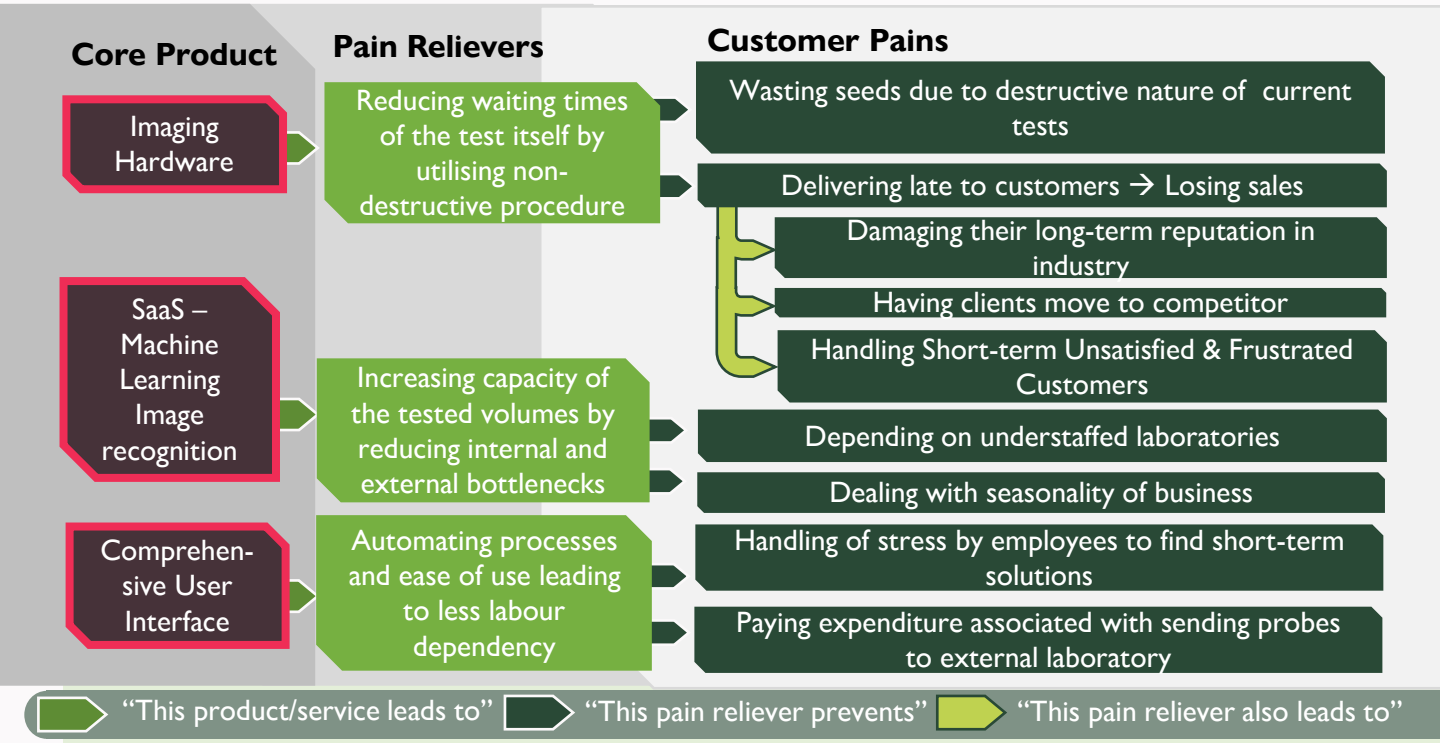
With the reduction of human errors and a standardised process for testing in mind, d2g develops machine learning algorithms with high accuracy as the key metric. We significantly reduce the manual labour needed to test germination and allow customers to fulfil other value-adding tasks instead of timely testing procedures.

Minimising dependency of external laboratories and internal laboratory spaces

Due to the elimination of two to four test runs per propagation, the dependence of smaller companies in particular on ISTA laboratories can be reduced and only require one official test for the official final sample. As the *Germinator* does not require the provision of large laboratory capacity and constant laboratory conditions, but can be set up in a small laboratory, our customers save space and resources.

Nice to have

Value Proposition Fit: How our core product addresses customer pains



"This product/service leads to" "This pain reliever prevents" "This pain reliever also leads to"

Aligning the most important pain relievers with the most important customer pain points, it is evident that the use of d2g's technology can solve both immediate and enduring customer problems. Our offering eliminates difficulties that arise from operational issues such as delivery delays, customer complaints and testing errors. Furthermore, d2g can also address strategic errors, thereby ensuring precise testing benefits the seed business and ensures customer loyalty over the long haul. Rare skilled workers are not restricted to performing test executions; they can utilise their proficiencies in other significant areas and delegate testing to automation.

Gains

Important

This next section will elaborate on customer gains, by integrating statements from the interviews with seed industry experts. Based on these we ranked the importance. The underlying questionnaire for the semi-structured interviews can be found in the appendix

✓ Avoiding long-term loss by not having unsatisfied clients	"[Having to wait for several weeks for test results] is of course unacceptable and the consequential losses are so high, because […] convincing the customer the following year to drop the competitor product and reintroduce our variety is of course all the more costly."
✓ Quicker quality Assessment through reduced waiting times and digital results	"The subject of [waiting] time [needs to be reduced]. You lose an incredible amount of time because you have to wait for processing. Sometimes you have to wait 4/5/6 days or even longer."
✓ Knowing that test results are consistent and reliable	"So the human factor, in a requirement that is as standardized and repeatable as possible, is simply always a problem. And we can already see from the difference between different laboratories and their results that it is definitely possible to incorporate a relatively wide spread."
✓ Looking Professional by delivering high-quality seeds on time through increased decision-making capabilities	Several interviews also highlighted the emotional aspect to having explain late dispatches or deliveries of poor quality to customers. One small company highlighted the necessity to be flexible for customers: "We are one of the market leaders in Europe due to the fact that we are so flexible. Our customers know that there are a few things in terms of speed and flexibility that only we can deliver."
✗ Short-term cost savings	Speaking with experts, the seed companies spends around 1 % of sales for testing alone not including the bound internal resources. Inherently, reducing this expenditure will be attractive to companies.
✓ Decreased dependency from external laboratories	"The current situation is that germination capacity tests are sometimes 3 to 4 weeks behind the results we are supposed to receive simply because people in the test laboratories fall ill with Covid, catch colds, resign, have to be retrained."
✗ Legal alternative to ISTA-Conform test	This brings home the question of a legally compliant market solution. It would be great if companies had a legal alternative in testing germination capacity other than in ISTA-certified laboratories.
✗ Improved sampling through automated processes	"[Currently] you have different sizes of batches from 500kg to 10/15/20 tons and larger and if there was/were a device that could randomize the sampling, then that would be even better […]"
✗ Integration with current internal auditing system	This topic was only mentioned briefly on the sidelines of interviews. Receiving results currently still involves significant amount of human labour to transfer formats of results to internal goods management and audit systems. Inherently, quick and easy integration of results are preferable.
✗ Receive customized advisory on how to proceed with propagation unit	"If you say, okay, there are various indications that this could be a problematic batch, then I would like to know this immediately, I would also like to know ultimately a recommendation as to whether and how the seed can then still be used […]"

Insignificant

✓ Addressed by d2g ✗ Unaddressed by d2g

Gain Creators

The Gain Creators address the outcomes and benefits they can expect from the d2g *Germinator*.

Essential

Creating long-term reliability and consistency of results

Our imaging hardware will allow our customer to have an in-house solution. This will reduce the dependency from external providers. Moreover, the design of the imaging chamber and the tray on which the seeds are placed upon will force the user to place the seeds in a certain fashion creating a standardized operating procedure that creates ease-of-use even for unexperienced users ultimately leading to reliability and consistency

Receiving results immediately accessible through web application

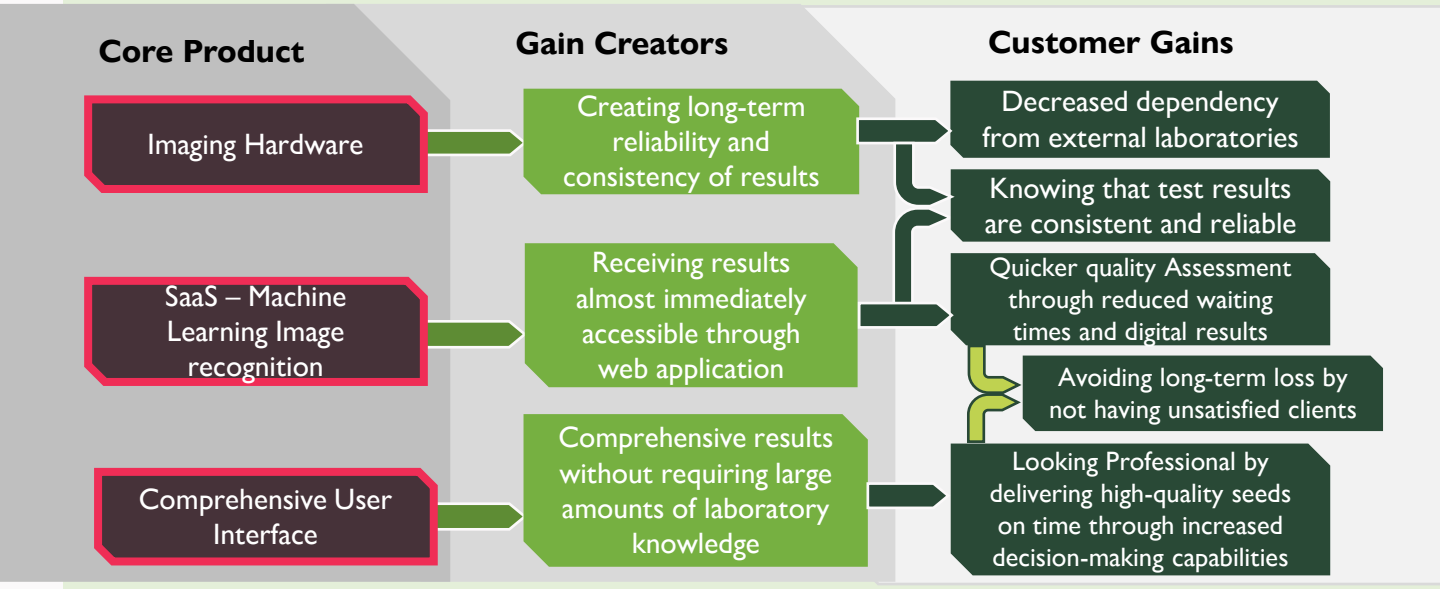
In addition, the provided ML powered image recognition system will lead to receiving results almost immediately after the imaging itself. This reduces waiting times allowing for an overall quicker quality assessment process overall. In addition, inherent to ML, the results will additionally become increasingly precise over time due to the cumulating training data.

Comprehensive results without requiring large amounts of laboratory knowledge

Lastly, the comprehensive user interface of our web application will further cement the ease of understanding the received results without being a laboratory expert. Having the results accessible almost immediately online will lead to increase decision-making capabilities and allows our customer to decide more assertively. Overall, this should lead to long-term better decision-making and thus to satisfied client´s customers which will stay loyally at our client's side.

Nice to have

Value Proposition Fit: How our core product addresses customer gains



"This product/service leads to" "This gain creator allows" "This gain also leads to"

On balance, d2g´s gain creators are focused on addressing the client´s most wanted and needed gains. Nonetheless, the interviews with clients also revealed a number of other gains. Of course, short-term cost savings are relevant also to our customer. Currently however, we cannot offer a solution that is both viable short and long-term. Other customer gains focus on the compliance, sampling, integrability and adaptability of a possible product to their own current systems and procedures. Although relevant, these issues did not appear to be the main focus of our customers. Fortunately, these gains offer a possible roadmap of how to expand the product in the future.

6. Conclusion

Conducting the interviews with seed industry experts has strengthened our belief in the value proposition originally conceived in the concept paper. Based on the results of the value proposition, we formulated a value proposition statement to guide us in the future:

The imaging hardware of our d2g Germinator combined with machine image recognition systems will help SMEs in the seed industry to ensure quality in time to increase reliability and customer loyalty by drastically reducing waiting times for germination tests while increasing consistency in contrast to current practices in ISTA-certified laboratories.

This report also elaborated on the overall feasibility of the product. Currently, we are confident that both the industry and financial feasibility are given, yet many pricing questions remain. The product feasibility has highlighted the technological complexity of the product. In turn, this is reflected in the organisational feasibility, to hire or partner up with engineering and software experts. This has to be closely considered going forward. Overall, we decided to move forward with the product. To finish this feasibility report, we would like to use one of our interviewees´ quotes to highlight the necessity for a new product for germination tests in the seed industry:

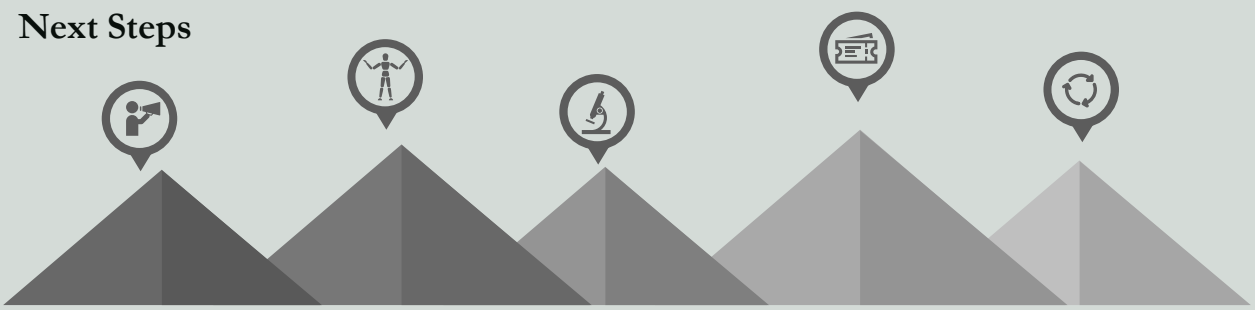
"I am surprised anyway that more hasn't happened yet [regarding seed germination tests]. It is simply an elementary point, and the seed business alone has a turnover of more than €60 billion, so it's a mystery to me that more hasn't happened yet."

Current and Future Activities

Start	due2grow *Germinator'*	✓						
Concept Paper	Conceptual Feasibility	✓						
Feasibility Report	Product Feasibility	✓	Industry Feasibility	✓	Organizational Feasibility	✓	Financial Feasibility	✓
	Customer Segmentation	✓	Value Proposition	✓	Problem-solution fit	✓		

Both the feasibility and the value proposition were assessed positively (indicated by check marks). The path to market launch is briefly outlined below. The next focus will be on creating awareness and finalising the business model to convince even the last person of d2g's innovative value proposition.

Next Steps



Investor Awareness Campaign

Beginning 2024

Creation of promotional material to create investor and customer awareness.

Business Model Fit

Spring 2024

Holistic Analysis of business organisation including resources, activities and partners to create an attractive revenue model.

Product Dev & Prototyping

Summer 2024

Production of prototype and corresponding software. Here, external support becomes necessary.

Market Entry

Early 2025

First contracts to be closed with seed customers.

Product-Market Fit

Early 2025

Close analysis whether value proposition proves as valid as imagined. Potential need for readjustment.

Competitor Product Analysis

To obtain a better understanding of the current industry landscape of germination tests, d2g undertook a thorough competitor analysis. Its result can be found below. It was filled based on interviews and extensive research. Since most competitors provide larger offerings, the competitor table focuses on a specific competitor product. As elaborated in the Concept Paper, the only direct competitor currently lies in the ISTA germination tests performed by certified laboratories. Since most of these are running at their capacities and as most of these laboratories are at least part government owned, ISTA already expressed its openness towards complimentary test procedures. Thus, these laboratories cannot be considered harsh competitors in the traditional sense. Seed-X GeNee as well as VideometerLab 4, on the other hand, are private companies offering valuable insights into what is technically possible. However, they are considered indirect competitors as they do not offer insights about germination tests and focus on different target customer.

		Direct Competitor	Indirect Competitors	
Feature	d2g *Germinator*	ISTA-Certified Germination Test [A1]	Seed-X GeNee Detect [A2]	VideometerLab 4 [A3]
Product Description	Non-destructive cloud vision-based seed germination test	Destructive seed germination test	Non-destructive seed phenotype analysis system using computer vision	Non-destructive phenotype analysis system using multispectral imaging
Target Customer / Function	• Seed Industry – Production • (Seed Customers)	• Seed Industry – Production • Seed Customers	• Scientific Research • Seed Industry - R&D	• Scientific Research • Seed Industry - R&D
Product Strengths	• Information about seed germination capacity • Quick & Non-destructive • Utilizes AI for improved results	• Information about seed germination capacity • Compliant with legally obliged germination test	• Non-destructive • Integrated hardware & software • Utilises AI for improved results • Quick (< 5 minutes)	• Non-destructive • Integrated hardware & software • Quick (< 5 minutes)
Product Weaknesses	New & unproven product	• Slow (> 5 days) • Unreliable • Destructive	• No statements regarding germination capacity • No statements regarding chemical composition of seed	• No statements regarding germination capacity • No usage of AI for improved results
Pricing	€72,000 for Hardware and €3600 mothly subscription	Circa €40 per Test (generally, pricing not easily accessible)	Not publically available,Only available after consultation	circa €60.000 for hardware (Software/Service fee N/A)
Place	Europe	Global	Global	Global
Promotion & Positioning	B2B and associated promotional channels targeting seed companies	B2B and associated promotional channels targeting firms and science institutes	B2B and associated promotional channels targeting firms and science institutes	B2B and associated promotional channels targeting firms and science institutes
People	< 10 employees	< 50 employees (in individual laboratories)	< 50 employees	< 50 employees
Headquarters	Ireland	Globally spread independent labratories	USA	Denmark

Competitor Product Analysis Table

Seed Expert Questionnaire [A4]

Customer Jobs

- What functions do you try to perform? (for example, execute specific problem, solve a specific issue, etc.) (Mission)
- What social/societal goals are you trying to accomplish? (Vision)
- What are the general key success factors of your business?
- What are the key success factors regarding seed germination tests?
  - How do you test seed germination?
  - Where do you test seed germination?
  - What is minimal desired germination capacity?
- What is an explanatory situation when seed germination tests are especially crucial?
- What is the most important aspect to the survival of your business?
- What needs to be accomplished/ Which jobs need to be completed, to make you feel satisfied?

Customer Pains

- What do you find currently too costly regarding seed propagation? (Something that requires a lot of time, costs too much money, it takes a lot of efforts, etc.)
- What are your frustrations, annoyances, or things that give them a headache regarding seed propagation?
- What are the current solutions missing that do not suit your needs regarding seed germination tests? Which features are they missing? Are there performance issues that annoy you or are their certain malfunctions?
- What are the main challenges and problems you are facing regarding seed propagation? (A lack of understanding of how things work, the difficulties with implementation, etc.)
- What negative social consequences does the customer face or fear to face (Loss of reputation, credibility, trust, social status, and so on)
- What risks do you fear? (financial, social, technical, etc.)
- How do current seed germination tests impact these main challenges, problems, negative social consequences and risks?
- What's keeping worried regarding seed propagation? What are their big issues, concerns, and worries?
- What common mistakes / labour intensive workarounds do you allow regarding seed propagation?
- What barriers keep you from implementing specific solutions to these mistakes and workarounds?

Customer Gains

- What should be saved to make you happy regarding seed germination tests? (Time, money, efforts, etc.)
- What results do you expect, and what can surpass these expectations regarding seed germination tests? What is less important?
- What do you like about current solutions? (Specific features, performance, quality, etc.)
- What would simplify the work or life of you regarding seed germination tests? (More services, lower cost, new features, etc.)
- What positive social consequences do you want to get? (Increase in reputation, credibility, trust, social status, and so on
- What are you looking for regarding seed germination tests? (A smart design, guarantees, specific features, etc.)
- What do they aspire to achieve, or what would be a big relief to you?
- How do you measure success and failure regarding seed propagation practices?
- What aspects would increase the likelihood of implementation of the specific solution? (Decrease of the price, investments, improvement of quality, productivity, etc.)

due2grow

Product

due2grow introduces a cutting-edge Seed Testing Machine, *Germinator*, designed to revolutionize the seed quality assessment process. Our machine combines state-of-the-art technology with a user-friendly interface, providing accurate and efficient results for seed germination testing.

Target Market

Our primary target market includes SME seed producers. With the increasing demand for high-quality seeds to enhance crop yield, our product caters to the needs of those seeking reliable and rapid seed quality evaluation to be able to offer their customers the highest quality seeds right on time when they need them.

Why Due2Grow?

Time Efficiency: Our *Germinator* leverages advanced automation to significantly reduce testing time. Rapid results empower users to make timely decisions, ensuring the seamless flow of seed production and distribution processes.

Competitive Price: We understand the economic challenges faced by our clients. By providing a high-quality, yet affordable solution, we enable businesses to enhance seed quality without compromising their budget.

Automation Advantage: The integration of automation not only accelerates the testing process but also minimises the need for manual labour. This not only saves time but also reduces operational costs for our clients.

Special Features

Multi-Parameter Analysis: The machine assesses seeds for germination via spectral imaging, providing a comprehensive evaluation of the seed's structure.

User-Friendly Interface: Our intuitive interface makes it easy for operators to navigate and interpret results, reducing the learning curve and minimizing errors.

Non-Destructive Testing: Our Seed Testing Machine employs advanced non-destructive testing techniques. Unlike traditional methods that may compromise seed viability, our machine allows for thorough analysis without harming the seed.

Our dynamic team of five is a unique blend of innovative minds with diverse backgrounds, bringing together a wealth of expertise. The fusion of data science, entrepreneurial spirit, and agricultural experience sets us apart. Together, our team is committed to pushing the boundaries of innovation, making seed testing smarter, and empowering seed breeders with cutting-edge technology.

Table of References

Cover Letter

Image: https://www.pexels.com/de-de/foto/person-die-eine-grune-pflanze-halt-1072824/

Agenda

Image: https://www.pexels.com/de-de/foto/leere-autobahn-mit-blick-auf-berg-unter-dunklem-himmel-1955134/

Product Feasibility

PF1: Wei, W., Zhu, W., & Lin, G. (2013). *Approaching Business Models from an Economic Perspective*. Springer Berlin Heidelberg. https://doi.org/10.1007/978-3-642-31023-2

PF2: ElMasry, G., Mandour, N., Al-Rejaie, S., Belin, E., & Rousseau, D. (2019). Recent Applications of Multispectral Imaging in Seed Phenotyping and Quality Monitoring—An Overview. *Sensors*, *19*(5), 1090. https://doi.org/10.3390/s19051090

PF3: Long, W., Jin, S., Lu, Y., Jia, L., Xu, H., & Jiang, L. (2021). A Review of Artificial Intelligence Methods for Seed Quality Inspection based on Spectral Imaging and Analysis. *Journal of Physics: Conference Series*, *1769*, 012013. https://doi.org/10.1088/1742-6596/1769/1/012013

PF4: López-Maestresalas, A., Keresztes, J. C., Goodarzi, M., Arazuri, S., Jarén, C., & Saeys, W. (2016). Non-destructive detection of blackspot in potatoes by Vis-NIR and SWIR hyperspectral imaging. *Food Control*, *70*, 229–241. https://doi.org/10.1016/j.foodcont.2016.06.001

PF5: Yang, G., Wang, Q., Liu, C., Wang, X., Fan, S., & Huang, W. (2018). Rapid and visual detection of the main chemical compositions in maize seeds based on Raman hyperspectral imaging. *Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy*, *200*, 186–194. https://doi.org/10.1016/j.saa.2018.04.026

PF6: Mankins, J. C. (n.d.). *TECHNOLOGY READINESS LEVELS*.

PF7: *Technology Readiness Levels—NASA*. (2023, September 27). https://www.nasa.gov/directorates/somd/space-communications-navigation-program/technology-readiness-levels/ [Accessed 7 Dec. 2023]

PF8: Reinecke, S., & Noll, L. J. (2023). *Aktives Preismanagement*. Springer Fachmedien Wiesbaden. https://doi.org/10.1007/978-3-658-42288-2

Table of References

Industry Feasibility

IF1: Mcdonald, M. B. (1993). The History of Seed Vigor Testing. *Journal of Seed Technology*, *17*(2), 93–100.

IF2: ISTA. (n.d.). *Ensuring Seed Quality by Uniformity In Seed Testing*. https://www.seedtest.org/api/rm/PMR344E7Y258BKQ/ista-presentation2023-english-2.pdf

IF3: Seed-X. (n.d.). *GeNee Detect. Seed-X Technologies*. Retrieved 6 December 2023, from https://www.seed-x.com/product/detect/

IF4: Videometer. (n.d.). *VideometerLab—Multispectral imaging technology*. Videometer. Retrieved 6 December 2023, from https://videometer.com/videometerlab/

IF5: Market Data Forecast. (2023, March). *Seed Testing Market Research Report*. Market Data Forecast. https://www.marketdataforecast.com/market-reports/seed-testing-market

IF6: Ragonnaud, G. (2013). *The EU seed and plant reproductive material market in perspective.* A Focus on companies and market shares. https://www.europarl.europa.eu/RegData/etudes/note/join/2013/513994/IPOL-AGRI_NT(2013)513994_EN.pdf

IF7: Mordor Intelligence. (n.d.). *Global Seed Market Size, Analysis & Industry Trends*. Retrieved 6 December 2023, from https://www.mordorintelligence.com/industry-reports/seeds-industry

IF8: OECD. (2018). *Concentration in Seed Markets: Potential Effects and Policy Responses*. OECD. https://doi.org/10.1787/9789264308367-en

IF9: Elias, S. G., Copeland, L. O., McDonald, M. B., & Baalbaki, R. Z. (2012). Why Seeds are Tested, and When. In Seed Testing: Principles and Practices (pp. 1–10). *Michigan State University Press*. http://www.jstor.org/stable/10.14321/j.ctt7zt51m.5

IF10: Porter, M. E. (2008). The five competitive forces that shape strategy. *Harvard business review*, 86(1), 78.

IF11:Oliver, E., & Shoham, J. (2019). *Analysis of Sales and Profitability Within the Seed Sector*. https://www.fao.org/3/ca6929en/ca6929en.pdf

Organisational Feasibility

OF1: Mamabolo, A., & Myres, K. (2020). A systematic literature review of skills required in the different phases of the entrepreneurial process. *Small Enterprise Research*, *27*(1), 39–63. https://doi.org/10.1080/13215906.2020.1730230

Financial Feasibility

FF1: www.enterprise-ireland.com. (n.d.). *HPSU Feasibility Study Grant | Business Support | Enterprise Ireland*. Available at: https://www.enterprise-ireland.com/en/supports/hpsu-feasibility-study-grant [Accessed 7 Dec. 2023].

FF2: www.enterprise-ireland.com. (n.d.). *Pre-Seed Start Fund | Business Support | Enterprise Ireland*. Available at: https://www.enterprise-ireland.com/en/supports/pre-seed-start-fund [Accessed 7 Dec. 2023].

FF3: ideateireland.ie. (n.d.). *Ideate Ireland - Empowering Entrepreneurs*. Available at: https://ideateireland.ie/ [Accessed 7 Dec. 2023].

FF4: www.irishseedtrade.ie. (n.d.). *The Irish Seed Trade Association*. Available at: https://www.irishseedtrade.ie/about-ista [Accessed 7 Dec. 2023].

Table of References

Value Proposition Design

VP1: Strategyzer. (n.d.). *Value Proposition Canvas – Download the Official Template*. Strategyzer. Retrieved 7 December 2023, from https://www.strategyzer.com/library/the-value-proposition-canvas

VP2: Osterwalder, A., Pigneur, Y., Bernarda, G., & Smith, A. (2014). *Value proposition design: How to create products and services customers want*. John Wiley & Sons.

Appendix

A1: ISTA. (n.d.). *Ensuring Seed Quality by Uniformity In Seed Testing*. https://www.seedtest.org/api/rm/PMR344E7Y258BKQ/ista-presentation2023-english-2.pdf

A2: Seed-X. (n.d.). *GeNee Detect. Seed-X Technologies.* Retrieved 6 December 2023, from https://www.seed-x.com/product/detect/

A3:Videometer. (n.d.). *VideometerLab—Multispectral imaging technology*. Videometer. Retrieved 6 December 2023, from https://videometer.com/videometerlab/

A4: Hygger University. (2023, November). *Questions for Value Proposition Canvas*. https://university.hygger.io/en/articles/1818952-questions-for-value-proposition-canvas