iVending Part 1

Project Group 37

Business Requirements

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Document Purpose

The objective of the Business Requirements document is to define the high-level business requirements for the scope of the project.

If a separate Business Case document has not been previously prepared, an additional objective of the Business Requirements document is to document the Business Case.

# Business Case

## 1.1. Overview

iVending project aims to develop cutting-edge internet-enabled vending machines that will redefine customer convenience. These machines will accept a variety of payment methods, including cash, credit cards, and mobile payments, making them more accessible to a wide spectrum of customers. Customers can remotely verify product availability via mobile devices, removing the need for physical presence to the machine. Furthermore, to maintain product freshness and reduce downtime, the project prioritizes fault tolerance and self-monitoring features. iVending intends to position itself as a market leader in the vending sector by utilizing an Agile software development methodology and capitalizing on new consumer trends and technology breakthroughs. iVending Incorporated intends to transform the vending scene and develop a strong market presence by focusing on functionality and user experience.

## 1.2. Business Justification

The iVending project fills an important gap in the vending business by delivering a game-changing solution that takes advantage of cutting-edge technology and consumer behavior patterns. Traditional vending machines frequently lack payment method versatility, limiting customer accessibility. Customers must also physically approach the machine to check product availability, which is inconvenient. iVending aims to fill these gaps by providing a unified experience with cash, credit card, and mobile payment alternatives. The project not only improves ease by incorporating real-time product availability checks via mobile devices, but it also capitalizes on the growing desire for autonomous and self-service solutions. Furthermore, the addition of fault tolerance and self-monitoring features answers concerns about product spoiling and machine downtime, resulting in a strong and dependable vending experience. This project has the potential to transform the industry by establishing iVending as an industry leader and unlocking hitherto untapped revenue sources in high-traffic areas such as campuses and apartment complexes.

## 1.3. Benefits

**Distinctiveness and Competitive Advantage:**

By adopting novel payment mechanisms and real-time accessibility features, the iVending project distinguishes itself from typical vending solutions. This distinction gives the company a distinct competitive advantage in a continually changing sector, attracting customers looking for modern, convenient vending solutions.

**Adapting to Changing Consumer Trends:**

The initiative matches with consumers' growing preferences and habits, which increasingly value convenience, payment flexibility, and technology-driven solutions. By addressing these developments, iVending is well-positioned to serve a wide range of customers.

**Improved Customer Convenience and Access:**

iVending removes obstacles to entry for a broader consumer base by allowing a variety of payment methods such as cash, credit cards, and mobile payments. This immediately solves the annoyance that customers experience when they are limited to cash-only vending machines, improving accessibility and user happiness.

**Product Availability Checks in Real Time:**

Customers' ability to remotely check product availability via mobile devices eliminates the need for physical closeness to the machine. This not only saves time, but also eliminates the aggravation of approaching a vending machine only to discover that it is out of stock. It is closely related to the stated problem statement and enhances the entire customer experience greatly.

**Reduced Product Spoilage Risk:**

The use of fault tolerance and self-monitoring features guarantees that products are kept in optimum condition, reducing the danger of spoilage. This directly answers customer concerns about product quality and freshness by delivering a consistently high-quality choices.

**Increased machine uptime:**

The iVending machine's self-monitoring capabilities help to maximize machine uptime. Downtime is reduced by proactively recognizing and fixing potential issues, ensuring that products are always available to customers.

**Revenue Streams and Market Share Increases:**

iVending has the ability to grab a major share of the vending business by providing a technologically superior and customer-centric vending solution. This clearly corresponds with the highlighted business potential, allowing iVending to tap into previously untapped revenue sources and strengthening the company's position as an industry leader.

## 1.4. Strategic Overview

**Adapting to Regulatory and Compliance Requirements:**

Given the possibility of including alcoholic beverages in vending offers, a strategic goal is to handle legal and compliance needs as soon as possible. This ensures that iVending acts within the law and establishes the company as a reputable and compliant industry participant.

**Continuous Improvement and Adaptation:**

The strategic goal of adopting an Agile software development process is to build a culture of continual innovation and adaptation. This enables iVending to keep ahead of industry trends, respond quickly to customer input, and bring new features and technologies to improve the vending experience.

**Revenue diversification and expansion:**

The strategic goal of introducing the iVending machine is to diversify revenue streams beyond traditional vending methods. iVending intends to drive revenue growth and profitability by leveraging on emerging consumer preferences and behaviors.

**Risk reduction and product quality assurance:**

Implementing fault tolerance and self-monitoring features is a proactive strategy for mitigating the hazards of product spoiling and machine downtime. By emphasizing product quality and dependability, iVending hopes to gain the trust of both customers and distributors.

**Developing Relationships with Distributors:**

The project aspires to form strong ties with distributors who will be critical in the deployment and maintenance of iVending equipment. Building mutually beneficial connections with distributors is a key goal for ensuring the iVending solution's widespread adoption.

**Expansion and penetration of the market:**

The project's goal is to strategically expand iVending's market reach by focusing on high-density regions like universities and apartment complexes. iVending seeks to access previously untouched markets and develop a significant presence in these locations by offering a technologically superior vending solution with varied payment choices.

**Developing Technological Leadership:**

One important strategic goal is to position iVending as a technological leader in the vending sector. iVending distinguishes itself from standard vending machines by including internet connectivity, mobile payment alternatives, and real-time product availability checks. This position of leadership will strengthen iVending's competitive advantage and brand perception.

**Increasing Customer Loyalty and Experience:**

The project aims to improve the overall consumer experience by providing convenient payment alternatives and product availability checks. By providing added value through these features, iVending aims to foster customer loyalty and encourage repeat business.

## 1.5. Risks to Business

Risks generally fall within 3 classifications:

**Business Risk --** Identifies the risk to the business of doing or not doing the project. For example; loss of market opportunity or threat of competition.

**Project Risk** -- This is a risk to the successful completion of the project. For example, lack of funding, resources or implementation problems.

**Product Risk --** These are the risks associated with the product or service itself. For example; brand image, security, and other product or service specific items.

The following matrix identifies key risks of this project, degree of impact and probability (H=High, M=Medium, L=Low) and the next steps to address or mitigate the risks.

### Risk associated to the project

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Risk Type** | **Description** | **Probability** | | | **Impact** | | | **Strategy for mitigating the risk** |
| **H** | **M** | **L** | **H** | **M** | **L** |
| **Project Risk** | Risk of delays in project completion due to unforeseen circumstances or scope changes. | **✓** |  |  |  | **✓** |  | Implement Agile project management methodologies for adaptability. Maintain open communication channels for quick issue resolution. |
| **Technology Risk** | Risk of software or hardware failures in iVending machines leading to service interruptions or compromised user experience. |  | **✓** |  | **✓** |  |  | Conduct rigorous testing, quality assurance, and regular maintenance. Implement failover mechanisms for critical system components. |
| **Business Risk** | Risk of not aligning the project with the core business objectives and failing to achieve the desired outcomes. |  |  | **✓** |  | **✓** |  | Conduct thorough market research and feasibility studies before project initiation. Regularly reassess project alignment with business goals. |
| **Operational Risk** | Risk of inefficiencies or breakdowns in iVending machine operations, potentially leading to customer dissatisfaction or loss of revenue. |  | **✓** |  |  |  | **✓** | Establish robust operational procedures and provide comprehensive staff training. Implement continuous monitoring and performance optimization protocols. |
| **Financial Risk** | Risk of cost overruns or inadequate revenue generation, potentially impacting the financial viability of the iVending project. |  |  | **✓** | **✓** |  |  | Conduct detailed financial analyses, including cost-benefit assessments and revenue forecasts. Implement cost-effective resource allocation and revenue diversification strategies. |
| **Product Risk** | Risk of security vulnerabilities or fraudulent activities within the iVending system, potentially leading to financial losses. |  | **✓** |  |  | **✓** |  | Implement advanced encryption and security protocols. Regularly audit system logs for suspicious activities. Provide user education on security best practices. |

### Risk of not doing the project

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Risk Type** | **Description** | **Probability** | | | **Impact** | | | **Strategy for mitigating the risk** |
| **H** | **M** | **L** | **H** | **M** | **L** |
| Market Risk | Risk of missing out on potential market expansion opportunities and losing competitive advantage in the vending industry. | **✓** |  |  | **✓** |  |  | Conduct continuous market research and trend analysis. Develop flexible business strategies to adapt to changing market dynamics. |
| **Strategic Risk** | Risk of making suboptimal business decisions, potentially resulting in missed opportunities or inefficient resource allocation. |  | **✓** |  |  | **✓** |  | Establish a robust strategic planning process with regular reviews and adjustments. Engage key stakeholders in decision-making to ensure diverse perspectives. |
| **Regulatory Risk** | Risk of non-compliance with industry standards or legal requirements, potentially leading to regulatory penalties or reputational damage. |  | **✓** |  |  |  | **✓** | Conduct thorough regulatory assessments and stay updated on relevant industry standards. Implement compliance protocols and regular audits. |
| **Organizational Risk** | Risk of over-reliance on specific organizational elements, potentially impacting the project's ability to deliver services effectively. |  |  | **✓** | **✓** |  |  | Diversify resources and establish strategic partnerships to reduce dependency on any single organizational component. Maintain clear communication channels with all stakeholders. |
| **Legal Risk** | Risk of legal liabilities or lawsuits due to non-compliance with contracts or business practices, potentially leading to financial losses. |  |  | **✓** |  | **✓** |  | Conduct comprehensive legal reviews of contracts and business practices. Clearly communicate legal responsibilities and obligations to all parties involved. |
| **Product Risk** | Risk of potential security vulnerabilities or fraudulent activities in the iVending system, even without project implementation. |  |  | **✓** |  | **✓** |  | Implement advanced security measures and regular audits to detect and prevent fraudulent transactions, irrespective of project implementation. |

# Scope

## In Scope Functionality and Components

The following information is the high-level functionality and components that are in the scope of this project.

Project Scope: The scope of this project focus on:

* Developing cutting-edge, internet-connected vending machines that offer the best possible consumer experience.
* Incorporating cutting-edge features like:
* Intuitive touchscreen interfaces with rich graphical features and mobile optimization.
* Enhanced customization like tweaking drink recipes, selecting preparation options.
* Easy self-checkout with credit card, NFC, and other payment methods. without any hassles.
* Integration for a flawless experience with digital wallets, loyalty programs, and mobile apps.
* Creating dynamic product menus that provide more product availability outside of physical inventories.
* Ensuring cybersecurity, privacy, and compliance with industry best practices.
* Personalized promotions, recommendations, and tailored offerings for each customer.
* creating an open platform driven by APIs to facilitate future innovation and interaction with third-party apps.

**Context Diagram**

A diagram of a vending machine

Description automatically generated

**Functionality:**

* Intuitive touchscreen interface on vending machines
* Connectivity with digital wallets and mobile apps
* Automated inventory replenishment - Use data to automatically trigger supply reorders.
* Customized advertisements and suggestions
* Increased personalization and accessibility of products
* Self-checkout and payment without any hassles
* Cashless payments - Support emerging payment types like Apple/Google Pay, Venmo, etc.
* Computer vision and cutting-edge sensors for automation and personalization
* Voice control - Use voice commands to operate the machines via assistants like Alexa.
* regular changes to software to add new features.
* A platform with open APIs for creativity and extension
* Flexible architecture to support future business needs.
* Social media integration - Allow customers to share purchases and interact with the brand.

**Components:**

* Cutting-edge vending hardware with touchscreens, sensors, computer vision, etc.
* administration portals, mobile apps, and machine operating system software
* APIs to integrate with partners, CRM, and payments.
* Cloud-based solutions for deployed machine management
* Device synchronization and state management
* Systems for inventory, supply chains, and logistics
* Analytics and customer database systems
* Infrastructure of the network for machine connectivity
* Systems for identification, access, and security management.
* Customer engagement portal - Manage real-time communication with customers.
* Warehouse management system - Manage logistics of product re-supply.

**Event List:**

**Direct Events:**

* **CUSTOMER** selects **BEVERAGE**.
* **CUSTOMER** tenders **PAYMENT**.
* **VENDING MACHINE** dispenses **BEVERAGE.**
* **VENDING MACHINE** dispenses **CHANGE**

**Indirect Events:**

* **PAYMENT** exceeds **PRICE**.
* (**PAYMENT** - **PRICE**) exceeds **CHANGE AVAILABLE**.
* **BEVERAGE** not available

## Out of Scope Functionality and Components

The following information is the high level functionality and components that are specifically excluded from the scope of this project.

* Integration with any legacy systems that are currently in place. The new platform is Focus.
* Hardware manufacturing - The actual design and manufacture of the physical vending machines and components. The scope focuses on the software systems.
* Food preparation and products: locating and creating the real food and drink goods that are sold. The project is centered around vending operations.
* Marketing/advertising: Promotional campaigns and brand marketing are two different things.
* Third-party partnerships are any kind of vendor or app integrations that take place outside of primary platforms.
* Customer service: There isn't a call center or live customer support representatives to help clients.
* Facilities management: There are no parts for controlling wifi, utilities, or air conditioning in vending machines.
* Repairs for vending machines: This excludes physical machine maintenance and repairs.
* Distribution warehouses: These are locations without facilities for holding and transporting tangible goods.
* Legal services: Contracting and legal issues are probably handled differently.

# Process Flow

|  |
| --- |
| Include a diagram(s) such as business process models (BPM) showing how the product or service of the project will operate when completed. Include existing processes as well as new processes that will be created as part of the project  **INPUT**——→**PROCESSING**——→**OUTPUT** |

A diagram of a process

Description automatically generated**BPM Diagram**

**As-is Diagram**

A diagram of a flowchart

Description automatically generated

To-Be Diagram

A diagram of a process

Description automatically generated

**As is:**

* A customer approaches a vending machine and chooses.
* When a product is in stock, the vending machine dispenses it.
* the customer inputs cash or coins to pay.
* Periodic manual restocking and cash collection
* little insight of sales and inventories

**Issues:**

* Limited payment options.
* Frequent out of stocks.
* Manual restocking is labor intensive.
* Absence of use analytics

**To-Be:**

* Customer authenticates through mobile app.
* dynamic suggestions and offers for products.
* Real-time tracking of inventory levels.
* Auto restocking and cashless payments
* Cloud-based reporting and analytics

**Solutions:**

* Mobile app integration.
* Inventory management system.
* Cashless transactions
* Telemetry and data platform.

# Business Requirements

The following are high-level business requirements. The business requirements are divided into two types.

* Functional requirements directly support the functions of the product of the project.
* Non-functional requirements are those that do not directly support the functions of the product of the project, but are needed for the success of the project.

## Functional Requirements

The following functional requirements are grouped in categories specifically identified for this project or in models such as use cases specifically identified for this project.

### Vending Machine Operations

FR 1.1: The vending machine must be adaptable to multiple sorts of goods (food, drink, perishables).

Acceptance Criteria: Administrators should be able to customize product offerings based on location and client preferences.

FR 1.2: To allow worldwide use, the vending machine must work on standard electrical power.

Acceptance Criteria: The machine should be compatible with many countries' electrical standards.

FR 1.3: The vending machine must have a self-maintenance mechanism that sends alarms in the event of a malfunction.

Acceptance Criteria: The system should send real-time alerts to the operation center.

FR 1.4: The vending machine shall use machine learning for real-time operation monitoring.

Acceptance Criteria: When machine performance decreases, the system should issue alarms.

**Use Case Diagram**

A diagram of a company

Description automatically generated

**USE CASE DESCRIPTION**

**Use Case 1: Customer Purchase**

* **Trigger:** Customer initiates a purchase from the vending machine.
* **Normal Flow of Events:**
  1. Customer interacts with the vending machine interface.
  2. Customer selects desired items for purchase.
  3. Customer makes payment using a debit/credit card or digital wallet.
  4. Vending machine dispenses the selected items.
  5. Customer receives a receipt.
* **Alternative Flow (If-Else):**
  1. If the customer successfully selects and provides payment information:
     + The vending machine processes the transaction and dispenses the items.
  2. Else if the customer does not select or provide valid payment information:
     + The vending machine prompts the customer to try again.

**Use Case 2: Loyalty Program Signup**

* **Trigger:** Customer decides to sign up for the loyalty program.
* **Normal Flow of Events:**
  1. Customer selects the "Sign Up for Loyalty Program" option.
  2. Customer provides their email address for registration.
  3. Customer receives a confirmation email with a registration link.
  4. Customer clicks the link and provides additional information (name, contact details).
  5. The customer is successfully enrolled in the loyalty program.
* **Alternative Flow (If-Else):**
  1. If the customer successfully provides the required information:
     + The system registers the customer in the loyalty program.
  2. Else if the customer does not provide valid information:
     + The system prompts the customer to re-enter the required information.

**Use Case 3: Inventory Management**

* **Trigger:** Operations Department needs to manage the inventory of items.
* **Normal Flow of Events:**
  1. Operations Department logs into the system.
  2. The Operations Department selects the "Inventory Management" option.
  3. System displays available actions (e.g., restock, remove items).
  4. The Operations Department selects the desired action (e.g., restock).
  5. Operations Department specifies the machine and item to be restocked.
  6. System updates inventory levels and triggers reorder points.
* **Alternative Flow (If-Else):**
  1. If the Operations Department successfully selects an action and specifies the necessary information:
     + The system processes the inventory management action.
  2. Else if the Operations Department encounters an issue in the selection or specification process:
     + The system prompts the Operations Department to re-enter the required information.

**Use Case 4: Distributor Management**

* **Trigger:** The Purchasing Department needs to manage relationships with distributors.
* **Normal Flow of Events:**
  1. The Purchasing Department logs into the system.
  2. The Purchasing Department selects the "Distributor Management" option.
  3. System displays available distributors and actions (e.g., select distributor, place order).
  4. The Purchasing Department selects the desired distributor.
  5. The Purchasing Department specifies items and quantities for ordering.
  6. System generates a purchase order and notifies the distributor.
* **Alternative Flow (If-Else):**
  1. If the Purchasing Department successfully selects a distributor, specifies items, and places an order:
     + The system processes the purchase order and notifies the distributor.
  2. Else if the Purchasing Department encounters an issue in the selection or specification process:
     + The system prompts the Purchasing Department to re-enter the required information.

**Use Case 5: Disinfectant Program**

* **Trigger:** Operations Department initiates the disinfecting process for the vending machines.
* **Normal Flow of Events:**
  1. Operations Department initiates the disinfection process through the system.
  2. The system checks availability and safety conditions for the disinfectant unit.
  3. Disinfectant unit activates the process in a safe environment.
  4. Disinfectant unit emits a non-toxic disinfectant on the vending machine.
  5. The disinfectant unit monitors chemical levels and alerts if they are too low.
* **Alternative Flow (If-Else):**
  1. If the Operations Department successfully initiates the disinfection process and all safety conditions are met:
     + The disinfectant unit proceeds with the disinfection process.
  2. Else if there are safety concerns or technical issues preventing the disinfection process:
     + The system displays an error message and contacts the iVending operation center for resolution.

**Use Case 6: Account Management**

* **Trigger:** Customer decides to manage their account and view rewards.
* **Normal Flow of Events:**
  1. Customer logs into their account through the iVending app.
  2. Customer selects the "Account Management" option.
  3. System displays available actions (e.g., view rewards, fund account).
  4. Customer selects the desired action (e.g., view rewards).
  5. System retrieves and displays the customer's rewards information.
* **Alternative Flow (If-Else):**
  1. If the customer successfully logs in and selects an action:
     + The system processes the action and displays the relevant information.
  2. Else if the customer encounters an issue during the login or action selection process:
     + The system prompts the customer to re-enter login credentials or select a different action.

**Use Case 7: Machine Configuration**

* **Trigger:** The Operations Department needs to configure settings of the vending machine.
* **Normal Flow of Events:**
  1. Operations Department logs into the system.
  2. The Operations Department selects the "Machine Configuration" option.
  3. System displays available configuration options (e.g., item allocation, power settings).
  4. The Operations Department selects the desired configuration option.
  5. Operations Department provides necessary settings (e.g., item allocation percentages, power preferences).
  6. System updates the vending machine configuration.
* **Alternative Flow (If-Else):**
  1. If the Operations Department successfully selects a configuration option and provides settings:
     + The system updates the vending machine configuration.
  2. Else if the Operations Department encounters an issue in the selection or configuration process:
     + The system prompts the Operations Department to re-enter the required information.

**Use Case 8: Item Catalog Management**

* **Trigger:** The Operations Department needs to manage the catalog of items available for vending.
* **Normal Flow of Events:**
  1. Operations Department logs into the system.
  2. The Operations Department selects the "Item Catalog Management" option.
  3. System displays available actions (e.g., add item, update item details).
  4. Operations Department selects the desired action (e.g., add item).
  5. The Operations Department provides details for the new item (e.g., name, category, pricing).
  6. System updates the catalog with the new item.
* **Alternative Flow (If-Else):**
  1. If the Operations Department successfully selects an action and provides the necessary details:
     + The system updates the catalog with the new item.
  2. Else if the Operations Department encounters an issue in the action selection or detail provision process:
     + The system prompts the Operations Department to re-enter the required information.

**State Machine Diagram**

A diagram of a product

Description automatically generated

### Inventory Management

FR 2.1: The system must use Economic Order Quantity (EOQ) concepts to manage inventory in real time.

Acceptance Criteria: Based on item quantities and consumption patterns, the system should produce automatic purchase orders.

FR 2.2: To regulate freshness and minimize spoilage, the system must track item aging.

Acceptance Criteria: The system should generate reports on the age of inventory items.

FR 2.3: To optimize purchasing and pricing, the system must aggregate inventory data at the machine, site, and geographic levels.

*Acceptance Criteria*: The system should allow for data analytics on inventory levels

### Customer Interaction

FR 3.1: The system must have an easy-to-use interface for customers to make purchases.

Acceptance Criteria: The interface should be simple to use and navigate.

Customers must be able to make payments via debit cards, credit cards, or digital wallets.

FR 3.2: Criteria for Acceptance: The payment mechanism should be secure and dependable.

FR 3.3: The system must provide a loyalty program in which customers can earn points and obtain discounts.

*Acceptance Criteria*: The loyalty program should track points accurately and apply discounts automatically.

### Public Health Features

FR 4.1: The system must have a disinfection program that is activated when a consumer leaves.

Acceptance Criteria : The disinfection procedure should be both safe and efficient.

FR 4.2: The disinfection unit is responsible for monitoring and maintaining acceptable chemical levels.

Acceptance Criteria: When chemical levels are low, the system should send out notifications.

## Non-Functional Requirements

### Reporting Requirements

* The system must give full information on sales, inventory levels, and customer activity via a web-based dashboard that can be exported in PDF and CSV formats.

### Operating Regulation Requirements

* The system must adhere to all applicable local and international vending machine legislation and standards, notably those concerning food safety and cleanliness.

### Documentation Requirements

* Provide administrators and operators with extensive documentation on machine setup, maintenance, and troubleshooting, including video tutorials and FAQs.
* Create user manuals and tutorials for customers to effectively navigate the vending interface and mobile app, available in both digital and paper media.

### Training Requirements

* Provide operations staff with training on equipment installation, maintenance, and inventory management, as well as periodic refresher courses.
* Provide client training on how to efficiently utilize the vending machine interface and mobile app, with freely accessible online resources and tutorials.

### Support Requirements

* Create a dedicated support channel (e.g., a hotline or email) to handle customer inquiries, technical difficulties, and feedback, with a guaranteed response time of fewer than 24 hours.
* Ensure timely response times for support inquiries, with a goal resolution time of 48 hours for reported issues.

### Marketing Requirements

* Create a marketing strategy to promote iVending's distinctive features in apartment complexes and on campus, targeting certain client groups through social media campaigns, partnerships with student organizations, and targeted advertising.
* Implement a consumer engagement strategy that includes promotions, discounts, and a tiered loyalty program with distinct incentives for various levels of customer interaction.

### Legal, Regulatory, and Patent Protection Requirements

* Through frequent legal assessments and updates, ensure compliance with all local and federal rules and regulations governing food vending, payment processing, and data privacy.
* Obtain any appropriate patents or intellectual property rights for new vending machine features or technology, including continued monitoring for suspected infringements.

### Security Requirements

* Implement strong security measures, such as encryption, secure authentication, and frequent security audits, to protect customer payment information, personal data, and transaction history.
* Conduct frequent security audits and vulnerability assessments to detect and resolve potential threats, focusing on critical vulnerabilities first.

### Performance Requirements

* To offer a flawless experience, the vending machine's reaction time for consumer interactions should be less than 3 seconds, especially during peak load situations.
* The system should be able to handle concurrent transactions without degrading performance, especially during peak usage times, and should have scalability safeguards in place for future development.

## Information Requirements

**Internal Information Requirements**:

**Base Data:**

* **Machine Configuration:**

Description: Information on the configuration settings of each vending machine, such as item allocation, temperature settings, and maintenance parameters.

Source: Administrator input during machine setup.

* **Inventory Information:**

Description: Real-time data on the quantity, kind, and quality of items stocked in each machine.

Source: The inventory management system of the vending machine generated this data.

* **Purchase History of Customers:**

Description: Individual client transaction records, including items purchased, payment method, and timestamps.

Source: Customer interactions with the vending machine were captured.

**Summary Data:**

* **Sales Reports:**

Description: Sales aggregate statistics, including total income, popular items, and sales trends over certain time periods.

Source: Individual transaction data.

* **Inventory Status:**

Description: A high-level overview of inventory levels across all machines, including low-stock alerts and perishable item status.

Source: Compiled from basic inventory data.

* **Customer Engagement Metrics:**

Description: Metrics relating to consumer loyalty program membership, points earned, and redemption history.

Source:Aggregated from individual consumer data.

**External Information Requirements:**

**Base Data:**

* **Distributor Catalog:**

Description: Product description and pricing are provided for available catalog products from third-party distributors.

Source: Provided by third-party distributors.

* **Legal and Regulatory Updates:**

Description: Information on any modifications or amendments to vending machine regulations, particularly those pertaining to food and beverage sales.

Source: Obtained from the appropriate regulatory authorities.

**Summary Data:**

* **Market Trends and Demographics:**

Description: Data on local market trends, client demographics, and preferences in target places (for example, residences and campuses).

Source: Market research and demographic studies were used as sources.

* **Analysis of Competitors:**

Description: Analysis of competitive vending solutions, including products, price, and consumer involvement techniques.

Source: Competitive analysis and research.

* **Data Dictionary:**
* **Machine:**
* MachineID (Primary Key): Unique identifier for each vending machine.
* Location**:** Physical location where the vending machine is placed.
* Configs**:** Configuration settings for the machine.
* Maintenance**:** Indicates whether the machine has self-maintenance capabilities (Boolean).
* Cooling/Warming**:** Indicates the status of cooling/warming features (Boolean).
* Cashless**:** Indicates whether the machine accepts cash (Boolean).
* Failover Capability**:** Indicates whether the machine has failover capabilities (Boolean).
* Monitoring**:** Indicates whether the machine has self-monitoring capabilities (Boolean).
* **Item:**
* ItemID (Primary Key): Unique identifier for each item.
* Name: Name of the item.
* Type: Category of the item (Food, Drink, Perishable).
* Brand: Brand associated with the item.
* Description: Description of the item.
* Pricing: Price of the item.
* Inventory Level: Current inventory level of the item.
* Reorder Point: Minimum inventory level at which reordering is triggered.
* Shelf Life: Shelf life of the item for perishable items.
* **Inventory:**
* InventoryID (Primary Key): Unique identifier for each inventory entry.
* MachineID (Foreign Key): Identifier of the machine associated with the inventory.
* ItemID (Foreign Key): Identifier of the item associated with the inventory.
* Quantity: Quantity of the item in the inventory.
* Last Stocked Date: Date when the inventory was last restocked.
* Expiry Date: Expiry date for perishable items.
* **Distributor:**
* DistributorID (Primary Key): Unique identifier for each distributor.
* Name: Name of the distributor.
* Contact Information: Contact details for the distributor.
* Status: Status of the distributor (Active/Inactive).
* **Customer:**
* CustomerID (Primary Key): Unique identifier for each customer.
* Name: Name of the customer.
* Email: Email address of the customer.
* Loyalty Status: Loyalty status of the customer (Loyal/Non-Loyal).
* Account Balance: Current balance in the customer's account.
* **Account:**
* AccountID (Primary Key): Unique identifier for each account.
* CustomerID (Foreign Key): Identifier of the customer associated with the account.
* Balance: Current balance in the account.
* Funding Option: Funding option for the account (Credit/Debit/Digital Wallet).
* Account Type: Type of account (Individual, Corporate).
* Transaction History: History of transactions associated with the account.
* **Purchase Order:**
* OrderID (Primary Key): Unique identifier for each purchase order.
* Issue Date: Date when the purchase order was issued.
* Scheduled Delivery Date: Date for the scheduled delivery of the order.
* Shipping Address: Address to which the order will be shipped.
* Total Amount: Total amount for the purchase order.
* Status: Status of the purchase order (Pending, Shipped, Delivered).
* **Constraints:**
* MachineID, ItemID, InventoryID, DistributorID, CustomerID, AccountID, and OrderID are unique identifiers and cannot be null.
* Foreign key constraints to ensure referential integrity between related tables (e.g., MachineID in Inventory references MachineID in Machine).

**Normalization:**

We can apply normalization techniques to improve data integrity and eliminate redundancy.

* **New Entities after Normalization:**
* **Item:**
* ItemID (Primary Key)
* Name
* Type
* Brand
* Description
* Pricing
* Inventory Level
* Reorder Point
* Shelf Life
* Weight
* Dimensions
* Nutritional Information
* SupplierID (Foreign Key)
* **Supplier:**
* SupplierID (Primary Key)
* Name
* Contact Information
* Location
* Preferred Payment Terms
* **Explanation:**
* We have created a new entity called "Supplier" to store information about item suppliers.
* The "SupplierID" in the "Supplier" table is the primary key.
* The "SupplierID" in the "Item" table is a foreign key that establishes a relationship between the "Item" entity and the "Supplier" entity.
* This relationship allows each item to be associated with a specific supplier.
* **Benefits:**

1. **Elimination of Redundancy:**
   * Supplier information is now stored in a separate table. This eliminates the need to repeat supplier details for each item, reducing redundancy.
2. **Improved Data Integrity:**
   * By normalizing the data, we ensure that supplier information is consistent and accurate across all items associated with a particular supplier.
3. **Simplifies Maintenance:**
   * Changes or updates to supplier information only need to be made in one place (the "Supplier" table) rather than updating multiple records in the "Item" table.
4. **Facilitates Future Expansion:**
   * The normalized structure allows for easy addition of new suppliers and the association of multiple items with each supplier.
5. **Enables Efficient Querying:**
   * With a normalized structure, it becomes easier to perform queries related to suppliers, such as finding all items associated with a specific supplier.

**Additional attributes and refinements for each entity:**

* **Machine:**
* **Configurations:**
  + Additional configuration settings for the machine, such as display settings, language preferences, and power-saving options.
  + **Refinement:** These settings can be managed through a dedicated admin interface accessible by authorized personnel.
* **Self-Maintenance Interval:**
  + Time interval (in days or hours) for regular self-maintenance checks and tasks.
  + **Refinement:** Allows for customizable scheduling of self-maintenance tasks based on specific machine usage patterns.
* **Weight:**
  + The weight of the item, especially relevant for shipping and inventory management.
  + **Refinement:** Allows for precise tracking of item weight for logistical purposes.
* **Dimensions:**
  + Physical dimensions (length, width, height) of the item, important for inventory space optimization.
  + **Refinement:** Enables efficient packing and utilization of vending machine space.
* **Supplier Information:**
  + Information about the suppliers of each item, including contact details and delivery schedules.
  + **Refinement:** Facilitates effective communication and coordination with suppliers.
* **Nutritional Information:**
  + Detailed nutritional facts for food items, providing transparency for health-conscious customers.
  + **Refinement:** Supports customer decision-making based on dietary preferences and restrictions.
* **Inventory:**
* **Stock Status:**
  + Indicates whether an item is currently in stock or out of stock.
  + **Refinement:** Allows for real-time visibility of item availability.
* **Distributor:**
* **Location:**
  + Specific geographic location information for each distributor's warehouse or distribution center.
  + **Refinement:** Helps optimize shipping and delivery logistics.
* **Preferred Payment Terms:**
  + Specifies the preferred payment terms and methods accepted by each distributor.
  + **Refinement:** Streamlines financial transactions and ensures alignment with iVending's payment policies.
* **Customer:**
* **Address:**
  + Physical address information for each customer, including street address, city, state, and postal code.
  + **Refinement:** Facilitates accurate delivery and billing processes.
* **Phone Number:**
  + Contact number of the customer for communication and verification purposes.
  + **Refinement:** Enables easy outreach for notifications and updates.
* **Registration Date:**
  + Date when the customer registered with iVending's loyalty program or platform.
  + **Refinement:** Supports tracking of customer acquisition and engagement metrics.
* **Account:**
* **Account Type:**
  + Specifies whether the account is of individual or corporate type.
  + **Refinement:** Allows for tailored services and offerings based on account type.
* **Purchase Order:**
* **Additional Attributes:**
  + Depending on specific business requirements, additional attributes such as order priority, special instructions, or promotional codes may be included.
  + **Refinement:** Provides flexibility to accommodate unique order processing needs

**Logical Data Model:**

**Entities:**

**1. Machine:**

- MachineID (Primary Key)

- Location

- Configurations

- Self-Maintenance Status (Boolean)

- Cooling/Warming Status (Boolean)

- Cashless (Boolean)

- Fail Over Capability (Boolean)

- Self-Monitoring Status (Boolean)

**2. Item:**

- ItemID (Primary Key)

- Name

- Type (Food, Drink, Perishable)

- Brand

- Description

- Pricing

- Inventory Level

- Reorder Point

- Shelf Life (for perishable items)

**3. Inventory:**

- InventoryID (Primary Key)

- MachineID (Foreign Key)

- ItemID (Foreign Key)

- Quantity

- Last Stocked Date

- Expiry Date (for perishable items)

**4. Distributor:**

- DistributorID (Primary Key)

- Name

- Contact Information

- Status (Active/Inactive)

**5. Customer:**

- CustomerID (Primary Key)

- Name

- Email

- Loyalty Status (Loyal/Non-Loyal)

- Account Balance

**6. Account:**

- AccountID (Primary Key)

- CustomerID (Foreign Key)

- Balance

- Funding Option (Credit/Debit/Digital Wallet)

**7. Purchase Order:**

- OrderID (Primary Key)

- Issue Date

- Scheduled Delivery Date

- Shipping Address

- Total Amount

- Status (Pending, Shipped, Delivered)

Additional Attributes and Refinements:

**1. Item:**

- Weight

- Dimensions

- Supplier Information

- Nutritional Information

**2. Inventory:**

- Stock Status (In Stock, Out of Stock)

**3. Distributor:**

- Location

- Preferred Payment Terms

**4. Customer:**

- Address

- Phone Number

- Registration Date

**5. Account:**

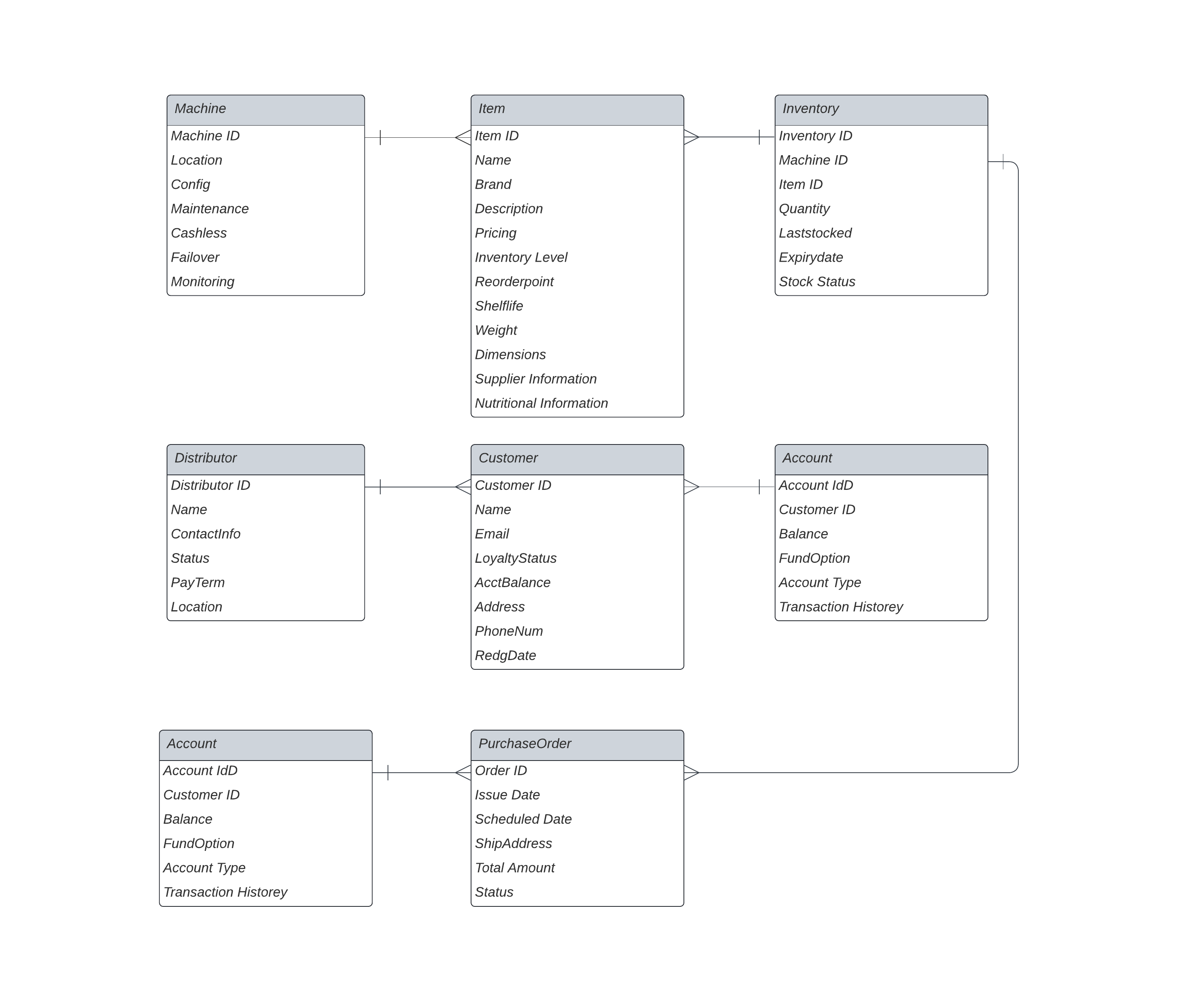
- Account Type (Individual, Corporate)

- Transaction History

**Constraints:**

* MachineID, ItemID, InventoryID, DistributorID, CustomerID, AccountID, and OrderID are unique identifiers and cannot be null.
* Foreign key constraints to ensure referential integrity between related tables (e.g., MachineID in Inventory references MachineID in Machine).

**Logical Data Model**



# 5. Assumptions

The following assumptions are considered accurate for planning and business requirements purpose.

**1. Focus on Operations:** iVending's core focus is on self-servicing customers and autonomous business solutions using smart vending machines.

**2. Aiming Locations:** With a big consumer base, iVending will primarily target clustered residences and campus areas. Installations in housing complexes and high-traffic areas like as airports are examples of this.

**3. Product Line:** The vending machines will provide a variety of food, snack, and drink options, catering to breakfast, lunch, and dinner preferences.

**4. Cashless Transactions:** The vending machines will use a cashless system to enhance consumer convenience, security, and safety.

**5. Relationships with Distributors:** iVending will work with third-party distributors to deliver meals, snacks, and drinks. The catalog products will be managed by the corporation, and distributors will be chosen based on cost-effectiveness.

**6. Customer Loyalty Program:** Using an iVending app, iVending will develop a MYiVendingRewards program that will provide customers with points, payment methods, and redemption prizes.

**7.Public Health Measures:** Due of the COVID pandemic, iVending will implement a disinfection program for machines that will be activated when a customer leaves, ensuring a safe environment for users.

**8.International Operation:** The vending machines will be designed to operate on standard electrical power in several nations, allowing for international operation.

**9.Legal Considerations for Alcohol:** iVending is investigating the legal requirements for supplying alcohol in its vending machines, but recognizes that legislative limits may cause this service to be delayed.

**10. Inventory Management:** To improve restocking and eliminate waste, real-time inventory management will be implemented using economic order quantity (EOQ) techniques.

# Constraints

The following are known constraints that may limit the business requirements of the project:

**1. Regulatory Compliance:** Adherence to local, state, and international standards governing the sale and distribution of food, beverages, and possibly alcoholic beverages via vending machines.

**2. Technological Limitations:** The availability of adequate technology to support vending machine features such as self-maintenance, real-time monitoring, and failover capabilities.

**3. Compatibility with Power Supplies:** To enable international deployment, vending machines must be designed to function on standard electrical power in multiple nations.

**4. Inventory Control System:** Factors such as supplier reliability and demand changes can have an impact on the usefulness of economic order quantity (EOQ) ideas and the accuracy of real-time inventory tracking.

**5.Supplier Reliability:** Dependence on third-party distributors for timely and consistent supply of items may be impacted by supplier availability and any potential disruptions in their operations.

**6.Market Acceptance:** Customer acceptance and adoption of the cashless payment system, as well as their desire to utilize smart vending machines, are critical to the success of the iVending business model.

**7.Considerations for Public Health:** The efficacy of the disinfectant program is dependent on accurate sensors and the availability of sufficient, safe disinfectant chemicals.

**8.Budget Constraints:** While not specifically specified in the project description, money resources and budgetary considerations may influence the project's magnitude and scope.

**9.Vending machine:** In certain areas, such as apartment complexes or airports, may be influenced by considerations such as space availability and leasing agreements.

**10.Impact of COVID-19:** The ongoing pandemic may continue to influence customer behaviors and tastes, thereby hurting demand for self-service vending solutions.

**11.Legal Considerations for Alcohol:** Selling alcoholic beverages in vending machines may be subject to stringent regulatory regulations, such as age verification and licensing, which may limit the feature's deployment.

# Funding

**Funding Status:** The iVending project's funding is still in the planning stages. The management team is actively looking at several funding options to help with the development and execution of the smart vending machine program.

**Potential funding sources include:**

**Individual Investors:**

Seek funding from private individuals or venture capital firms interested in helping innovative enterprises such as iVending Incorporated.

**Investors in the form of angels:**

Approach high-net-worth individuals who are prepared to fund the company in exchange for stock or ownership.

**Grants and Contests:**

Apply for business grants, innovation competitions, and startup accelerators that offer financial assistance to emerging enterprises in the technology and consumer services sectors.

**Campaigns for Crowdfunding:**

Launch crowdfunding campaigns on platforms such as Kickstarter or Indiegogo to gather funds from a large number of individual backers interested in the notion of smart vending machines.

**Bank Loans or Credit Lines:**

Secure loans or lines of credit from financial institutions to fund the vending machine's initial research, production, and deployment.

**Strategic Alliances:**

Investigate possible collaborations with firms or organizations who share iVending's goals and potentially give funds or resources in exchange for mutual advantages.

**Grants & Programs from the Government:**

Examine available government grants, subsidies, or programs that encourage technological innovation and entrepreneurship in the consumer services market.

Sponsorship Programs or Corporate Sponsorship:

Collaborate with established companies in the vending or consumer products industries to create sponsorship or co-development opportunities.

**Crowdfunding for Equity:**

Use equity crowdfunding platforms to distribute ownership stakes in iVending Incorporated to a diverse group of investors.

**Founders' own investments:**

Consider contributions from the project's founders and early team members.

**Early Adopters' Revenue:**

Offer potential client’s early access or pre-sales of iVending equipment to generate initial revenue.

# Known Impacts

The following groups will be impacted because of this project:

|  |  |
| --- | --- |
| **Who** | **How** |
| <Business Partners> | Establishing contractual ties and agreements for the delivery of food, snacks, and drinks to iVending Incorporated will have an impact on business partners such as distributors and prospective third-party suppliers. |
| <Business Units> | Various business departments within iVending, including Operations, Accounting, Marketing, and IT, will be directly impacted by the deployment of the smart vending machine program. This involves machine installation and maintenance, inventory management, customer loyalty programs, and technology infrastructure. |
| <Customers> | Customers, both known and unknown, will benefit from improved access to high-quality meals, snacks, and beverages via iVending devices. They will also benefit from the loyalty program, which will allow them to accumulate points and gain discounts on future purchases. |
| <Third-parties> | Forming contractual arrangements with iVending Incorporated to supply the vending machines with a selection of food, snack, and drink goods will have an impact on third-party distributors and potential suppliers. |
| <Processors> | Implementing systems and standards to efficiently manage the iVending machines and their contents will have an influence on the Operations Department, which is in charge of equipment installation, maintenance, and inventory management. |
| <Other> | Customers and personnel will benefit from public health and safety precautions such as the disinfection program activated following a customer's exit, delivering a safer vending experience. |

Appendix A – Risk Types

| **Risk Type** | **Definition** |
| --- | --- |
| Association Risk | Organizational forces that could either significantly change the fundamental structures that drive overall objectives and strategies or impair its business viability.  Significantly impacts the ability to deliver fundamental service offerings or impair its business viability.  Same as Enterprise Risk |
| Availability Risk | Interruption of access to important information, software, services or resources |
| Business Operations Risk | Business processes do not achieve the objectives they were designed to achieve in supporting business model. |
| Business Risk | Identifies the risk to the business of doing a project or not doing a project. |
| Confidentiality Risk | Unauthorized disclosure or viewing of data/information |
| Enterprise Risk | Organizational forces that could either significantly change the fundamental structures that drive overall objectives and strategies or impair its business viability.  Significantly impacts the ability to deliver fundamental service offerings or impair its business viability.  Same as Association Risk |
| Environment Risk | External forces that could either significantly change the fundamental assumptions that drive overall objectives and strategies or threaten its business model. |
| Financial Risk | The risk of business model, or a particular business function not resulting in profitability or financial viability for or its business partners, given the current business environment. (Same as Business Risk) |
| Fraud Risk | The specific risk that a product or service could provide a potential increase in fraudulent transactions. |
| Identification Risk | Communicating parties that are not sufficiently authenticated to ensure that their identity is correct. This may lead to unauthorized parties having access to systems, applications or data/information. |
| Information Risk | Any risk of unauthorized access, viewing, modification or rendering inaccessible information assets of the Enterprise. |
| Integrity Risk | Undetected modification of data/information either malicious or accidental. |
| Legal Risk | The risk that business practices might contribute to increased exposure of lawsuits or legal liability. |
| Market Risk | The risk of being slow or unable to adapt to economic or industry changes, or competitive forces. |
| Non-Compliance Risk | Stems from violations of, or nonconformance with internal policies & procedures and external laws, rules, regulations, industry practices, or ethical standards. |
| Operational Risk | Stems from operational inadequacies with affect to product or service delivery, aka, Business Operations Risk |
| Organizational Risk | Organizational dependencies that could either significantly impact the ability to deliver fundamental service offerings or impair its business viability. |
| Project Risk | A risk to the successful completion of the project. |
| Regulatory Risk | The risk that business practices might contribute to increased regulatory non-compliance or non-compliance with applicable laws and legislation. |
| Residual Risk | The amount of risk that remains after all mitigation is performed. Residual Risk tends to grow over time. |
| Settlement Risk | Stems from the inability of parties to meet their legitimate financial and settlement obligations in a timely manner. Settlement risks include both short-term liquidity problems and possible long-term loss of capital. |
| Strategic Risk | Stems from poor business decisions, or improper implementations of those decisions. |
| Technology Risk | Arises when information technologies do not operate as intended or compromise the integrity and reliability of transaction processing services or when system development activities do not sustain the evolution of service offerings. |
| Third-Party Risk | The financial, brand or compliance exposure that exists when a third-party lacks sufficient controls to protect data, systems, products or services. Includes risk of vendor financial insolvency or risk of a vendor not adhering to specific security or business commitments in their contract. |