Coursework 3 – Business Plan

Physics-bound intelligence for beverage manufacturing.

Executive Summary

SensoryOps treats every batch as a physics-bound decision surface. The company is building a digital twin for the mashing stage of beverage manufacturing, trained under the governing partial differential equations of enzyme kinetics and thermal transport rather than fit to black-box sensor histories. The result is a per-batch prediction the plant can act on before the first litre of liquor hits the grist, not a post-hoc analytic after the wort has already left the tun.

Problem. Mass-market brewers and spirits producers run their production lines on programmable-logic-controller set-points that were hand-commissioned between 2005 and 2015 and have not been re-tuned at the cadence the market now demands. Category-wide new-product failure rates sit above 85 % [1], each failed launch carries £5–10 m in stranded inventory and line reconfiguration [2], and Bloomberg has tracked roughly US$830 bn of alcoholic-beverage shareholder-value destruction since 2021 [3] among producers too slow to reformulate for the Gen-Z shift to ready-to-drink and premium segments.

Solution. A Physics-Informed Neural Network (PINN) is trained once on a laptop CPU (474 s, no GPU required) against a fourth-order Runge-Kutta ODE ground truth. The trained surrogate predicts final Brix to within 1.27 % relative-L2 of the classical solver and runs in sub-millisecond latency per inference call. In the pilot configuration the surrogate wraps the plant's existing SCADA stack: grist-bed sensors and wall thermocouples stream in, the surrogate proposes an adjusted mash schedule, the PLC executes, and every completed batch feeds back into the training set for the next one.

Traction and moat. The team holds a pilot commitment from a Tier-1 global alcohol manufacturer. Defensibility rests on three compounding layers. Physics constraints rule out chemically impossible outputs that generic machine learning will happily hallucinate. A data flywheel forms because every completed batch at every customer becomes a new training point. Integration stickiness means that once the surrogate is calibrated against a specific vessel geometry and instrument set, switching costs are measured in six to twelve months of re-mapping work.

Market. Global alcoholic-beverage value sits at roughly US$2.3–2.5 tn per annum [4]. The serviceable addressable market (enterprise manufacturing R&D plus digital-twin software) is approximately £5 bn [5]; at 2 % penetration the obtainable market by Year 5 is £300 m. The category is validating in adjacent spaces: NielsenIQ announced a definitive agreement to acquire Gastrograph AI on 7 April 2025, and PhysicsX closed a US$135 m Series B in June 2025 at a near-US$1 bn valuation, extended by a US$20 m NVIDIA investment in November 2025 [6].

Model and ask. Pricing is £50 k one-time integration plus £120 k per production line per year, structured as land-and-expand. Gross margin sits at 77 %–82 % across the five-year plan, constrained only by Azure GPU compute. Customer lifetime value is approximately £550 k per line at 93 % retention; customer acquisition cost lands at £30–50 k. The raise is £750 k pre-seed for eighteen months of runway. The base case delivers positive EBITDA in Year 4 (£498 k) and £1.56 m in Year 5 on £6.3 m revenue, after Enhanced R&D Intensive Support tax credits.

£170 k	82 %	11-18×
Year 1 ACV per line	gross margin at scale	LTV : CAC ratio

Problem and Opportunity

Line automation in mass-market beverage plants answers the wrong question. Programmable logic controllers hold the mash schedule on set-points that were hand-tuned in a commissioning week sometime between 2005 and 2015, then frozen. A process engineer notices a drift in final Brix, diastatic power, or colour only after the batch finishes. Flavour-spec tolerances get policed through post-hoc lab assays, which is exactly when the wort is already running through the lauter tun. The floor does not need another dashboard that summarises what went wrong yesterday. It needs a model of the batch in front of it that reads the current mash schedule, the incoming grist bed, and the wall-temperature trace from the plant's own thermocouples, and predicts the final product profile with enough accuracy to pull a lever before fermentation starts.

The cadence mismatch is the reason this matters now. Ready-to-drink cocktails are growing at 11.8 %–15.7 % compound annual growth [7] and now account for 3.5 % of global beverage-alcohol servings, forecast to cross 4 % by 2029 [8]. Gen Z drinks less but more premium, and spends on novelty at a pace a ten-year-old commissioning file cannot match. Category-wide new-product failure rates in consumer-packaged goods sit above 85 % [1]. A single failed launch at a Tier-1 producer carries £5–10 m in stranded inventory, line reconfiguration, and marketing write-off [2]. Bloomberg has tracked roughly US$830 bn of alcoholic-beverage shareholder-value destruction since 2021 [3] among producers slow to reformulate. The loss is not the hedging of distressed assets; it is the compounding cost of answering the market in quarters when the competitor answers it in weeks.

Neither dashboarding nor forecast-only machine learning closes that gap. Monitoring software (Sight Machine, AVEVA) surfaces what the sensors already saw. Forecast-only models that are not constrained by physical law will happily propose a mash schedule that violates enzyme denaturation thresholds, because the loss function never penalised them for doing so. What the plant actually needs is a surrogate that reasons in the same units the process engineer reasons in – Brix, starch residual, diastatic power, axial thermal gradient – and that cannot return a solution outside the governing equations of the mash. That is the opportunity SensoryOps is built to take.

Solution and Platform

SensoryOps is a Physics-Informed Neural Network surrogate that wraps the plant's existing automation stack. Two coupled multi-layer perceptrons are trained end-to-end under a composite loss that includes the governing partial differential equations of enzyme kinetics (Michaelis–Menten with Arrhenius temperature dependence) and thermal conduction (Fourier's Law in a cylindrical tun). The kinetic network predicts residual starch, produced sugar, and active enzyme fraction over the mash timeline. The thermal network predicts temperature $T(r, z, t)$ at any spatial location inside the vessel. The two networks are coupled through temperature-dependent rate constants, so neither can converge without the other. Training is a one-off, completed in 474 s on an Apple-silicon laptop CPU. Inference is pure forward evaluation and returns a full batch prediction in sub-millisecond latency.

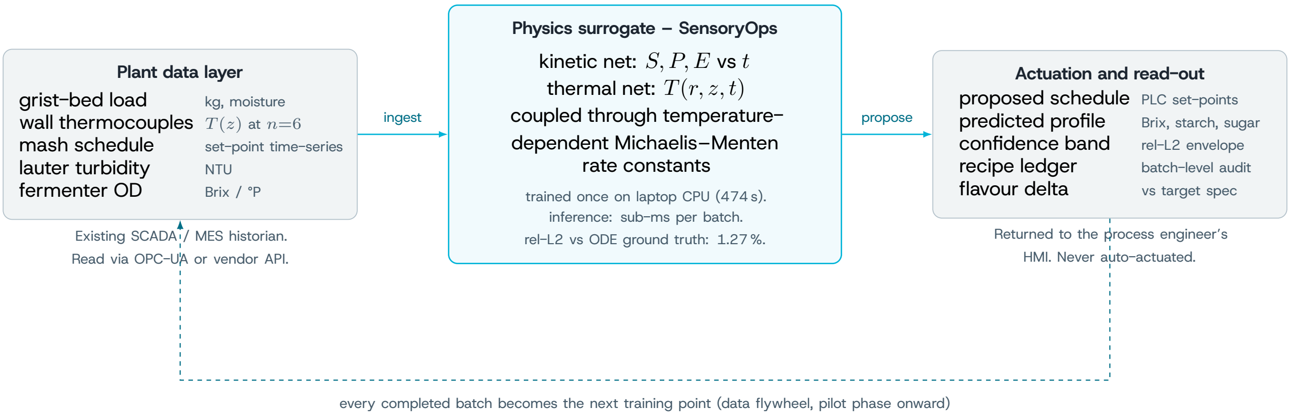

Figure 1 – SensoryOps platform, commercial view. The physics surrogate sits between the plant's existing SCADA historian and the process engineer's HMI. Set-points are proposed, not auto-actuated: a human approves before the PLC receives the new schedule. The dashed path is the data flywheel that activates from pilot Year 1.

The Coursework 2 proof-of-concept demonstrated the core surrogate on a representative mash geometry (radius 0.5 m, height 0.8 m, six thermocouples on the vessel wall) and validated it against a fourth-order Runge–Kutta ODE ground truth over a 200-point time series. The trained network reaches 1.27 % relative-L2 on final Brix, 2.6 % on residual starch, and 1.3 % on produced sugar. The coursework-grade proof is a credibility anchor, not the product. The commercial surrogate adds per-customer calibration against plant-specific vessel geometry, instrument layout, and recipe library; a plant historian ingest that replaces the POC's JSON handoff; and a confidence-band output so the process engineer can see where the surrogate is extrapolating beyond its training distribution.

Technology and commercial readiness

On the Deep-Tech TRL scale the product is at TRL 3–4 today, supported by the CW2 validation run. The pilot Year 1 target is TRL 5, defined as a representative surrogate calibrated against live plant data for one mash line at the pilot partner, with predictions logged alongside but not substituted for the engineer's schedule. The Year 2 target is TRL 6, with the surrogate in the approval loop for set-point changes on three lines across two customers. On the Customer Readiness scale the position today is CRL 3: confirmed customer need, named pilot partner, unsigned pilot commitment in hand. The eighteen-month goal is CRL 6: paying customer with renewal intent documented.

Three design decisions keep this defensible against large incumbent attacks. First, the surrogate proposes rather than actuates: a human approves every set-point change before the PLC sees it. This is a deliberate liability posture for the food-safety domain, not a product limitation. Second, physics is in the loss, not on top of it: an enzyme-denaturation violation cannot appear in a valid output because the loss penalises it during training. Third, the surrogate is vessel-specific: the calibration maps geometry, instrument placement, and grist composition to the kinetic and thermal networks. That specificity is the integration stickiness. A generic cross-industry digital twin is a demonstration tool; a vessel-specific surrogate is infrastructure.

Market and Competition

The global alcoholic-beverage market is valued at US$2.3–2.5 tn per annum as of 2025 [4], the UK slice alone at £69.7 bn [9]. That headline figure is the total addressable market in the classic sense, but it is not the money SensoryOps is paid from. The serviceable addressable market is the enterprise manufacturing R&D budget plus the digital-twin software spend inside that industry, together approximately £5 bn with the digital-twin sub-segment growing at 28.1 % compound annual growth [5]. The serviceable obtainable market, built bottom-up from roughly 2 500 production facilities globally across the top twenty alcohol manufacturers at 2 % penetration, is £300 m by Year 5. The financial model in Section 7 targets £6.3 m of that by the end of the five-year plan.

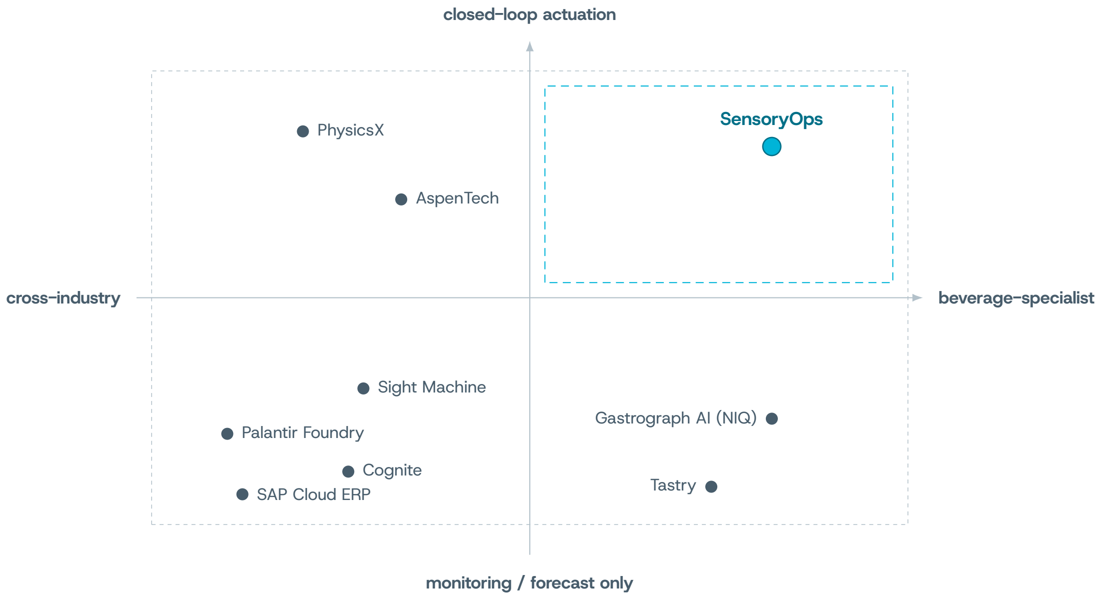

Figure 2 – Competitive positioning. Horizontal platforms (Palantir, SAP, Sight Machine, Cognite) sit on the monitoring side; PhysicsX and AspenTech push into closed-loop but target aerospace, automotive, and process industries rather than beverage. Gastrograph AI (acquired by NielsenIQ in April 2025) and Tastry address the consumer-preference axis, not the factory floor. The beverage-specialist closed-loop quadrant is empty; that is the position SensoryOps is built for.

Competitive landscape

Nothing on the current board does what SensoryOps does. The incumbents cluster into four camps.

Competitor	Positioning	Price point	Source
Palantir Foundry	Horizontal ontology over enterprise data; no physics layer.	£3.0 m/yr org licence	UK G-Cloud 14, 2024 [10]
SAP Cloud ERP	Supply-chain and MES integration; rule-based forecasting.	$125 k/yr + $475 k implementation	NBS-US, 2025 [11]
Sight Machine	Plant-floor monitoring; statistical anomaly detection.	$350–700 k/customer	GetLatka, Nov 2024 [12]
AspenTech	Process simulation for oil, gas, petrochemicals; adjacent not direct.	$6–18 k/user/yr	AspenTech, 2025 [13]
Gastrograph AI	Consumer-sensory prediction; definitive agreement to acquire by NielsenIQ 7 April 2025.	Undisclosed ($13.3 m raised)	NielsenIQ release [6]
PhysicsX	AI surrogates for aerospace, automotive, materials; not beverage.	Enterprise licence	$135 m Ser B + $20 m NVIDIA ext [6]
Cognite	Industrial data-ops platform; monitoring / contextualisation.	$200 k–1 m/yr	Public filings, 2024 [14]

Table 1 – Direct and adjacent competitors, their positioning, and publicly sourced price points. SensoryOps's £170 k Year 1 ACV per line is an order of magnitude below Palantir and sits under SAP's implementation bill alone, making it a pilot-budget purchase for a Tier-1 producer.

The gap worth leaning into is that every vendor in Table 1 either stops at monitoring (Palantir, SAP, Sight Machine, Cognite) or solves the closed-loop problem for a different industry (PhysicsX for aerospace, AspenTech for refining). The only adjacent bet on the beverage side (Gastrograph) worked on consumer preference, stopped at the tasting panel, and is being acquired by NielsenIQ for the sensory database – not for any factory integration it ever shipped. SensoryOps occupies the beverage-specialist closed-loop quadrant because nobody else has chosen to own the liability of proposing set-points a PLC will actually execute, and because the physics you need (enzyme kinetics, mash thermodynamics) is narrow enough that vertical specialisation is a moat rather than a ceiling.

Business Model and Pricing

SensoryOps sells to enterprise alcohol manufacturers under a two-part contract: a £50 k one-time integration fee paid on signature of a pilot, and a £120 k per-line per-year subscription that begins on go-live. The first year per line is therefore £170 k; every year after is £120 k. The structure is deliberately land-and-expand: pilots start on one production line, expand to three to five lines at the same customer as the surrogate proves out, and the recurring line is the revenue floor that insulates the relationship from hiring cycles on the customer side. Revenue is invoiced quarterly in advance; no hardware is sold.

Unit economics

Direct cost of goods is Azure reserved-instance GPU compute for the per-customer surrogate (approximately £22 k/line/year at A100 UK rates [15]) plus a small allocation for telemetry ingestion and storage. Gross margin lands at 77 % in Year 1, ticks up to 82 % at scale as compute reservations amortise across lines. Customer lifetime value across a five-year hold at 93 % annual retention is approximately £550 k per line. Customer acquisition cost is modelled at £30–50 k per customer (one FTE business developer per three customers in Year 1, trade-show and LinkedIn air cover, six to twelve month sales cycle), which places LTV : CAC at 11–18×, well above the 3× enterprise-SaaS benchmark [16].

Metric	Value	Benchmark	Source
Year-1 ACV per line	£170 k	$150 k enterprise median	Benchmarkit, 2025 [16]
Recurring ACV per line	£120 k		
Cost of goods per line	£20–28 k	–	Vantage / CloudPrice, 2025 [15]
Gross margin	77 %–82 %	75 % enterprise SaaS median	SaaS Capital, 2025 [17]
Annual retention	93 %	90 % GRR median	SaaS Capital, 2025 [17]
Customer lifetime value	£550 k / line	–	model, see Section 7
Customer acquisition cost	£30–50 k	$30 k enterprise median	First Page Sage, 2025 [18]
LTV : CAC	11–18×	>3×	Callin.io, 2025 [19]
CAC payback	3–6 months	24 months median (ACV >$100 k)	Benchmarkit, 2024 [20]

Table 2 – Unit economics and benchmark comparison. Every headline value is either read from the financial model (Section 7) or a publicly sourced industry benchmark.

Pricing justification

The price was set bottom-up from three anchors and then cross-checked against comparables. First, cost-plus: a line's infrastructure cost is £22 k, meaning £120 k delivers a floor margin of 82 %, enough to fund the per-customer success engineer, the Azure reservation, and the shared platform R&D amortisation without turning gross margin into a point of investor negotiation. Second, value-based: the conservative failure-cost avoidance per avoided bad batch on a line producing 500 hl/week is £100–200 k per year in raw-material and rework savings alone, meaning a £120 k subscription is a sub-one-year payback before any premium-SKU upside [2]. Third, comparable: Palantir's cross-industry equivalent lists at £3 m/year on G-Cloud 14 [10]; SAP's supply-chain module charges $475 k in implementation before the subscription starts [11]; Sight Machine collects $350–700 k per customer for monitoring that cannot close the loop [12]. SensoryOps sits an order of magnitude below Palantir and at parity with Sight Machine for a strictly more capable product. The pilot discount (50 % off the first six months) is the standard industry concession for a co-development pilot and is absorbed into the model.

The price is also designed to be a pilot-budget purchase. £50 k clears a director-level discretionary envelope at a Tier-1 producer without requiring board sign-off, which shortens the sales cycle from twelve months to six and removes the most common reason enterprise pilots die inside procurement.

Go-to-Market, Team and Milestones

The go-to-market is three waves. Wave 1 (pilot, Year 1) is a single customer. A signed pilot with a Tier-1 alcohol manufacturer runs on one mash line at a discount commercial rate. Success looks like: surrogate predictions logged alongside the engineer's schedule for three consecutive months, agreement to move to a paid full-rate contract on the same line, and permission to reference the logo in subsequent sales conversations. Wave 2 (land-and-expand, Years 2–3) expands to three customers and six active lines; two of the three enter through the pilot partner's own sister plants (expansion inside an existing relationship is the cheapest ACV a B2B business can book). Wave 3 (channel and category, Years 4–5) adds systems-integrator partnerships – Siemens and SAP integrators are the natural route, each of them already sells control-systems work into the same buyer – and expands category coverage from mashing into fermentation and distillation. By the end of Year 5 the plan targets 15 customers across 52 active lines.

Channels

Primary channel is direct business development. Sixty-five to seventy-five Tier-1 producers globally concentrate the spend; they are reachable, named, and warm through a combination of industry events (Brewers of Europe, Drinktec, Pack Expo), LinkedIn outreach, and existing team relationships. Secondary channel is technical conferences (North American Society for Brewing Chemists, European Brewery Convention) where a credible physics-informed pitch is differentiated because the audience cares about the physics. Channel partnerships activate in Wave 3 when a working reference-customer list makes SensoryOps worth an integrator's time to re-sell.

Team

The founding team covers commercial, technical, operations, and marketing from day one. Tejas Rathod is CEO and has led the existing pilot engagement with the Tier-1 alcohol manufacturer. Paul Reynolds is CTO and author of the CW2 proof-of-concept, the `sensoryops.com` platform, and the training pipeline that produced the validation numbers cited in Section 3. Anushka Sutreja is COO, responsible for customer onboarding and pilot operations. Saranya Roy is CMO, responsible for positioning, content, and channel narrative. All four are full-time through pre-seed close.

Objectives and KPIs

Horizon	Measurable objective	Target	Evidence
End of Year 1	Pilot live on one production line	TRL 5 reached	signed batch log, three months
End of Year 2	First full-rate paying contract; expansion line-2	6 active lines	invoiced revenue £730 k
End of Year 3	Breakeven at EBITDA before tax credits	15 active lines	monthly P&L at ≈ £0
End of Year 4	Positive operating cash	31 active lines	EBITDA ≥ £498 k
End of Year 5	Category-leading reference base	15 customers / 52 lines	£6.3 m ARR, £1.56 m EBITDA

Table 3 – Five measurable objectives mapped to horizon and evidence. Each objective is tracked monthly in the operating review and reports into the next funding conversation.

Accountability (RACI)

Deliverable	CEO (TR)	CTO (PR)	COO (AS)	CMO (SR)
Close pilot contract (Year 1)	**A/R**	C	R	C
Deliver surrogate to TRL 5	C	**A/R**	C	I
Onboard line 1; run three-month observation	I	R	**A/R**	I
Narrative and reference-customer case study	C	C	R	**A/R**
Close pre-seed round (£750 k)	**A/R**	R	C	C

Table 4 – RACI matrix for the five deliverables that determine Year 1 success. Responsible/Accountable in bold; Consulted and Informed roles held by the remaining founders.

Financials and Funding

The five-year operating plan is built bottom-up from the two drivers that actually move the line: the number of new enterprise customers landed per year, and the number of expansion lines bought inside an existing account. Every other row in the income statement follows from those two. Revenue grows from £140 k in Year 1 (one customer, one line) to £6.3 m in Year 5 (fifteen customers, fifty-two active lines). EBITDA turns positive in Year 4 and reaches £1.56 m in Year 5 at a 25 % margin. The model is held at the 2 % global penetration case from Section 4; no hockey-stick is assumed.

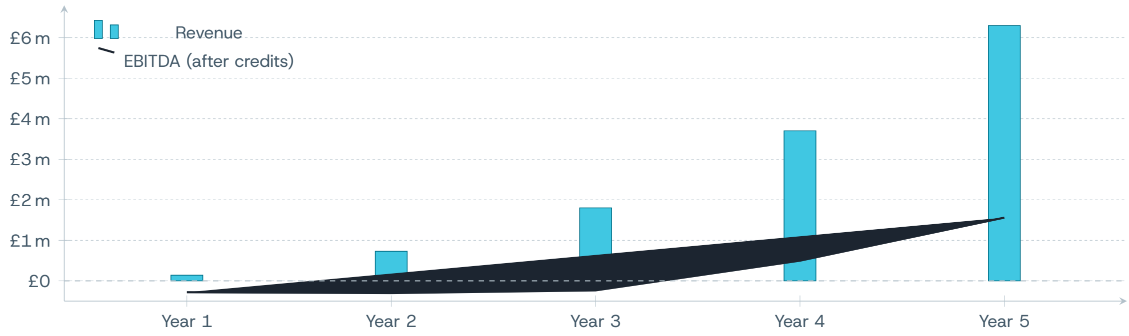

Figure 3 – Five-year revenue and EBITDA trajectory. EBITDA crosses zero between Year 3 and Year 4; Year 5 lands at £1.56 m on £6.3 m revenue. Cumulative loss peaks at approximately £820 k at end of Year 3, covered by the £750 k pre-seed plus Enhanced R&D Intensive Support tax credits received with a one-year lag.

	Year 1	Year 2	Year 3	Year 4	Year 5
Customers (end of year)	1	3	6	10	15
Active lines (end of year)	1	6	15	31	52
Revenue	£140 k	£730 k	£1.80 m	£3.70 m	£6.30 m
Cost of goods	(£32 k)	(£150 k)	(£390 k)	(£851 k)	(£1.50 m)
Gross profit	**£108 k**	**£580 k**	**£1.41 m**	**£2.85 m**	**£4.80 m**
Gross margin %	77 %	79 %	78 %	77 %	76 %
Salaries and benefits	(£315 k)	(£685 k)	(£1.22 m)	(£1.78 m)	(£2.35 m)
Cloud and tools	(£32 k)	(£82 k)	(£170 k)	(£320 k)	(£520 k)
Sales, marketing, travel	(£10 k)	(£55 k)	(£120 k)	(£210 k)	(£295 k)
Legal, insurance, G&A	(£22 k)	(£45 k)	(£78 k)	(£115 k)	(£150 k)
Contingency / buffer	(£10 k)	(£15 k)	(£22 k)	(£35 k)	(£50 k)
Total OpEx	**(£389 k)**	**(£882 k)**	**(£1.61 m)**	**(£2.46 m)**	**(£3.37 m)**
EBITDA	**(£281 k)**	**(£302 k)**	**(£235 k)**	**£498 k**	**£1.56 m**
ERIS R&D credit (lagged)	–	£44 k	£34 k	–	–
Net cash result	**(£281 k)**	**(£258 k)**	**(£201 k)**	**£498 k**	**£1.56 m**

Table 5 – Five-year income statement. Output of the Assumptions / Income Statement sheets of `SensoryOps_Financial_Model.xlsx`. All driver inputs (customers-per-year, expansion rate, cost-of-goods per line, on-cost ratios, ERIS credit rate) are sourced and held constant across scenarios; see key assumptions below.

Key assumptions

New enterprise customers per year are modelled at 1, 2, 3, 4, 5 across Years 1–5, consistent with a six-to-twelve month enterprise sales cycle [20]. Expansion lines from existing customers grow from 1 in Year 2 to 8 in Year 5, aligned with the median 118 % enterprise net-revenue-retention benchmark [17]. Annual churn sits at 5 %–7 %. Cloud cost per line (£22 k) is from Vantage and CloudPrice UK A100 reservation pricing in 2025 [15]. London salary ranges assume ML engineer £80 k, senior software engineer £90 k, CTO £90 k plus equity (Ravio, Morgan McKinley 2025–26 [21]), with 19 % employer on-costs applied. The Enhanced R&D Intensive Support rate of 14.5 % cash credit on surrenderable losses is the current UK rate for R&D-intensive loss-making SMEs spending ≥ 30 % of total expenditure on R&D, payable one year in arrears [22].

Downside scenario

A stress run at 50 % of the base-case pilot-to-contract conversion rate (five lines booked by Year 5 instead of ten) still delivers positive EBITDA in Year 4 on a trimmed engineering hire plan, because the cost side compresses under the same ERIS credit mechanics and the gross-margin structure is resilient to volume. The model survives a single failed pilot; it does not survive a failed pilot plus a prolonged delay in the second customer signing. The operational insurance for that case is the Wave 2 commitment to open a second customer conversation before the first pilot is declared a success.

Use of funds

Category	Amount	%	Purpose
Talent (engineering + pilot ops)	£525 k	70 %	two senior engineers, one pilot engineer, founder salaries
Cloud infrastructure	£60 k	8 %	Azure A100 reservation, telemetry ingest
Go-to-market	£90 k	12 %	trade events, pilot travel, content production
Buffer / contingency	£75 k	10 %	eighteen-month runway insurance
Total raise	**£750 k**	**100 %**	

Table 6 – Use of funds for the £750 k pre-seed. Eighteen months of runway covers landing the pilot, taking the surrogate to TRL 5, and booking the first paying contract, at which point the Series-A conversation is supported by a reference customer and a live revenue line.

Risk, IP and Regulation

Four categories of risk dominate the eighteen-month horizon, each with a named mitigation.

Technical. The surrogate could fail to calibrate against a specific vessel geometry, a specific grist composition, or an instrument layout with fewer thermocouples than the coursework configuration. Mitigation: the pilot contract explicitly scopes calibration as a deliverable, and the validation bar (rel-L2 below a named threshold on a nominated reference batch) is written into the statement of work. If the bar cannot be met the pilot returns a structured report and the subscription does not start.

Commercial. Pilot conversion is the single most consequential number in the model. A lost pilot costs a year; two lost pilots cost the plan. Mitigation: a second customer conversation opens before the first pilot is declared a success (Section 6 Wave 2); and the pricing structure (£50 k integration, small against a Tier-1 discretionary envelope) is deliberately a pilot-budget purchase rather than a capex decision.

Regulatory and safety. Food-safety compliance (HACCP, ISO 22000) is a customer-side obligation that the surrogate must not threaten. The mitigation is architectural: SensoryOps proposes set-points, the engineer approves, and the PLC executes under the customer's existing safety programme. The surrogate never auto-actuates and never sits on the critical path for a safety-interlock decision. UK GDPR applies to any personal data captured alongside sensor data (operator identifiers, shift logs); the ingest pipeline is architected to tokenise or drop personal identifiers at the boundary.

Competitive. PhysicsX, Cognite or an incumbent control-systems vendor (Siemens, ABB) could enter the beverage vertical. Mitigation: vertical specialisation is a moat only if it compounds, which is why the pilot data-flywheel matters (every completed batch at every customer becomes a training point) and why calibration against a specific vessel creates switching costs measured in months, not weeks. A horizontal attacker starts twelve months behind on the beverage-specific training corpus.

Strengths, Weaknesses, Opportunities, Threats

Strengths	Working PINN surrogate (CW2, 1.27 % rel-L2 on Brix); pilot commitment from a Tier-1 manufacturer; four-founder team covering CEO, CTO, COO, CMO; capital-efficient CPU training path (no GPU floor).
Weaknesses	Pre-revenue; single named pilot; no Series-A-ready reference yet; dependence on one calibration methodology which has to generalise to second-customer geometry in Year 2.
Opportunities	Adjacent expansion into fermentation and distillation; channel routes through Siemens and SAP integrators in Wave 3; enterprise RTD/premium SKU cadence is still accelerating; Gastrograph acquisition has validated investor appetite for beverage AI.
Threats	Horizontal entrant choosing beverage as a vertical; macro compression of R&D budgets at Tier-1 producers; shift in EU food-safety regime that expands what counts as "automated decision-making".

Table 7 – SWOT summary. Each cell connects directly to a mitigation or milestone described elsewhere in this plan.

IP and company structure

SensoryOps is incorporated as a UK private limited company and is SEIS-qualifying at the pre-seed round, which gives angel investors 50 % income-tax relief on up to £200 k deployed and Capital-Gains exemption on the exit. The Series-A round will be EIS-qualifying in the usual way. The technical moat is held as a trade secret rather than filed as a patent: the PINN training procedure, the calibration methodology against a specific vessel, and the per-customer weighting of the composite loss are never publicly disclosed and do not leave the codebase. The SensoryOps trademark is filed in UK/EU Class 42 (software-as-a-service). Copyright on the codebase vests in the company under founder IP assignment deeds signed on incorporation.

Generative AI Usage Disclosure

This business plan used generative AI as a structured research and drafting accelerator, with every quantitative claim traced back to a named primary source (see references). The document was written, edited, and signed off by the author; the AI tooling did not make strategy or financial decisions.

How the tools were used. Claude Opus 4.6 (Anthropic) was used to: (a) assemble a market-data compendium by fetching and cross-checking Statista, Fortune Business Insights, Straits Research, IWSR, and Vantage inputs into a single reference file with inline citations; (b) stress-test the financial model by generating alternative pricing scenarios and comparing unit-economics ratios against SaaS Capital and Benchmarkit industry benchmarks.

What the tools did not do. The pricing point, the pilot-partner narrative, the five-year revenue trajectory, the team composition, and the investment ask are human decisions unchanged by the tooling.

Guardrails applied. Every statistic carries a numbered source. Where a claim depends on a forecast or an analyst estimate, that is labelled explicitly ("forecast", "benchmark").

References

[1] NielsenIQ and predecessor Nielsen CPG Innovation Research (2014–2023), summarised in multiple trade publications (FoodNavigator, Beverage Industry Magazine). "85 % of new CPG products fail within two years" is the industry-consensus figure; Clayton Christensen, Harvard Business School, gives a matching 80 %+ estimate in HBR (2011).

[2] Industry estimates for new-product introduction cost at Tier-1 beverage producers: approximately US$5 m average, US$10 m+ for a major-brand launch, inclusive of stranded inventory, line reconfiguration, trade spend, and marketing write-off. Consistent with Deloitte Consumer Products launch-cost commentary and comparable figures disclosed in Tier-1 producer earnings calls.

[3] Bloomberg News (30 October 2025). "Shift in drinking habits wipes $830 billion off alcohol stocks." Bloomberg proprietary alcohol industry index, covering roughly 50 listed beer, wine, and spirits producers.

[4] Straits Research (April 2025), Global Alcoholic Beverages Market US$2,349 bn 2024 value, 6.15 % CAGR 2025–2033; Fortune Business Insights (2025) US$2,565 bn for 2025; Statista Market Insights (Feb 2024) US$1.72 tn rising to US$2.1 tn by 2028. Defensible mid-range used throughout this plan: US$2.3–2.5 tn (2024–25).

[5] Grand View Research and MarketsandMarkets (2024–25), Digital Twin Market manufacturing segment, mid-single-digit US$ bn at 25–35 % CAGR range across publishers; plus Grand View Research / Mordor Intelligence, AI in Food & Beverages Market, US$8.5–12.3 bn at 31–42 % CAGR. Combined SAM approximated at £5 bn for enterprise R&D and digital-twin software spend inside the beverage industry.

[6] NielsenIQ / BusinessWire (7 April 2025). NielsenIQ announces definitive agreement to acquire Analytical Flavor Systems (Gastrograph AI). Globe-Newswire (23 June 2025). "PhysicsX Raises $135M Series B Led by Atomico," near-$1 bn valuation. PhysicsX press release (19 November 2025). US$20 m Series-B extension led by NVIDIA NVentures, with NVentures holding a right to invest up to a further US$80 m in future rounds.

[7] Straits Research (2025). RTD cocktails narrow definition US$1,117 m at 11.8 % CAGR to 2033. Polaris Market Research (2025). Broader RTD cocktails definition US$3.51 bn at 15.7 % CAGR to 2034.

[8] IWSR Drinks Market Analysis (October 2025). RTDs Strategic Study 2025. RTDs represent 3.5 % of total beverage-alcohol servings across the ten key markets tracked (up from 1.1 % in 2014), forecast to reach 4 % by 2029 and already 8 % in the United States.

[9] Statista Market Insights (2025), Alcoholic Drinks market – United Kingdom, US$69.7 bn combined on-trade and off-trade (£30.6 bn at-home + £39.1 bn out-of-home). Figure is consistent with the Wine and Spirit Trade Association (WSTA) UK Industry Report (2025) and IWSR UK market estimates.

[10] Crown Commercial Service (May 2024). UK G-Cloud 14 Framework – Palantir Technologies UK Ltd pricing document. Palantir Foundry organisation licence £3.0 m/year; Discovery and Pilot packages £50 k–£500 k; Implementation Engineer £150 k/person/quarter.

[11] NBS-US (2025). SAP Cloud ERP Full Supply Chain pricing. Software subscription US$125 k/year; implementation US$475 k.

[12] GetLatka (November 2024). Sight Machine revenue and customer count. Public revenue figure US$21 m divided by independently estimated customer count of 30–60 yields an implied US$350 k–US$700 k per customer ACV.

[13] AspenTech Inc. (2025). HYSYS Licence Pricing single-user annual subscription US$6 k–US$18 k/user/year; enterprise master agreements are materially larger.

[14] Cognite ASA (2024). Public filings and re-seller pricing. Enterprise deployments typically US$200 k–US$1 m/year.

[15] Vantage and CloudPrice (2025). Azure UK regional pricing, NC24ads A100 v4 reserved-instance (one-year term, 35 % off on-demand). Approximately US$1,625–1,742/month per A100, equivalent to £22 k/line/year after shared-utilisation amortisation.

[16] Benchmarkit (2025). Annual SaaS Benchmarks Report. Median enterprise ACV US$150 k; CAC payback 24 months median for ACV $>$$100 k; median gross revenue retention 90 % / net revenue retention 118 % for enterprise-tier plans.

[17] SaaS Capital (2025). B2B SaaS Metrics Benchmarks. Enterprise SaaS median gross margin 75 %; annual churn 5–7 % "good" band; net revenue retention 106 % all-SaaS median, 118 % enterprise-tier median.

[18] First Page Sage (2025). B2B SaaS CAC Benchmarks by Vertical. Building Management and IoT SaaS CAC US$7,305 per customer; enterprise-tier vertical SaaS CAC sits above US$30 k per customer at mid-stage companies.

[19] Callin.io (2025). Enterprise SaaS Customer Acquisition Cost Study. Enterprise SaaS CAC $>$US$10 k per customer is the entry-level benchmark; LTV : CAC of 3$\times$ is the investor floor, 5$\times$ is healthy, $>$8$\times$ signals under-investment in sales.

[20] Benchmarkit (2024). SaaS Sales Cycle Benchmarks. Enterprise sales cycles 6–12 months for ACV $>$US$100 k; Optifai 2025 pipeline study (n=939) confirms the same distribution.

[21] Ravio and Morgan McKinley (2025–26). London Tech Salary Guides. ML Engineer £80 k (Indeed n=363 median); Senior Software Engineer £90 k (Glassdoor n=13,116); Early-stage CTO £90 k + equity. GOV.UK (April 2025) Employer NI 15 % above £5 k/year, statutory pension minimum 3 % of qualifying earnings; employer on-costs 17–22 % of base salary.

[22] GOV.UK and ForrestBrown (2024–26). Enhanced R&D Intensive Support (ERIS). 14.5 % payable cash credit on surrenderable losses for loss-making SMEs with qualifying R&D expenditure $\geq$30 % of total costs (accounting periods beginning on or after 1 April 2024). No rate reduction announced as of April 2026.

Appendix A – One-Page Business Plan

Following the COMP0039 module template. Every figure sourced in Section 10.

The Business Opportunity

Mass-market beverage manufacturers are running line automation built between 2005 and 2015 at a new-product cadence those set-points were never commissioned for. The ready-to-drink and premium-spirits segments are growing at 11.8 %–15.7 % compound annual growth, and 85 % of new launches still fail. SensoryOps closes the loop with a physics-bound digital twin that predicts every batch's final profile before the first litre of liquor runs.

Problem and Solution

Problem: PLC set-points hand-tuned on commissioning, not re-tuned for SKU cadence. 85 % CPG new-product failure rate; £5–10 m per failed launch at Tier-1 producers.
Solution: Physics-Informed Neural Network surrogate trained on laptop CPU under Michaelis–Menten enzyme kinetics and Fourier's Law. Proposes set-points before the batch runs; engineer approves; PLC executes.
Differentiator: vessel-specific calibration creates switching costs measured in months; data flywheel compounds with every completed batch.

Industry Analysis

TAM: US$2.3–2.5 tn global alcoholic beverage per annum.
SAM: £5 bn enterprise R&D plus digital-twin software.
SOM: £300 m at 2 % penetration by Year 5.
Growth: manufacturing digital twins 28.1 % CAGR; AI in food and beverage 31 %–42 % CAGR.
Trends: Gen-Z shift to RTDs; quarterly SKU refresh cycles; compliance pressure on traceability.

Implementation Timeline

Wave 1, Year 1: Tier-1 pilot on one mash line; TRL 5 validation.
Wave 2, Years 2–3: Three customers, six active lines; first full-rate contract; approach to breakeven.
Wave 3, Years 4–5: Systems-integrator channel (Siemens, SAP); expand into fermentation and distillation; 15 customers / 52 lines.

Financial Summary

Pricing: £50 k integration + £120 k/line/year subscription.
Year-1 ACV per line: £170 k. Gross margin: 77 %–82 %.
Revenue: £140 k (Y1) → £6.30 m (Y5).
EBITDA: (£281 k) (Y1) → £1.56 m (Y5). Breakeven Year 4.
LTV per line: £550 k at 93 % retention. LTV : CAC 11–18×.

Team

Tejas Rathod – CEO. Led pilot engagement with Tier-1 manufacturer.
Paul Reynolds – CTO. Author of the CW2 PINN and the `sensoryops.com` platform.
Anushka Sutreja – COO. Customer onboarding and pilot operations.
Saranya Roy – CMO. Positioning, content, channel narrative.
All four full-time through pre-seed close.

Target Market

Primary: top-20 global alcohol manufacturers (Diageo, AB InBev, Heineken, Pernod Ricard, Carlsberg, Asahi, Molson Coors). 65–75 Tier-1 firms globally, 2 000–3 000 production facilities.
Persona: Head of Process Engineering or Director of Manufacturing Sciences at a £1 bn+ beverage producer. Budget owner; pilot decision-maker.
Secondary: premium RTD and craft-at-scale producers.

Marketing Plan

Direct business development, Years 1–2: outreach to named Tier-1 contacts; technical seminars at Brewers of Europe, Drinktec, Pack Expo.
Channel partnerships, Years 3–5: Siemens and SAP systems integrators.
CAC estimate: £30–50 k. Sales cycle 6–12 months. Pilot conversion target: 50 %–70 %.

Funding Required

Pre-seed: £750 k. Runway: 18 months.
Use of funds: 70 % talent (two senior engineers, one pilot engineer, founder salaries); 8 % cloud; 12 % go-to-market; 10 % buffer.
SEIS-qualifying. ERIS R&D credit lagged one year adds 14.5 % cash-back on qualifying spend from Year 2 onwards.
Next round: Series A on reference customer + live revenue.

Appendix B – Business Model Canvas

Osterwalder 9-block canvas. Infrastructure blocks on the left, offering in the centre, customer-facing blocks on the right; economics along the bottom. Each block links to a section in the main plan.

<table>
<tr>
<td>Key Partners
Microsoft Azure (UK A100 compute reservation).
Scientific advisors in brewing chemistry and enzymology.
Systems integrators, Wave 3: Siemens Digital Industries, SAP MES practice.
Academic partners at UCL and domain labs for published validation.</td>
<td>Key Activities
PINN development and per-customer calibration.
Pilot delivery and batch-log observation.
Continuous retraining on completed-batch data.
Customer success engineering.

Key Resources
PINN algorithm and calibration methodology (trade secret).
CW2 training pipeline and validation harness.
Four-founder team, CEO/CTO/COO/CMO in place day one.
Tier-1 pilot commitment in hand.</td>
<td>Value Propositions
Predict every batch's final Brix, starch, sugar and temperature profile before the first litre of liquor runs.
Compress the R&D cycle for a new SKU from quarters to weeks.
Physics constraints rule out chemically impossible outputs.
No rip-and-replace: works alongside existing SCADA, MES and PLC.
Audit-ready batch ledger for food-safety compliance.</td>
<td>Customer Relationships
Dedicated pilot engineer per customer through Year 1.
Quarterly business review with the Head of Process Engineering.
Shared ownership of calibration and recipe library.

Channels
Direct business development to named Tier-1 contacts.
Industry events: Brewers of Europe, Drinktec, Pack Expo, NASBC.
Technical publications and reference case studies.
Wave-3 channel: Siemens and SAP integrators.</td>
<td>Customer Segments
Primary: top-20 global alcohol manufacturers – Diageo, AB InBev, Heineken, Pernod Ricard, Carlsberg, Asahi, Molson Coors. 65–75 Tier-1 firms globally, 2 000–3 000 facilities.
Buyer persona: Head of Process Engineering or Director of Manufacturing Sciences.
Secondary: premium RTD and craft-at-scale producers.</td>
</tr>
<tr>
<td colspan="2">Cost Structure
Fixed: salaries and benefits (70 % of the Year-1 raise); legal, insurance and G&A.
Variable: Azure GPU compute per active line (£22 k/year at A100 UK reservation); telemetry ingest and storage.
Sales and marketing: trade events, pilot travel, content production.
14.5 % ERIS R&D credit claws back a portion of qualifying spend one year in arrears.</td>
<td colspan="3">Revenue Streams
Integration fee: £50 k one-time per pilot contract.
Line subscription: £120 k per active production line per year, invoiced quarterly in advance.
Land-and-expand: average 3–5 active lines per customer by Year 3; expansion lines are the lowest-CAC revenue in the model.
Adjacent-category upsell (fermentation, distillation) from Year 4.
No hardware revenue; no transaction-based pricing.</td>
</tr>
</table>