**Wolthers Coffee QC System - Phase 2 Product Requirements Document**

**Project Context**

**Domain:** qc.wolthers.com  
**Current Phase:** Phase 2 - Core Features  
**Last Updated:** October 8, 2025

**Phase 1 Completion Summary (✅ Complete)**

The following foundational systems are fully operational:

**Authentication & User Management**

* Microsoft OAuth integration with Azure AD
* Email/password authentication via Supabase Auth
* Role-based access control (10-tier hierarchy)
* Global admin access control system with approval workflow
* Automatic profile creation for OAuth users
* QC access enablement system

**Database Architecture**

* Complete Supabase schema with 8 core tables
* Row Level Security (RLS) policies on all tables
* Helper functions for role/permission checks
* Quality templates system (3 default templates)
* Client-specific quality configurations
* Supply chain tracking fields

**UI/UX Foundation**

* Three-column layout (left sidebar, main content, right sidebar)
* Dark/Light theme system with seamless switching
* Professional header with green color scheme (#bg-green-800 light, #08231B dark)
* Collapsible navigation sidebar with submenu support
* Language selector (EN | PT | ES)
* Custom SampleTin icon component
* Monochrome lab-appropriate icon system

**Dashboard Systems**

* Main dashboard with real-time statistics
* Sample lanes with status-based color coding
* Weekly activity charts from live data
* Supply Chain Sankey visualization (exporter → importer → roaster)
* Supplier Performance Review dashboard with quarterly rankings
* Certificate Statistics dashboard with 4 chart types
* Role-based data filtering (lab-specific vs global views)

**Data Integration**

* Real Supabase queries (no mock data)
* 8 clients seeded with QC enablement
* 8 samples with full supply chain data
* Performance metrics tracking
* Supplier reviews system

**Phase 2 Objectives**

Build the core quality control workflow that enables labs to:

1. Intake and track coffee samples
2. Perform quality assessments (green bean, roast, cupping)
3. Manage quality specifications per client
4. Generate and deliver certificates
5. Manage multi-lab storage systems
6. Enable client portal access with company-specific dashboards

**Feature Requirements - Phase 2**

**1. Sample Management & Intake**

**Priority:** P1 (Critical for MVP)

**1.1 Sample Intake Form**

**User Story:** As a lab technician, I need to manually register new coffee samples so they enter our quality control pipeline.

**Automatic Tracking Number Generation**

The system must support **client-specific tracking number formats**:

**Examples:**

* **Dunkin Format:**
  + Approved: B-12345-25 (Brazil 2025), P-12345-26 (Peru 2026), G-12345-25 (Guatemala 2025)
  + Rejected: B-12345-25-R, P-12345-26-R, etc.
  + Pattern: [Country Initial]-[5 digits]-[YY] (approved) or [Country Initial]-[5 digits]-[YY]-R (rejected)
* **Blaser Format:**
  + AD-12345-YY (Alfenas Dulce quality)
  + BD-12345-YY (Blaser Dulce quality)
  + Pattern: [Quality Code]-[5 digits]-[YY]

**Country Initials:**

* B = Brazil
* P = Peru
* G = Guatemala
* E = El Salvador
* M = Mexico
* C = Colombia
* R = Rejected (suffix for rejected samples)

Each client can have a completely different numbering system configured in their profile.

**Sample Type Definitions**

* **PSS** - Pre-Shipment Sample
* **SS** - Shipment Sample (can be linked to an already approved PSS)
* **Type Sample**
* **Stocklot/Offer Sample**

**Form Fields**

**Origin Information:**

* Origin country (lab-dependent):
  + Lab in Brazil: Always Brazil
  + Lab in Guatemala: Can be El Salvador, Guatemala, Mexico, or others
  + Lab in Colombia: Colombia or others
  + Third-party labs: Access to pre-determined origins only
* Region/department (optional)
* Micro-lot/estate name (optional)
* Processing method (Natural, Washed, Honey, etc.)

**Sample Identification:**

* Sample type (PSS, SS, Type, Stocklot/Offer)
* Sample nr
* Lot nr
* Link to existing PSS (if SS)
* Wolthers Contract # (if exists and in future will be linked with Wolthers system to auto approve/reject and inform exporter/importer automatically)
* Exporter contract #
* Buyer Contract #
* Roaster Contract # if any
* ICO number if SS
* Container nr if SS

**Quantity Information:**

* Number of bags
* Weight of bags in kg:
  + **Brazil:** 59kg or 60kg bags, OR bulk (21.6 MT = 360 bags), OR 20 big bags × 1 MT = 333 × 60kg bags, OR 30kg bags
  + **Colombia/Peru:** 70kg bags, OR 30kg bags, OR bulk, OR big bags

**Client & Supply Chain:**

* Client/Final Buyer (e.g., Dunkin, Nespresso)
* Importer (if not the final client)
* Exporter/Coop
* Producer (if available)

**Technical Notes:**

* Integration with quality\_specifications to auto-assign quality requirements per client
* Automatic tracking number generation based on client-configured format
* Validation of bag weights based on origin country

**1.2 Quality Specification Assignment**

**User Story:** As a lab manager, I need to define quality parameters for each client, origin, and quality name.

**Quality Parameter Types**

**1. Cupping Score Requirements (Optional)**

Most qualities are NOT score-based, but can include:

* Minimum total cupping score (e.g., 80.0)
* Attribute-based scoring with ranges on a scale of 1-7 (increments: 0.5 or 0.25):
  + Fragrance: e.g., 4 ± 1 (range: 3-5)
  + Aroma: e.g., 5 ± 0.5 (range: 4.5-5.5)
  + Body: e.g., 4.5 ± 1
  + Sweetness: e.g., 5 ± 0.5
  + Acidity: e.g., 4 ± 1
  + Balance: e.g., 4.5 ± 0.5
  + Finish: e.g., 4 ± 1

**2. Cupping Defects**

* Maximum number of faults/taints
* Pre-defined severity levels (1-5 scale)
* No defects allowed (checkbox option)

**3. Screen Size Analysis**

* Percentage requirements per screen size (Pan, Peas 9, Peas 10, Peas 11, 12-20)
* If a quality is only for specific screens (e.g., screens 17/18), show Pan 17/18 instead of all screens
* Pass/fail thresholds

**4. Defect Classification**

The defect name and point values vary from origin to origin. Country lab manager or global lab manager must be able to add new defect names, set as primary or secondary, and configure point values for each origin.

**Brazil Example - Category 1 (Primary) Defects:**

* Full black: 1.00 point
* Full sour: 1.00 point
* Pod or Cherry: 1.00 point
* Stone/Stick: 1.00 point
* Foreign material: 1.00 point

**Brazil Example - Category 2 (Secondary) Defects:**

* Severe Broca: 0.2 point
* Minor Broca: 0.1 point
* Broken: 0.1 point
* Unripe/Immature: 0.2 point
* Shells: 0.1 point
* Husk: 0.5 point
* Partial Sour: 0.5 point
* Parchment: 0.5 point
* Partial Black: 0.5 point

**Configuration Requirements:**

* Maximum total defects (primary + secondary combined OR separate limits)
* Maximum Category 1 (primary) defects
* Maximum Category 2 (secondary) defects

**5. Origin Specifications**

* Specific origin/micro-origin requirements:
  + Single origin (e.g., "Cerrado only")
  + Blend allowed (e.g., "Cerrado and Sul de Minas blend")
  + Regional requirements (e.g., "Huila")
* Optional or required field per quality

**Configuration Interface**

Lab managers must be able to configure all these parameters per:

* Client
* Origin country
* Quality name
* Processing method (optional)

**1.3 Sample Dashboard & Tracking**

**User Story:** As any user, I need to see the current status and location of all samples I have access to.

**Requirements**

**Searchable Table/Grid View with Filters:**

* Status (Received, In Progress, Under Review, Approved, Rejected)
* Date range
* Client
* Quality
* Importer (if not the final client)
* Exporter/Coop
* Producer (if available)
* Laboratory location
* Sample type

**Sample Detail View:**

* Complete timeline (received → assessment → cupping → certificate)
* Current storage location
* Assigned quality specification
* All assessment results
* Generated certificates
* Activity log

**Bulk Actions:**

* Export to Excel
* Print labels
* Assign to cupper(s)
* Print QR Code table for cupping on a thermal printer
  + QR Code + date rcvd + Client + Quality + optional hide supplier name or show supplier name (exporter/coop/producer) + table with:
    - Add 4 rows for cupper names automatically added from assign to cuppers or leave blank if not assigned
    - Columns: Frag/Arom/Body/Acid/Swtn/Bala/Fini
    - Then at the end: Taints and Faults
    - Purpose: Cuppers can write down notes if they want, then scan QR Code and automatically get with OCR the handwritten notes, and double check if data is correct
* Move to storage/destroy after X months (each client has specific storage duration requirements to check for arrival problems)

**1.4 Storage Management System**

**Requirements:**

**Per-Lab Storage Configuration:**

Each laboratory has unique storage configurations that must be fully customizable:

**Example: Santos HQ Configuration**

* **Shelf 1:** 6 columns × 3 rows (side A)
* **Shelf 2:** 6 columns × 3 rows (side A)
* **Shelf 3:** 4 columns × 3 rows (side B)
* **Shelf 4:** 8 columns × 3 rows (side B)
* Each position can store 3 stacks × 7 tins (front and back) = 42 samples per position

**Storage Organization:**

* Shelves organized by clients (e.g., Dunkin shelf, Blaser shelf)
* Visual grid representation of storage layout
* Real-time occupancy tracking
* Client-based filtering and grouping

**Storage Duration Rules:**

* Each client has specific "must store" timer settings
* Automated alerts when samples approach storage expiration
* Bulk move to archive or destroy after configured duration

**2. Quality Assessment Pipeline**

**Priority:** P1 (Critical for MVP)

**2.1 Green Bean Analysis Interface**

**User Story:** As a lab analyst, I need to record green bean quality metrics according to the sample's quality specification.

**Requirements**

**Form Sections:**

**1. Defect Classification**

* Category 1 defects (configurable per origin)
* Category 2 defects (configurable per origin)
* Photo upload for defect examples
* Defect count per X g sample (each client has a specific need)
* Automatic equivalency calculation
* **Automatic show warning when out of spec**

**2. Screen Size Analysis**

* Screen sizes (Pan, Peas 9, Peas 10, Peas 11, 12-20)
* Percentage retained on each screen
* Automatic pass/fail against specification
* Visual bar chart of distribution (optional)
* **Automatic show warning when out of spec**

**3. Physical Properties**

* Moisture content (%) with pass/fail indicator
* Water activity (if applicable)
* Density
* Color assessment (visual scale or colorimeter)

**4. Compliance Check**

* Real-time comparison against quality specification
* Red/yellow/green indicators per parameter
* Overall pass/fail determination
* Override capability with justification field

**Technical Notes**

* Form auto-saves every 30 seconds
* Mobile/tablet optimized for lab use
* Calculator widget for defect equivalencies
* Photo compression before upload
* Integration with quality\_assessments table

**2.2 Roast Analysis Interface**

**User Story:** As a roaster, I need to record roast profile and prepare samples for cupping.

**Requirements**

**Roast Profile Fields:**

* Roast date and time
* Batch size (grams)
* Target roast level (Colorimeter or Light, Medium-Light, Medium, etc.)
* Actual roast level achieved
* Roast time (minutes:seconds) **(optional)**
* First crack time **(optional)**
* Agtron score (if available)

**Quaker Counting:**

* Count interface with increment/decrement buttons
* Photo upload of quakers **(optional)**
* Threshold indicator (typically <3 for specialty, <8 for Dunkin, or leave empty if not needed - each client has different needs)

**Sample Preparation Tracking:**

* Cooling time logged **(optional)**
* Rest time before cupping **(optional)**
* Grind size setting **(optional)**
* Number of cups prepared
* Cupping scheduled time **(optional)**

**Database Extensions Needed:**

* roast\_profiles table (or extend quality\_assessments)
* roast\_photos table

**2.3 Digital Cupping Interface (Web Version)**

**User Story:** As Grader, I need to evaluate qualities by client needs/specs, or when doing as a Q Grader, I need to evaluate coffee samples using SCA cupping protocols with real-time collaboration.

**Requirements**

**Cupping Session Setup:**

* Session creation wizard:
  + Select samples to cup (multi-select)
  + Add cuppers (minimum 2 required)
  + Set session type (Standard, Calibration, Q Grading)
  + Choose cupping form (SCA, custom)
  + Privacy settings (scores visible to all, or hidden until submit)

**Cupping Interface (per sample):**

Tabbed layout for multiple samples with attribute scoring sliders and +/- buttons based on quality setup for the client (example scale 1-7, 0.25 increments):

* Fragrance/Aroma
* Acidity
* Body
* Balance
* Sweetness
* Finish
* Uniformity (if Q Grading: 2 points per cup, max 10)
* Clean Cup (if Q Grading: 2 points per cup, max 10)
* Overall impression **(optional)**

**Defects Section:**

Each origin has different taints and levels. Lab manager/lab global manager must be able to add/edit/remove:

**Taint** (levels can vary, to be setup on backend for each taint)

* Brazil example: Harsh, Grassy/green, Woody, Past crop, Fruity, Dirty

**Faults** (levels can vary, to be setup on backend for each fault)

* Brazil example: Hard (riado), Phenol (rio), Fermented, Earthy, Moldy
* Number of cups affected

**Additional Fields:**

* Notes field (rich text)
* Descriptors tags (autocomplete common flavors)
* Automatic total score calculation if Q Grading
* Finalize cupping, which for this user turns the sample into "under review"

**Real-Time Collaboration:**

* Live score updates from other cuppers (if privacy allows)
* User average score rounded to closest increment level for each attribute if below discrepancy detection
* Discrepancy detection:
  + Flag scores > x points different from average (this needs to be setup for each client/quality too)
  + Highlight divergent attributes
  + Suggest re-cupping
* Session timer showing time elapsed
* Progress indicator (cuppers completed/pending)

**Post-Session Features:**

* Aggregate scores calculation if Q Grader
* Generate approved or rejected cert for the quality/client
* Standard deviation per attribute
* Generate cupping report PDF
* Export to Excel (if user wants to)
* Save as reference cupping

**Database Extensions Needed:**

* cupping\_sessions table (already exists)
* cupping\_scores table (already exists)
* cupping\_descriptors table
* cupping\_taints table (origin-specific)
* cupping\_faults table (origin-specific)

**3. Quality Specifications Management**

**Priority:** P1 (Critical for MVP)

**3.1 Quality Template Builder**

**User Story:** As a quality manager, I need to create reusable quality templates that define pass/fail criteria.

**Requirements**

**Template Creation Interface:**

* Template naming and description
* Origin selection (single or multi-origin)
* Processing method applicability
* Parameter configuration sections:

**1. Screen Size Requirements**

* Enable/disable specific screens (Pan, Peas 9, Peas 10, Peas 11, 12-20)
* Set minimum percentage for each screen
* Set maximum percentage for pans (fines)
* Visual representation of ideal distribution

**2. Defect Thresholds**

* Maximum total defects allowed
* Maximum Category 1 defects
* Maximum Category 2 defects
* Specific defect limits (e.g., max 1 full black)
* Configurable defect types and point values per origin

**3. Physical Properties**

* Moisture content range (e.g., 10-12%)
* Water activity maximum
* Minimum density
* Color range

**4. Cupping Requirements**

* Minimum total score (e.g., 80.0) - **OPTIONAL**
* Attribute-based ranges (1-7 scale, ± tolerance)
* Maximum allowed defects (faults/taints with severity 1-5)
* Required descriptors/flavor profile
* Discrepancy threshold per client/quality

**5. Processing Method Specifications**

* Allowed methods (Natural, Washed, Honey, etc.)
* Method-specific requirements

**Template Management:**

* Template library view (searchable, filterable)
* Clone template functionality
* Template versioning (track changes over time)
* Archive/activate templates
* Usage statistics (how many clients use this template)

**Database Extensions Needed:**

* quality\_templates table (already exists, may need fields)
* quality\_parameters table (flexible parameter definitions)
* template\_versions table
* origin\_defects table (defect types per origin)

**3.2 Client-Specific Quality Assignment**

**User Story:** As a sales manager, I need to assign quality specifications to clients for their different origins and sample types.

**Requirements**

**Client Quality Library:**

* Per-client dashboard showing all their qualities
* Group by origin, processing method, sample type
* Quick clone from template
* Bulk import from CSV/Excel

**Quality Assignment Interface:**

* Client selector (autocomplete)
* Origin specification:
  + Country (required)
  + Region/department (optional)
  + Micro-lot/estate name (optional)
* Processing method
* Sample type (PSS, SS, Type)
* Select base template or create custom
* Customize parameters from template
* Save and apply to future samples

**Quality Inheritance System:**

* Hierarchy: Global Template → Client Template → Sample-Specific
* Override capability at each level
* Visual indicator showing which level is active
* Change history tracking

**Database Extensions Needed:**

* client\_qualities table (already exists)
* quality\_overrides table

**4. Certificate Generation System**

**Priority:** P1 (Critical for MVP)

**4.1 Automated Certificate Generation**

**User Story:** As a lab manager, I need to automatically generate professional certificates when samples are approved.

**Requirements**

**Certificate Data Collection:**

* Trigger: When sample status changes to "Approved"
* Auto-populate from:
  + Sample information (exporter, buyer, roaster, origin, etc.)
  + Quality assessment results
  + Cupping session results
  + Laboratory information
  + Quality specification used

**Certificate Templates:**

* Professional PDF layout matching Wolthers branding
* Green color scheme (Dunkin-style as per requirements)
* Lab country flag branding elements (Brazil for Brazil, Peru for Peru, etc.)
* Sections:
  + **Header:** Wolthers logo, laboratory info, certificate number
  + **Sample Details:** Tracking number, exporter, buyer, roaster, origin, bags, ICO if SS, container nr if SS, etc.
  + **Quality Assessment Results:**
    - Screen size distribution (table and chart)
    - Defect analysis
    - Moisture content
    - Compliance status (Pass/Fail with checkmarks)
  + **Cupping Results:**
    - Aggregate and average scores from all cuppers to closest increment nr.
    - Flavor notes and descriptors
    - Final score if Q Grading
  + **Signatures:**
    - Digital signature of approving Q Grader
    - Lab manager signature
    - QR code for verification
  + **Footer:** Authentication code, issue date, validity period

**Certificate Metadata:**

* Unique certificate number (format specific for each client/quality spec)
* Authentication code (alphanumeric, 16 characters)
* QR code linking to verification portal
* Digital signature hash
* Version number (if regenerated)

**Generation Options:**

* Language selection (EN, PT, ES)
* Include/exclude cupping notes
* Include/exclude photos
* Watermark for draft vs final

**Database Extensions Needed:**

* certificates table (already exists)
* certificate\_signatures table
* certificate\_versions table

**4.2 Certificate Distribution System**

**User Story:** As a client, I need to receive my certificates via email and download them from the portal.

**Requirements**

**Email Delivery:**

* Automatic email upon certificate generation
* Recipients: Client contact email(s) from clients table
* Usually set to send by end of day, or client can choose to receive as it goes batch by batch
* Email template:
  + Subject: "Coffee Quality Certificate - [Tracking Number]"
  + Body: Summary of results, download link, verification instructions
  + Attachment: PDF certificate
  + Wolthers branding
* Delivery tracking (sent, opened, bounced)
* Retry logic for failed deliveries

**Download Portal:**

* Client dashboard section "My Certificates"
* Searchable table with filters:
  + Date range
  + Sample tracking number
  + Origin
  + Status (Approved, Rejected)
* Download buttons (PDF, Excel)
* Bulk download (ZIP)
* Certificate preview modal

**API Integration:**

* REST API endpoint for external systems
* Authentication via API key
* Endpoints:
  + GET /api/certificates/:id (retrieve certificate data)
  + GET /api/certificates/:id/pdf (download PDF)
  + POST /api/certificates/verify (verify authenticity)
* Rate limiting
* Webhook support for real-time notifications

**Database Extensions Needed:**

* certificate\_deliveries table (email tracking)
* api\_keys table (for external integrations)

**5. Client Portal & Dashboard**

**Priority:** P1 (Critical for MVP)

**5.1 Client-Side Dashboard**

**User Story:** As a client company, I need a dedicated portal to view all my certificates, approvals, and sample activity.

**Client Type Classification**

When creating a client/company, specify their role:

* Producer
* Exporter/Coop/Exporting Producer
* Buyer/Importer/Dealer (e.g., Blaser)
* Importer/Roaster (e.g., Nespresso, Nordquist, Löfberg)
* Final Buyer (e.g., Dunkin)

**Dashboard Features**

**Overview Section:**

* Total samples submitted
* Pending approvals
* Approved samples
* Rejected samples
* Average cupping scores (if applicable)

**Certificates & Approvals:**

* All certificates for this client
* Real-time status updates
* Download capabilities
* Filter by origin, date, status

**Supply Chain Visibility:**

* **Sankey Chart (Conditional):**
  + Full flow for buyers who purchase from roasters (e.g., Dunkin)
  + Half/one-way flow for buyers who purchase from traders (e.g., Nespresso from Exporter(s) > Blaser > Nespresso)
  + Hide for certain client types who don't need supply chain visualization

**Supplier Review:**

* Performance metrics for their suppliers/exporters
* Quality trends over time
* Rejection rates

**Real-Time Activity Feed:**

* Live updates on sample processing
* Status changes in the quality lanes
* Notifications for completed assessments

**5.2 Client User Administration**

**User Story:** As a company admin, I need to manage users from my organization.

**Requirements**

**Company Admin Panel:**

* Approve/reject user registration requests
* Email domain validation (@company.com)
* User must have same email domain as company
* Role assignment within company:
  + Admin
  + Viewer
  + Quality Manager

**Row-Level Security (RLS):**

* Clients can ONLY see their own data
* No access to:
  + Finance department data
  + Other companies' qualities and approvals
  + Sensitive laboratory operations
* Can see:
  + Their own samples across all origin labs
  + Their quality specifications
  + Real-time activity for their samples only

**Multi-Laboratory Access:**

* Clients can receive qualities from multiple origin labs
* Unified view across all labs
* Lab-specific filtering available

**Database Extensions Needed:**

* client\_users table
* client\_user\_roles table
* Enhanced RLS policies for client isolation

**6. Multi-Laboratory Coordination**

**Priority:** P2 (Important for full release)

**6.1 Laboratory Configuration System**

**User Story:** As a global admin, I need to configure new laboratories with their specific settings and capabilities.

**Requirements**

**Lab Creation Wizard:**

**Lab Identification:**

* Laboratory name
* Location (country, city, address)
* Time zone
* Contact information
* Lab code (3-letter, e.g., BRA, COL, GUA, PER)

**Lab Capabilities:**

* Services offered (green analysis, roasting, cupping, Q grading)
* Equipment available
* Staff count
* Maximum daily sample capacity

**Storage Configuration:**

* Number of shelves
* Columns per shelf
* Rows per shelf
* Total capacity (auto-calculated)
* Naming convention
* Client-based organization

**Financial Settings:**

* Default currency
* Pricing structure:
  + Each client has their own negotiation
  + Can be from 0.35 USD c/lb to 1 c/lb or USD per sample too
  + **Third party labs:** If we hire a 3rd party lab to do QC for us, they can charge us a fee like 20 USD per sample, and we can charge the final buyer a different fee for approved, or approved/rejected lots too
* Invoice numbering format
* Tax information: We will use BVI for all our own labs

**Lab Settings Dashboard:**

* Edit lab information
* View lab statistics
* Manage lab users
* Configure quality templates specific to this lab
* Set notification preferences

**Database Extensions Needed:**

* laboratories table (with all configuration fields)
* lab\_capabilities table
* lab\_pricing table

**6.2 Cross-Lab Sample Transfers**

**User Story:** As a lab manager, I need to transfer samples between laboratories for specialized testing.

**Requirements**

**Transfer Request System:**

**Initiate Transfer:**

* Select sample(s) to transfer
* Choose destination laboratory
* Select reason (specialized equipment, capacity, client preference)
* Estimated arrival date
* Special handling instructions

**Transfer Approval Workflow:**

* Destination lab receives transfer request
* Approve/reject with comments
* Update sample tracking status

**Transfer Completion:**

* Mark as shipped (with tracking number)
* Mark as received at destination
* Update storage location
* Update sample ownership

**Transfer History:**

* Timeline of all transfers
* Current location always visible
* Custody chain for audit

**Database Extensions Needed:**

* sample\_transfers table
* transfer\_history table

**7. User Experience Enhancements**

**Priority:** P2 (Important for full release)

**7.1 Notifications System**

**User Story:** As any user, I need to receive timely notifications about samples, sessions, and certificates relevant to me.

**Requirements**

**Notification Types:**

**Sample-related:**

* New sample assigned to me
* Sample ready for cupping
* Sample approaching deadline
* Storage capacity warning

**Cupping-related:**

* Invited to cupping session
* Session starting soon (15 min reminder)
* Score discrepancy detected
* Session completed

**Certificate-related:**

* Certificate generated
* Certificate delivery failed
* Certificate verification requested

**Administrative:**

* Access request pending approval
* New user joined lab
* System maintenance scheduled

**Notification Delivery:**

* In-app notification center (right sidebar)
* Email digest (daily or real-time, user preference)
* Browser push notifications (opt-in)
* Mobile notifications (Phase 3 - iPad app)

**Notification Management:**

* Mark as read/unread
* Archive notifications
* Notification preferences per type
* Do Not Disturb mode

**Database Extensions Needed:**

* notifications table
* notification\_preferences table

**7.2 Activity Feed**

**User Story:** As a user, I want to see recent activities in my laboratory to stay informed.

**Requirements**

**Activity Types Tracked:**

* Sample intake
* Quality assessments completed
* Cupping sessions
* Certificates issued
* User actions (logins, changes)
* System events

**Activity Feed Display:**

* Right sidebar component (already in layout)
* Real-time updates via Supabase subscriptions
* Time grouping (Today, Yesterday, This Week, Older)
* User avatars and action icons
* Clickable to navigate to related item
* Filter by activity type
* Search activities

**Database Extensions Needed:**

* activities table

**8. Reporting & Analytics Enhancements**

**Priority:** P2 (Important for full release)

**8.1 Sample Analytics Dashboard**

**User Story:** As a lab manager, I need detailed analytics on sample processing performance.

**Requirements**

**Metrics to Display:**

* Sample volume trends (daily, weekly, monthly)
* Average processing time per stage
* Approval vs rejection rates
* Processing bottlenecks
* Top clients by volume
* Top origins by volume
* Sample type distribution (PSS vs SS vs Type)

**Visualizations:**

* Line charts for trends over time
* Bar charts for comparisons
* Pie charts for distributions
* Funnel chart for sample pipeline stages
* Heatmap for daily/hourly activity

**Export Capabilities:**

* Download charts as PNG
* Export data to Excel
* Schedule automated reports (email)

**8.2 Quality Trends Analysis**

**User Story:** As a quality manager, I need to track quality trends across origins and suppliers.

**Requirements**

**Quality Metrics:**

* Average cupping scores by:
  + Origin country
  + Processing method
  + Supplier/exporter
  + Time period
* Defect trends over time
* Screen size consistency
* Moisture compliance rates

**Comparative Analysis:**

* Side-by-side origin comparison
* Supplier performance ranking
* Seasonal quality variations
* Year-over-year trends

**Visualizations:**

* Multi-line charts for comparisons
* Box plots for score distributions
* Radar charts for flavor profiles
* Sankey diagrams for quality flow (already implemented)

**Technical Architecture Updates**

**Database Schema Extensions Required**

**New Tables:**

1. storage\_positions - Physical storage tracking
2. storage\_history - Audit trail for sample movements
3. quality\_parameters - Flexible parameter definitions
4. template\_versions - Quality template versioning
5. quality\_overrides - Sample-specific overrides
6. roast\_profiles - Roast data (or extend quality\_assessments)
7. cupping\_descriptors - Flavor tags library
8. cupping\_taints - Origin-specific taints with levels
9. cupping\_faults - Origin-specific faults with levels
10. origin\_defects - Defect types and point values per origin
11. certificate\_signatures - Digital signature tracking
12. certificate\_deliveries - Email delivery tracking
13. certificate\_versions - Certificate regeneration history
14. api\_keys - External integration authentication
15. sample\_transfers - Cross-lab transfers
16. transfer\_history - Transfer audit trail
17. notifications - User notification queue
18. notification\_preferences - User notification settings
19. activities - Activity feed events
20. lab\_capabilities - Laboratory service offerings
21. lab\_pricing - Laboratory pricing structures
22. client\_users - Client portal users
23. client\_user\_roles - Client user permissions

**Table Updates:**

* samples: Add workflow\_stage, assigned\_to, storage\_position\_id, sample\_nr, lot\_nr, wolthers\_contract, exporter\_contract, buyer\_contract, roaster\_contract, ico\_number, container\_nr
* quality\_assessments: Add defect photos, calculator fields, flexible sample\_weight
* laboratories: Add comprehensive configuration fields, lab\_code (3-letter)
* clients: Add notification\_emails array, client\_type enum, email\_timing preference
* quality\_specifications: Add discrepancy\_threshold per client/quality

**API Routes Required**

**Sample Management:**

* POST /api/samples - Create new sample
* GET /api/samples - List samples (with filters)
* GET /api/samples/:id - Get sample details
* PATCH /api/samples/:id - Update sample
* POST /api/samples/:id/assign-storage - Assign storage location
* POST /api/samples/:id/transfer - Initiate transfer

**Quality Assessment:**

* POST /api/assessments - Create assessment
* GET /api/assessments/:id - Get assessment
* PATCH /api/assessments/:id - Update assessment
* POST /api/assessments/:id/photos - Upload photos

**Cupping:**

* POST /api/cupping/sessions - Create session
* GET /api/cupping/sessions/:id - Get session details
* POST /api/cupping/sessions/:id/scores - Submit scores
* GET /api/cupping/sessions/:id/scores - Get all scores
* PATCH /api/cupping/sessions/:id/finalize - Finalize session (change status to under review)

**Certificates:**

* POST /api/certificates/generate - Generate certificate
* GET /api/certificates/:id - Get certificate data
* GET /api/certificates/:id/pdf - Download PDF
* POST /api/certificates/:id/resend - Resend email
* POST /api/certificates/verify - Verify authenticity

**Quality Templates:**

* GET /api/quality-templates - List templates
* POST /api/quality-templates - Create template
* GET /api/quality-templates/:id - Get template
* PATCH /api/quality-templates/:id - Update template
* POST /api/quality-templates/:id/clone - Clone template

**Origin Configuration:**

* GET /api/origins/:country/defects - Get defect types for origin
* POST /api/origins/:country/defects - Add defect type
* PATCH /api/origins/:country/defects/:id - Update defect
* GET /api/origins/:country/taints - Get taints for origin
* POST /api/origins/:country/taints - Add taint
* GET /api/origins/:country/faults - Get faults for origin
* POST /api/origins/:country/faults - Add fault

**Storage:**

* GET /api/storage/:labId - Get storage grid
* POST /api/storage/:labId/assign - Assign sample to position
* GET /api/storage/:labId/available - Get available positions

**Client Portal:**

* GET /api/client/dashboard - Client dashboard data
* GET /api/client/certificates - Client certificates
* GET /api/client/samples - Client samples
* POST /api/client/users - Create client user
* PATCH /api/client/users/:id/approve - Approve client user

**Real-Time Features (Supabase Subscriptions)**

**Channels to Implement:**

1. Cupping session scores - Live updates during cupping with automatic averaging
2. Sample status changes - Dashboard updates
3. Storage occupancy - Real-time grid updates
4. Notifications - Instant notification delivery
5. Activity feed - Live activity stream
6. Client dashboard - Real-time status for clients

**Performance Considerations**

**Optimization Strategies:**

* Implement pagination for sample lists (50 per page)
* Cache quality templates in browser localStorage
* Lazy load images in sample galleries
* Debounce search inputs (300ms)
* Index database columns: sample\_tracking\_number, client\_id, status, created\_at, sample\_nr, lot\_nr, ico\_number
* Use database views for complex analytics queries
* Implement Redis caching for frequently accessed data (Phase 3)

**Security Enhancements**

**Additional Security Measures:**

* API rate limiting (100 requests/minute per user)
* Input sanitization for all form fields
* File upload validation (type, size limits)
* CSRF token protection for state-changing operations
* Audit logging for all data modifications
* Encrypted storage for sensitive client data
* Regular security audits
* Strict RLS policies for client isolation
* Email domain verification for client user registration

**Notes for Staff Review**

Please review this document and provide feedback on:

1. **Sample Intake:** Are all necessary contract/reference fields included?
2. **Quality Specifications:** Do the origin-specific defect configurations cover all needed origins?
3. **Cupping Interface:** Are the cupping attributes and defects properly structured for your workflow?
4. **Storage Management:** Will the flexible shelf configuration work for all lab locations?
5. **Certificate Generation:** Are there any additional fields or formats needed for specific clients?
6. **Client Portal:** What additional features would improve client experience?
7. **Pricing Structure:** Are the third-party lab fee examples clear and complete?
8. **OCR Functionality:** Is the QR code + handwritten notes workflow practical for your cupping process?

**Please mark up this document with any changes, additions, or clarifications needed.**