

# Restaurant CRM Platform - Comprehensive Internal Product Requirements Document (PRD)

## 1. Executive Summary

This Product Requirements Document (PRD) serves as the comprehensive internal reference for the design, development, and delivery of the Restaurant CRM Platform. It consolidates the agreed scope, features, workflows, use cases, technical architecture, timelines, and role responsibilities for the development team.

### Key Objectives:

- Eliminate manual workflows and disconnected department processes
- Provide a single, real-time source of truth for inventory, sales, and finances
- Improve profitability through AI recommendations and data-driven decisions
- Enhance accountability with role-based dashboards and monitored communications

### Success Metrics:

- Reduction in stock discrepancies by at least 80%
- 30% improvement in order-to-service time
- Daily automated P&L generation with >95% accuracy
- Zero downtime during operating hours

**Timeline Overview:** Total project duration is 5 months (22 weeks), from planning to deployment.

## 2. Project Scope

The Restaurant CRM Platform is a cloud-based, multi-tenant solution designed specifically for restaurants, integrating inventory, procurement, stock control, kitchen management, processing & preparation, point of sale (POS), accounting, AI analytics, logistics tracking, real-time notifications, and inter-department communication. The system supports role-based dashboards and access control, enabling real-time monitoring from procurement to customer service.

## 3. Problem Statement & Goals

**Problem Statement:** Restaurants face challenges with disconnected workflows, manual accounting, lack of real-time visibility across departments, inefficient cost tracking, and absence of intelligent insights for profitability optimization.

## Goals:

- Centralize and automate restaurant operations from procurement to POS
- Implement advanced analytics and accountability features
- Enable real-time tracking and validation across all departments
- Provide comprehensive financial reporting and AI-driven insights

## 4. User Personas & Detailed Use Cases

### 4.1 Super Admin (Restaurant Owner/Manager)

**Primary Responsibilities:** Overall system oversight, user management, financial monitoring, strategic decision making

#### Core Use Cases:

##### 1. Organization Management

- Sign up restaurant and create organization profile
- Configure restaurant settings, locations, and operational parameters
- Set up payment plans and billing preferences
- Upgrade or downgrade organization subscription plans

##### 2. User & Role Management

- Create user accounts for all departments (Procurement, Stock Control, Processing, Kitchen, Customer Service)
- Assign specific roles and permissions to users
- Modify user permissions and department assignments
- Suspend, reactivate, or delete user accounts
- Monitor user activity and login patterns

##### 3. System Monitoring & Oversight

- View real-time dashboard showing all departmental activities
- Monitor cross-departmental workflow progress
- Track order fulfillment from procurement to customer service
- Receive alerts for critical issues or approval requirements

##### 4. Approval Workflows

- Approve or reject procurement orders above defined thresholds
- Review and approve budget allocations for departments
- Authorize special transactions or exceptions
- Approve menu changes and pricing updates

##### 5. Financial Management

- Access complete accounting module with full permissions
- Review daily, weekly, and monthly P&L statements
- Monitor cost ratios, profit margins, and financial KPIs

- Generate and export financial reports
- Set financial alerts and thresholds

#### **6. AI Analytics Access**

- Access all AI-powered insights and recommendations
- Configure AI parameters and thresholds
- Review demand forecasting and inventory optimization suggestions
- Implement AI-recommended pricing and menu optimizations

#### **7. Communication Oversight**

- Monitor inter-departmental chat communications
- Access general chat channels across all departments
- Send system-wide announcements and notifications
- Review communication audit logs

#### **8. Reporting & Analytics**

- Generate custom reports across all modules
- Schedule automated report deliveries
- Access real-time business intelligence dashboards
- Export data for external analysis

## **4.2 Procurement Department**

**Primary Responsibilities:** Purchase planning, supplier management, cost optimization, inventory procurement

**Core Use Cases:**

#### **1. Purchase Order Management**

- Create detailed purchase orders with item specifications
- Submit purchase orders for Super Admin approval (if above threshold)
- Modify or cancel pending purchase orders
- Track purchase order status through approval workflow

#### **2. Procurement Execution**

- Execute approved purchase orders with suppliers
- Record actual purchase costs and variations from estimates
- Upload purchase receipts and documentation
- Track delivery schedules and supplier performance

#### **3. Stock Transfer Management**

- Transfer purchased items to Stock Control department
- Create transfer documentation with item details, quantities, and costs
- Await validation confirmation from Stock Control
- Handle transfer discrepancies and corrections

#### **4. Inventory Requests Processing**

- Receive item requests from Stock Control department
- Evaluate request urgency and availability
- Plan procurement schedules based on stock requests
- Communicate delivery timelines to requesting departments

#### 5. **Supplier Management**

- Maintain supplier database with contact information and terms
- Evaluate supplier performance and pricing
- Negotiate contracts and pricing agreements
- Manage supplier payment terms and credit arrangements

#### 6. **Budget & Cost Management**

- Monitor procurement budgets and spending patterns
- Track cost variances and price fluctuations
- Generate procurement cost reports
- Identify cost-saving opportunities and bulk purchase options

#### 7. **Quality Assurance**

- Define quality standards for procured items
- Handle quality issues and supplier complaints
- Maintain quality audit trails for food safety compliance
- Coordinate with Stock Control on quality validation

### 4.3 Stock Control Department

**Primary Responsibilities:** Inventory validation, stock management, quality control, inter-department transfers

#### **Core Use Cases:**

##### 1. **Procurement Validation**

- Receive transfer notifications from Procurement
- Physically validate received items against transfer documentation
- Check quantities, quality, and specifications
- Approve or reject received items with detailed notes
- Report discrepancies to Procurement and Super Admin

##### 2. **Inventory Management**

- Maintain real-time inventory levels across all items
- Monitor stock levels against minimum and maximum thresholds
- Track item expiry dates and manage FIFO (First In, First Out) rotation
- Conduct regular stock audits and cycle counts
- Manage stock locations and storage optimization

##### 3. **Request Management to Procurement**

- Identify low stock levels and create replenishment requests
- Submit urgent procurement requests for critical items

- Specify quality requirements and preferred suppliers
- Track request status and follow up on delivery schedules
- 4. Processing Department Transfers**
  - Receive item requests from Processing Department
  - Validate request quantities against current inventory
  - Prepare items for transfer with proper documentation
  - Transfer approved items to Processing Department
  - Await validation confirmation from Processing Department
- 5. Stock Analysis & Reporting**
  - Generate inventory reports showing stock levels, movements, and valuations
  - Analyze stock turnover rates and identify slow-moving items
  - Report on waste, spoilage, and expiry-related losses
  - Provide inventory insights for menu planning and procurement optimization
- 6. Quality Control**
  - Inspect incoming items for quality, freshness, and compliance
  - Maintain quality standards and rejection criteria
  - Document quality issues and coordinate with suppliers
  - Ensure food safety compliance and storage conditions
- 7. Emergency Stock Management**
  - Handle urgent stock requests from all departments
  - Manage emergency procurement and expedited deliveries
  - Coordinate with Procurement for critical stock shortages
  - Maintain safety stock levels for essential items

## **4.4 Processing Department**

**Primary Responsibilities:** Recipe management, ingredient preparation, yield calculation, kitchen coordination

### **Core Use Cases:**

- 1. Stock Control Integration**
  - Request specific ingredients from Stock Control based on production schedules
  - Validate received items against request specifications
  - Confirm quantities and quality of received ingredients
  - Report discrepancies and coordinate corrections with Stock Control
- 2. Recipe Management & AI Integration**
  - Access AI module to calculate optimal raw material quantities
  - Input desired output quantities and receive ingredient calculations
  - Optimize recipes based on available ingredients and costs

- Update recipe specifications based on AI recommendations and yield analysis

### 3. **Production Planning**

- Create production schedules based on kitchen requirements and customer demand
- Plan ingredient preparation sequences and timing
- Coordinate with Kitchen department on production priorities
- Manage multiple recipe preparations simultaneously

### 4. **AI-Powered Yield Calculation**

- Use AI engine to calculate precise ingredient quantities for specific food items
- Optimize ingredient usage to minimize waste and maximize yield
- Predict output quantities based on input ingredients
- Adjust recipes for seasonal availability and cost variations

### 5. **Kitchen Transfers**

- Prepare processed ingredients for Kitchen department
- Create transfer documentation with recipe specifications and quantities
- Transfer prepared items to Kitchen with proper timing coordination
- Await validation from Kitchen department on received items

### 6. **Quality Control & Standardization**

- Maintain consistent preparation standards and techniques
- Document preparation procedures and best practices
- Monitor preparation quality and consistency
- Train staff on standardized preparation methods

### 7. **Waste Management & Optimization**

- Track preparation waste and identify optimization opportunities
- Monitor ingredient utilization rates and efficiency
- Report on preparation yields and cost efficiency
- Implement waste reduction strategies

### 8. **Production Reporting**

- Generate reports on production volumes and efficiency
- Track ingredient consumption vs. output ratios
- Monitor preparation times and productivity metrics
- Provide cost analysis for prepared items

## **4.5 Kitchen Department**

**Primary Responsibilities:** Food preparation, cooking operations, order fulfillment, real-time status updates

**Core Use Cases:**

## **1. Processing Department Integration**

- Receive processed ingredients from Processing Department
- Validate received items against kitchen requirements
- Confirm quantities, quality, and preparation standards
- Request additional ingredients or corrections as needed

## **2. Order Management**

- Receive customer orders from POS/Customer Service
- Prioritize orders based on preparation time and customer requirements
- Track order status through cooking stages
- Coordinate with Customer Service on order timing and special requests

## **3. Real-time Kitchen Activity Tracking**

- Update cooking status in real-time using mobile interface
- Track individual dish progress (preparation, cooking, plating)
- Monitor cooking equipment status and availability
- Update 3D visualization system with current kitchen activities

## **4. 3D Animation Integration**

- Interface with 3D visualization system for real-time activity display
- Update cooking stations, equipment usage, and staff activities
- Provide visual feedback for management monitoring
- Display kitchen workflow and bottleneck identification

## **5. Customer Service Coordination**

- Notify Customer Service when orders are ready for pickup/delivery
- Transfer completed orders to Customer Service with proper documentation
- Handle special customer requests and dietary requirements
- Coordinate on order modifications and cancellations

## **6. Quality Control**

- Maintain food quality standards and presentation
- Monitor cooking temperatures and food safety protocols
- Implement quality control checklists for each dish
- Handle customer feedback on food quality

## **7. Equipment & Resource Management**

- Monitor kitchen equipment status and maintenance needs
- Optimize cooking schedules based on equipment availability
- Manage kitchen staff assignments and workflow
- Report equipment issues and maintenance requirements

## **8. Kitchen Analytics**

- Track cooking times and efficiency metrics
- Monitor ingredient usage during cooking process
- Analyze kitchen productivity and bottleneck identification
- Generate reports on kitchen performance and optimization opportunities

## 4.6 Customer Service/POS Department

**Primary Responsibilities:** Order taking, payment processing, customer interaction, service coordination

### Core Use Cases:

#### 1. Order Management

- Take customer orders through POS interface
- Modify orders based on availability and customer preferences
- Track order status from kitchen through completion
- Handle order cancellations and modifications

#### 2. Kitchen Coordination

- Request orders from Kitchen department based on customer needs
- Receive notifications when orders are ready
- Validate completed orders against customer requirements
- Coordinate on special requests and dietary restrictions

#### 3. Payment Processing

- Process customer payments through integrated payment systems
- Handle cash, card, and digital payment methods
- Generate automatic updates to restaurant accounting system
- Manage payment discrepancies and refunds

#### 4. Receipt & Documentation

- Generate detailed receipts with itemized costs and taxes
- Provide digital receipt options (email, SMS)
- Maintain transaction records and audit trails
- Handle receipt reprints and transaction inquiries

#### 5. Full POS Integration

- Access complete point-of-sale functionality
- Manage menu items, pricing, and promotions
- Handle table management and reservation systems
- Process delivery and takeout orders

#### 6. Customer Relationship Management

- Maintain customer profiles and preferences
- Handle customer feedback and complaints
- Manage loyalty programs and customer rewards
- Track customer order history and preferences

#### 7. Inventory Integration

- Automatically update inventory levels based on sales
- Receive notifications about out-of-stock items
- Coordinate with Stock Control on item availability



- Handle menu item substitutions based on availability
- 8. Sales Reporting**

- Generate sales reports by item, time period, and staff
- Track daily revenue and transaction volumes
- Analyze customer ordering patterns and preferences
- Provide sales insights for menu optimization

## **4.7 Accounting Module (Super Admin Access Only)**

**Primary Responsibilities:** Financial tracking, cost analysis, profitability optimization, compliance reporting

**Core Use Cases:**

**1. Comprehensive Cost Analysis**

- Calculate and monitor Food Cost Ratio across all menu items
- Track Average Food Cost Ratio trends over time
- Determine Cost Per Unit for all inventory items
- Monitor Procurement Cost Percentage Increase patterns

**2. Advanced Stock & Valuation Reporting**

- Generate Stock Valuation Reports with real-time pricing
- Create Stock Usage Reports showing consumption patterns
- Maintain Open Receipts Report for pending transactions
- Produce Task Checklist Reports for operational compliance

**3. Profitability & Menu Analysis**

- Calculate Gross Selling Price and Net Selling Price for all items
- Determine Percentage Menu Mix and Average Menu Mix performance
- Analyze Gross Profit and Net Profit margins by item and category
- Implement Gross Profit Categorization (High/Medium/Low)
- Execute Menu Mix Categorization for performance optimization

**4. Strategic Product Classification**

- Implement Product Categorization using BCG Matrix methodology:
  - **Star Products:** High profitability, high popularity
  - **Cash Cow Products:** High profitability, stable demand
  - **Question Mark Products:** Uncertain profitability, variable demand
  - **Dog Products:** Low profitability, low popularity

**5. Wastage & Loss Management**

- Conduct comprehensive Wastage Analysis across all departments
- Track spoilage, expiry, and operational waste
- Identify waste reduction opportunities
- Calculate financial impact of waste on profitability

## 6. Financial Reporting & Visualization

- Generate daily, weekly, and monthly P&L statements
- Create visual dashboards with charts and graphs for all financial metrics
- Provide trend analysis and comparative reporting
- Export reports in multiple formats (PDF, Excel, CSV)

## 7. Real-time Financial Monitoring

- Track real-time revenue and expense flows
- Monitor cash flow and payment processing
- Maintain automated bookkeeping with transaction categorization
- Provide instant financial alerts for threshold breaches

## 4.8 Reporting Engine

**Primary Responsibilities:** Automated reporting, data distribution, performance monitoring, compliance documentation

### Core Use Cases:

#### 1. Automated Report Scheduling

- Configure daily, weekly, and monthly automated reports
- Customize report frequency based on Super Admin preferences
- Set up conditional reporting based on performance thresholds
- Manage report distribution lists and delivery methods

#### 2. Department-Specific Reporting

- Generate specialized reports for each department's KPIs
- Track department performance metrics and productivity
- Monitor inter-departmental workflow efficiency
- Provide department-specific analytics and insights

#### 3. Financial Reporting Automation

- Deliver automated P&L statements and financial summaries
- Generate cost analysis reports and variance analyses
- Provide inventory valuation and usage reports
- Create cash flow and payment processing summaries

#### 4. Operational Performance Reports

- Track order fulfillment times and customer satisfaction metrics
- Monitor inventory turnover and stock efficiency
- Report on waste levels and cost optimization opportunities
- Analyze kitchen productivity and service quality metrics

#### 5. Compliance & Audit Reporting

- Generate compliance reports for food safety and regulatory requirements
- Create audit trails for financial transactions and inventory movements

- Produce documentation for tax reporting and business analysis
- Maintain historical reporting for trend analysis and business planning

## 5. Functional Requirements

### 5.1 Core Features

#### Real-Time Workflow Tracking:

- End-to-end tracking from procurement → stock control → processing/preparation → kitchen → POS
- Department validation and approval system with audit trails
- Real-time status updates across all workflow stages
- Exception handling for workflow disruptions and delays

#### Accounting Module (18 Key Capabilities):

1. Food Cost Ratio calculation and monitoring
2. Average Food Cost Ratio trend analysis
3. Cost Per Unit determination for all items
4. Procurement Cost Percentage Increase tracking
5. Comprehensive Stock Valuation Reports
6. Detailed Stock Usage Reports
7. Open Receipts Report management
8. Task Checklist Report generation
9. Advanced Wastage Analysis
10. Gross Selling Price calculation
11. Net Selling Price determination
12. Percentage Menu Mix analysis
13. Average Menu Mix performance tracking
14. Gross Profit calculation and categorization
15. Net Profit analysis and optimization
16. Gross Profit Categorization (High/Medium/Low)
17. Menu Mix Categorization for performance optimization
18. Product Categorization using BCG Matrix (Star, Cash Cow, Question Mark, Dog)

#### AI Analytics:

- Cost and profit optimization recommendations
- Demand forecasting based on historical data and trends
- Menu profitability analysis with pricing suggestions
- Dynamic pricing recommendations based on market conditions
- Recipe-to-output yield estimation and optimization
- Waste reduction insights and prevention strategies

#### Point of Sale (POS):

- Mobile-first interface with responsive design

- Real-time order processing and kitchen integration
- Automatic stock level adjustments upon sale
- Complete synchronization with accounting module
- Multi-payment method support (cash, card, digital)
- Receipt generation and customer management

### **3D Kitchen Visualization:**

- Real-time animated 3D interface showing kitchen activities
- Visual representation of cooking, preparation, and equipment status
- Management oversight capabilities with live monitoring
- Integration with kitchen staff updates and status changes

### **Processing & Preparation Module:**

- Recipe management with AI-powered quantity calculation
- Ingredient preparation tracking and quality control
- Kitchen coordination and readiness status management
- Yield optimization and waste reduction features

### **Logistics Tracking:**

- Order completion to delivery tracking
- Rider handoff coordination for online orders
- Delivery time monitoring with performance analytics
- Customer satisfaction tracking for delivery services

### **Real-Time Notifications:**

- Multi-channel alert system (push, SMS, email)
- Department-specific notification preferences
- Critical alert escalation procedures
- Notification history and acknowledgment tracking

### **Role-Based Access Control:**

- Hierarchical permission system with granular controls
- Department-specific dashboard customization
- User activity monitoring and audit trails
- Secure authentication with session management

### **Internal Communication:**

- Monitored department-to-department messaging
- Admin oversight of all communication channels
- Message history and search capabilities
- File and media sharing within secure channels

## **5.2 Integration Requirements**

### **Payment Gateway Integration:**

- Multiple payment processor support (Stripe, PayPal, local processors)
- PCI-DSS compliance for secure payment processing
- Recurring payment handling for subscription services
- Refund and chargeback management

### **Communication Service Integration:**

- SMS gateway integration (Twilio, local providers)
- Email service integration (SendGrid, AWS SES)
- Push notification services (Firebase Cloud Messaging, Apple Push Notifications)
- WhatsApp Business API integration for customer communication

### **Cloud Storage Integration:**

- Document storage for receipts, invoices, and reports
- Image storage for inventory items and food photography
- Backup storage for data redundancy and disaster recovery
- Content delivery network (CDN) for optimal performance

### **Third-Party API Integration:**

- Accounting software integration (QuickBooks, Xero)
- Inventory management system integration
- Supplier API integration for automated ordering
- Delivery platform integration (Uber Eats, Jumia Food)

## **5.3 Data Requirements**

### **Real-Time Data Synchronization:**

- Cross-departmental data consistency
- Immediate updates across all connected systems
- Conflict resolution for simultaneous data modifications
- Data integrity maintenance across all operations

### **Financial Data Aggregation:**

- Automated P&L statement generation
- Real-time cost tracking and analysis
- Revenue recognition and reporting
- Tax calculation and compliance reporting

### **Analytics Data Processing:**

- Historical data analysis for trend identification
- Predictive analytics for demand forecasting
- Performance metrics calculation and reporting
- Business intelligence data warehouse maintenance

## 6. Non-Functional Requirements

### Performance Requirements:

- API response time: <200ms for standard operations
- UI update latency: <1 second for real-time updates
- Database query performance: <100ms for standard queries
- File upload processing: <5 seconds for standard document sizes

### Scalability Requirements:

- Support for 100+ concurrent users per restaurant
- Multi-tenant architecture supporting 1000+ restaurants
- Horizontal scaling capabilities for peak load handling
- Auto-scaling infrastructure for demand fluctuations

### Security Requirements:

- JWT authentication with secure token management
- Role-based access control with granular permissions
- Data encryption in transit (TLS 1.3) and at rest (AES-256)
- Regular security audits and vulnerability assessments
- GDPR and local data protection compliance

### Reliability Requirements:

- 99.9% uptime availability during operating hours
- Automated backup and disaster recovery procedures
- Redundant infrastructure with failover capabilities
- Data consistency and integrity maintenance

### Compliance Requirements:

- PCI-DSS compliance for payment processing
- Food safety regulation compliance reporting
- Tax regulation compliance and reporting
- Data protection and privacy regulation compliance

### Accessibility Requirements:

- WCAG 2.1 AA compliance for web interfaces
- Mobile accessibility features for touch interfaces
- Multi-language support for diverse user bases
- Keyboard navigation support for all interfaces

## 7. Technical Specifications

### 7.1 Architecture Overview

**Architecture Pattern:** Microservices with event-driven communication **Deployment Model:** Cloud-native containerized deployment **Communication Protocol:** RESTful APIs with WebSocket for real-time features **Data Storage:** Polyglot persistence with PostgreSQL and MongoDB

### 7.2 Technology Stack

#### Frontend Technologies:

- **Mobile Application:** Flutter 3.0+ with Dart
- **Web Dashboard:** React 18+ with Next.js 13+
- **Progressive Web App:** PWA capabilities with service workers
- **UI Framework:** Material Design 3.0 for consistency

#### Backend Technologies:

- **API Framework:** NestJS with TypeScript
- **Authentication:** Passport.js with JWT strategy
- **Real-time Communication:** Socket.io for WebSocket management
- **API Documentation:** OpenAPI 3.0 with Swagger integration

#### Database Technologies:

- **Primary Database:** PostgreSQL 15+ with advanced indexing
- **Document Store:** MongoDB 6.0+ for analytics and logging
- **Cache Layer:** Redis 7.0+ for session and application caching
- **Search Engine:** Elasticsearch 8.0+ for full-text search and analytics

#### Message Queue and Event Processing:

- **Message Broker:** RabbitMQ 3.11+ with clustering support
- **Event Streaming:** Apache Kafka for high-throughput events
- **Background Jobs:** Bull Queue with Redis backend
- **Workflow Orchestration:** Custom event-driven workflows

#### AI and Machine Learning:

- **ML Framework:** TensorFlow 2.0+ for predictive analytics
- **AI Services:** OpenAI API integration for intelligent insights
- **Data Processing:** Python with Pandas and NumPy for data analysis
- **Model Serving:** TensorFlow Serving for production ML models

#### Infrastructure and DevOps:

- **Containerization:** Docker with multi-stage builds

- **Orchestration:** Kubernetes with Helm charts
- **Cloud Provider:** Multi-cloud support (AWS, Google Cloud, Azure)
- **Monitoring:** Prometheus and Grafana for observability
- **Logging:** ELK Stack (Elasticsearch, Logstash, Kibana)

## 7.3 Security Architecture

### Authentication and Authorization:

- Multi-factor authentication support
- OAuth 2.0 and OpenID Connect integration
- Session management with secure cookie handling
- API key management for third-party integrations

### Data Security:

- End-to-end encryption for sensitive data
- Database encryption at rest and in transit
- Secure file upload with virus scanning
- Regular security penetration testing

### Network Security:

- Web Application Firewall (WAF) protection
- DDoS protection and rate limiting
- VPN access for administrative functions
- Network segmentation and access controls

## 8. Success Metrics & KPIs

### 8.1 Operational Metrics

- **Stock Discrepancy Rate:** Target <2% (80% improvement from baseline)
- **Order-to-Service Time:** Target improvement of 30%
- **System Uptime:** >99.9% availability during operating hours
- **Data Accuracy:** >95% accuracy in automated P&L generation

### 8.2 Performance Metrics

- **API Response Time:** <200ms average
- **Page Load Time:** <3 seconds for dashboard interfaces
- **Mobile App Performance:** <2 seconds for common operations
- **Database Performance:** <100ms for standard queries

### 8.3 Business Impact Metrics

- **Cost Reduction:** 15% reduction in operational costs through optimization
- **Revenue Growth:** 10% increase through better inventory management



- **Waste Reduction:** 25% reduction in food waste through better tracking
- **Customer Satisfaction:** >90% satisfaction rate for service speed

## 8.4 User Adoption Metrics

- **User Engagement:** >80% daily active users across departments
- **Feature Utilization:** >70% utilization of core features
- **Training Completion:** 100% completion of user training programs
- **Support Ticket Volume:** <5% of users requiring support monthly

# 9. Project Timeline & Milestones

## 9.1 Detailed Development Schedule

### Phase 1: Planning & Requirements (Week 1)

- Requirements finalization and stakeholder sign-off
- Technical architecture documentation completion
- Development environment setup and team onboarding
- Project management tool configuration and workflow establishment

### Phase 2: UI/UX Design (Weeks 2-5)

- User research and persona validation
- Wireframe creation for all user interfaces
- High-fidelity mockup development
- Design system creation and component library
- Prototype development and user testing
- Design review and approval process

### Phase 3: Backend Infrastructure (Weeks 6-8)

- Database schema design and implementation
- Authentication and authorization system development
- Core API service development
- Message queue and event system setup
- Third-party integration foundation
- Security implementation and testing

### Phase 4: Application Development (Weeks 9-14)

- Mobile application development (Flutter)
- Web dashboard development (React/Next.js)
- Core feature implementation across all modules
- Department-specific functionality development
- API integration and testing
- Cross-platform synchronization implementation

### **Phase 5: Real-time Integration (Weeks 15-17)**

- WebSocket implementation for real-time updates
- Redis integration for caching and session management
- RabbitMQ integration for event-driven communication
- Real-time notification system implementation
- 3D visualization system integration
- Performance optimization and scaling tests

### **Phase 6: AI & Analytics (Weeks 18-19)**

- AI model development and training
- Analytics engine implementation
- Reporting system development
- Business intelligence dashboard creation
- Predictive analytics integration
- Machine learning model deployment

### **Phase 7: Quality Assurance (Weeks 20-21)**

- Comprehensive testing across all modules
- Security testing and vulnerability assessment
- Performance testing and optimization
- User acceptance testing coordination
- Bug fixing and issue resolution
- Documentation completion and review

### **Phase 8: Deployment & Launch (Week 22)**

- Production environment setup and configuration
- Database migration and data import
- User training and onboarding
- Go-live coordination and monitoring
- Post-launch support and issue resolution
- Performance monitoring and optimization

## **9.2 Critical Path Dependencies**

- Database schema completion before API development
- Authentication system before role-based feature development
- Core API services before frontend integration
- Real-time infrastructure before notification system
- AI model training before analytics implementation

## 10. Team & Role Assignments

### 10.1 Development Team Structure

**Project Management:**

**Backend Development Team:**

**Frontend Development Team:**

**Specialized Development:**

- **AI/ML Engineer:** Machine learning model development, predictive analytics, AI integration
- **DevOps Engineer:** Infrastructure setup, deployment automation, monitoring, scaling
- **UI/UX Designer:** User interface design, user experience optimization, design system maintenance

**Quality Assurance:**

### 10.2 Responsibility Matrix

**Backend Development Responsibilities:**

- API design and implementation for all modules
- Database schema design and optimization
- Security implementation and authentication
- Third-party service integration
- Performance optimization and caching
- Error handling and logging

**Frontend Development Responsibilities:**

- User interface implementation across all platforms
- Real-time feature integration
- Responsive design and accessibility
- Component reusability and maintainability
- Cross-browser and cross-device compatibility
- User experience optimization

**AI/ML Engineering Responsibilities:**

- Predictive model development and training
- Analytics engine implementation
- Business intelligence integration
- Machine learning pipeline setup
- AI-driven recommendation system

- Performance monitoring for AI features

#### **DevOps Responsibilities:**

- Infrastructure architecture and setup
- Continuous integration and deployment
- Monitoring and alerting systems
- Scaling and performance optimization
- Security infrastructure and compliance
- Backup and disaster recovery

## **11. Constraints & Assumptions**

### **11.1 Project Constraints**

- **Timeline:** Fixed 22-week development schedule
- **Team Size:** Limited to assigned development team members
- **Technology Stack:** Must use approved technologies and frameworks
- **Compliance:** Must meet all regulatory and security requirements

### **11.2 Technical Constraints**

- **Performance:** Must meet specified response time and throughput requirements
- **Scalability:** Must support defined user loads and transaction volumes
- **Security:** Must implement enterprise-level security measures
- **Integration:** Must integrate with specified third-party services
- **Platform Support:** Must support specified mobile and web platforms

### **11.3 Business Assumptions**

- **Client Engagement:** Restaurant stakeholders will provide domain expertise and feedback
- **User Training:** End users will complete training programs for system adoption
- **Internet Connectivity:** Reliable internet access available at all operational locations
- **Hardware:** Adequate hardware available for system deployment
- **Data Migration:** Existing data can be migrated to new system format

### **11.4 Technical Assumptions**

- **Third-party Services:** Required external services will remain available and stable
- **Cloud Infrastructure:** Cloud services will meet uptime and performance requirements
- **Technology Updates:** Core technologies will remain stable during development period
- **Integration APIs:** Partner APIs will remain functional and well-documented
- **Security Standards:** Current security standards will remain applicable

## 12. Future Considerations & Roadmap

### 12.1 Phase 2 Enhancements (Months 6-12)

- **Customer Mobile Application:** Dedicated app for customer orders and loyalty programs
- **Advanced AI Features:** Enhanced predictive analytics and recommendation engines
- **Multi-location Support:** Chain restaurant management with centralized reporting
- **Advanced Reporting:** Business intelligence and advanced analytics dashboard

### 12.2 Phase 3 Expansions (Year 2)

- **Delivery Platform Integration:** Full integration with major delivery platforms
- **Supply Chain Management:** Extended supplier management and procurement automation
- **Customer Relationship Management:** Advanced CRM features and customer analytics
- **Franchise Management:** Multi-franchise support with centralized management

### 12.3 Long-term Vision (Years 3-5)

- **Market Expansion:** Support for different restaurant types and international markets
- **IoT Integration:** Smart kitchen equipment and sensor integration
- **Blockchain Integration:** Supply chain transparency and food safety tracking
- **Advanced AI:** Machine learning-driven autonomous operations and decision making