

# Bank Agent Criteria and Internal Policies

The below criteria have been used for all the bank agents. We have changed the config files for changing the internal policies of the banks.

All the internal policies of the banks has been summarized at the end of this document.

## Part 1: Defining the Bank's Internal Policies

Before writing any code, you need to define your bank's "personality" and risk appetite. This should be a configuration file (e.g., config.yaml or config.json) that your agent can read. This makes your agent's logic transparent and easy to modify.

Here are suggested policies to define, based on the problem statement<sup>1</sup>:

### 1. Risk Appetite & Eligibility:

- **Permitted Industries:** A list of industry\_code values (NAICS/SIC) that your bank is willing to lend to.
- **Restricted Industries:** A list of industries you will automatically reject (e.g., weapons manufacturing, gambling).
- **Loan Amount Limits:**
  - min\_loan\_amount: Minimum amount you will consider.
  - max\_loan\_amount: Maximum amount you are willing to lend.
- **Geographic Focus:** A list of acceptable jurisdiction values.

### 2. Financial Health Thresholds:

- **Minimum Annual Revenue:** The minimum financials\_annual\_revenue a company must have.
- **Maximum Debt-to-Asset Ratio:** A threshold for financials\_liabilities\_total / financials\_assets\_total. If the company's ratio is higher, they might be considered too risky.
- **Minimum Credit Score:** A threshold for an internal or external credit score<sup>2</sup>. Since you'll use synthetic data, you can create a simple internal scoring model.

### 3. Interest Rate Calculation Model:

Your interest rate will be the core of your offer. A good model is:

InterestRate\_final=BaseRate+RiskPremium-ESGDiscount

- **BaseRate:** A fixed base interest rate (e.g., 5.0%).
- **RiskPremium:** An additional rate based on risk factors. You can define tiers:

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### A More Realistic Risk Premium Model

Instead of broad tiers, this model quantifies risk by scoring key financial health indicators and combining them into a single, weighted score.

## Step 1: Identify Key Financial Metrics

First, your agent should calculate key financial ratios using the data provided in the Intent<sup>1</sup>:

- **Profitability Margin:** financials\_net\_income / financials\_annual\_revenue
- **Leverage (Debt-to-Asset Ratio):** financials\_liabilities\_total / financials\_assets\_total
- **Company Scale:** financials\_annual\_revenue

## Step 2: Define a Scoring Rubric (1-5 points)

Next, create a scoring system for each metric. A higher score indicates lower risk.

Metric	Score = 5 (Very Low Risk)	Score = 3 (Avg. Risk)	Score = 1 (Very High Risk)
<b>Profitability</b>	> 20% margin	5% - 10% margin	< 0% margin (loss)
<b>Leverage</b>	< 0.2 ratio	0.4 - 0.6 ratio	> 0.8 ratio
<b>Scale</b>	> \$50M revenue	\$5M - \$10M revenue	< \$1M revenue

You can define the intermediate scores (4 and 2) logically between these benchmarks.

## Step 3: Assign Weights to Each Metric

Assign a weight to each metric based on its importance in determining credit risk. The weights must sum to 100%.

Metric	Weight	Rationale
Profitability Margin	40%	A direct measure of operational efficiency and ability to generate profit.
Leverage (Debt-to-Asset)	40%	Indicates how much the company relies on debt; high leverage is a major risk factor.
Company Scale	20%	Larger, more established companies are generally more stable.

## Step 4: Calculate the Final Risk Premium

1. Calculate the Weighted Risk Score: Use the scores and weights to get a final risk score between 1 and 5.

$$\text{WeightedRiskScore} = (\text{ScoreProfitability} \times 0.4) + (\text{ScoreLeverage} \times 0.4) + (\text{ScoreScale} \times 0.2)$$

2. **Map Score to Premium:** This final score maps directly to the interest rate premium. A lower score results in a higher premium.

Weighted Risk Score	Risk Category	Risk Premium to Add
4.5 - 5.0	Excellent	+0.50%
3.5 - 4.49	Good	+1.25%
2.5 - 3.49	Average	+2.75%
1.5 - 2.49	Sub-par	+4.50%
< 1.5	High-Risk	<b>Reject or +6.00% (Manual Review)</b>

### Example Calculation

Let's say a company agent sends an Intent with the following financials:

- Annual Revenue: \$8M
- Net Income: \$480,000
- Total Assets: \$10M
- Total Liabilities: \$5M

#### Your agent's calculation:

##### 1. Metrics:

- Profitability:  $\$480k / \$8M = 6\%$
- Leverage:  $\$5M / \$10M = 0.5$
- Scale: **\$8M**

##### 2. Scoring:

- Profitability Score = **3 points** (since 6% is between 5-10%)
- Leverage Score = **3 points** (since 0.5 is between 0.4-0.6)
- Scale Score = **3 points** (since \$8M is between \$5M-\$10M)

##### 3. Weighted Score:

- $\text{WeightedRiskScore} = (3 * 0.4) + (3 * 0.4) + (3 * 0.2)$
- $= 1.2 + 1.2 + 0.6 = \mathbf{3.0}$

**4. Final Risk Premium:**

- A score of 3.0 falls into the "Average" risk category.
- The resulting **Risk Premium is +2.75%**.

This premium would then be added to your

BaseRate before subtracting any ESGDiscount to get the final interest rate for the offer<sup>222</sup>. This method provides a clear, data-driven, and auditable trail for how your agent arrived at its pricing decision<sup>3</sup>.

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- **ESGDiscount:** A rate reduction based on the company's ESG performance. This is the "carbon-adjusted" component<sup>3</sup>.

## A Realistic ESG Scoring and Discount Model

This approach breaks down the ESG assessment into two main pillars: a quantitative score based on carbon performance and a qualitative score based on certifications and governance.

### **Step 1: The Quantitative Pillar (Carbon Performance Score)**

This is the core of the "carbon-adjusted interest rate"<sup>1</sup>. The goal is to measure how carbon-efficient a company is compared to its industry peers.

1. **Extract Data:** Use the LLM to parse the company's `esg_reporting_url`<sup>2</sup> to get two key figures:
  - Total annual emissions (Scope 1, 2, and 3).
  - Total annual revenue.

2. **Calculate Financed Emissions Intensity:**

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3. **Compare to Industry Benchmark:** A company's emissions intensity is only meaningful in context. Your agent's internal policies (`config.yaml`) should include industry benchmarks.

Industry Code (NAICS)	Industry Name	Benchmark Intensity (tons / \$M revenue)
5415XX	Software Development	10
311XXX	Food Manufacturing	250
441XXX	Auto Dealerships	80

4. **Calculate the Carbon Performance Score (out of 100):** Score the company based on how much better or worse its intensity is compared to the benchmark.

Performance vs. Benchmark	Carbon Score
> 50% Better	100
25% - 50% Better	85
0% - 25% Better	70
0% - 20% Worse	50
> 20% Worse	30

### Step 2: The Qualitative Pillar (Certifications & Governance Score)

This pillar rewards proactive ESG management and good governance.

1. **Analyze Certifications:** Your agent will parse the `esg_certifications` field from the Intent<sup>3</sup>. Award points for recognized certifications defined in your bank's policies.

Certification	Points Awarded
B Corp Certification	40
ISO 14001	25
Science Based Targets initiative (SBTi)	25
SA8000 (Social Accountability)	10

2. **Calculate the Qualitative Score (out of 100):** Sum the points from the certifications. You can cap the maximum score at 100.

### Step 3: Calculating the Final Weighted ESG Score

Combine the two scores using weights that prioritize the quantitative carbon data, as this directly relates to the "carbon-adjusted" requirement.

- **Carbon Performance Score Weight:** 70%

- **Qualitative Score Weight:** 30%
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#### **Step 4: Mapping the ESG Score to a Financial Discount**

Finally, translate the single ESG score into a tangible interest rate discount. This creates a direct financial incentive for companies to improve their ESG performance.

Final ESG Score	ESG Category	Interest Rate Discount
90 - 100	ESG Leader	<b>-0.75%</b>
75 - 89	ESG Strong Performer	<b>-0.50%</b>
50 - 74	ESG Average Performer	<b>-0.25%</b>
< 50	ESG Laggard	<b>-0.00% (No discount)</b>

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#### **Example Calculation**

A Food Manufacturing company applies for a loan.

- **From LLM (parsing esg\_reporting\_url):**
  - Revenue: \$100M
  - Emissions: 20,000 tons
- **From Intent (esg\_certifications field):** "B Corp Certification, ISO 14001" <sup>4</sup>

Your agent's calculation:

1. **Carbon Performance:**
  - Emissions Intensity =  $20,000 / 100 = \mathbf{200 \text{ tons} / \$M}$
  - Industry Benchmark (Food Mfg.) = **250 tons / \$M**
  - The company is **20% better** than the benchmark  $((250-200)/250)$ .
  - **Carbon Performance Score = 70**
2. **Qualitative Performance:**
  - B Corp (40 pts) + ISO 14001 (25 pts) = **65 points**
  - **Qualitative Score = 65**
3. **Final Weighted ESG Score:**
  - Final ESG Score =  $(70 * 0.7) + (65 * 0.3)$

- = 49 + 19.5 = **68.5**

#### 4. Final ESG Discount:

- A score of 68.5 falls into the "ESG Average Performer" category.
- The resulting **ESG Discount is -0.25%**.

This discount is then applied to the interest rate after the risk premium has been added, creating a comprehensive and justifiable final offer.

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## Part 2: Bank Agent Workflow and Criteria

This is the step-by-step logic your agent will execute when it receives an Intent<sup>4</sup>.

### Step 1: Ingest and Verify the Intent

1. **Listen for Request:** Set up a web server (e.g., using Flask or FastAPI in Python) that accepts a signed JSON Intent via a POST request<sup>5</sup>.
2. **Verify Signature:** Fetch the sender's public key from the `sender_public_jwk_url` provided in the Intent<sup>6</sup>. Use this key to verify the signature. If verification fails, reject the request immediately. This asserts the client's identity<sup>7</sup>.
3. **Prevent Replay Attacks:** Check the nonce and `intent_id` against a database of previously processed intents. If it's a duplicate, reject it.
4. **Log Identity Verification:** Create an audit log entry stating how the sender's identity was verified<sup>8</sup>.

### Step 2: Data Enrichment and Pre-Processing

1. **ESG Data Extraction:** The Intent contains an `esg_reporting_url`<sup>9</sup>.
  - Your agent should programmatically access this URL. (For the hackathon, this can be a URL pointing to a simple text file in your repo).
  - Use the provided LLM API (Tachyon)<sup>10</sup> to parse this report.

Your prompt should be: *"From the following ESG report, extract the total Scope 1, Scope 2, and Scope 3 emissions in tons of CO2e and the company's total annual revenue."*

2. **Calculate Carbon Metrics:** Based on the extracted data, calculate key metrics needed for your policy:
  - **Financed Emissions Intensity** = (Total Emissions) / (Annual Revenue in \$M). This is crucial for calculating the carbon-adjusted interest rate<sup>11</sup>.
3. **Internal Credit Score:** Generate a simple credit score. For example: Score = (Net Income / 10000) + (Assets / Liabilities \* 10). This is a synthetic score based on available financials<sup>12</sup>.

### Step 3: Policy Evaluation (The Decision Engine)

This is where you apply your internal policies from Part 1 to the Intent data.

## 1. Initial Knockout Criteria:

- Check if industry\_code is in your restricted list.
- Check if jurisdiction is one you operate in.
- Check if the requested amount\_value is within your min\_loan\_amount and max\_loan\_amount.
- **If any check fails**, generate a rejection response and log the reason.

## 2. Financial Health Check:

- Compare financials\_annual\_revenue to your minimum threshold.
- Calculate the Debt-to-Asset ratio and compare it to your policy.
- Compare your calculated internal credit score to your minimum threshold.
- **If any check fails**, reject or, for a more advanced agent, counter-offer with a smaller loan amount.

## 3. Log All Steps: For each check, create a trace log explaining the decision, which is a hackathon requirement<sup>13</sup>. Example:

"Check: Annual Revenue. Value: \$5M. Threshold: \$2M. Result: PASS."

Step 4: Calculate and Assemble the Offer

If all checks pass, you can now construct the offer<sup>14</sup>.

### 1. Calculate the Interest Rate: Apply your formula:

- Start with the BaseRate.
- Add the RiskPremium based on which financial tier the company falls into.
- Subtract the ESGDiscount by comparing their calculated Financed Emissions Intensity to your policy's benchmark.

### 2. Generate ESG Summary: Use the LLM again<sup>15</sup>.

- **Prompt:** "You are a bank's AI agent. Based on the following data [company's emissions, certifications, Financed Emissions Intensity], write a clear, human-readable ESG summary<sup>16</sup> for a loan offer. Highlight how their positive ESG profile resulted in a favorable interest rate."

### 3. Determine Final Terms: Decide on the amount\_approved and repayment\_period<sup>17</sup>.

To determine final approved amount follow this:

Of course. To enable your bank agent to approve lesser amounts based on risk, you can implement a **Dynamic Lending Ratio** model. This model calculates the maximum amount your bank is willing to lend based on a combination of the company's revenue, its financial risk score, and its ESG score.

This model determines the **Maximum Approved Amount** by adjusting a baseline lending percentage based on the specific risk and ESG profile of the applicant.

### Step 1: Establish a Base Lending Ratio

First, define a baseline for how much you're willing to lend, expressed as a percentage of a company's annual revenue. This should be part of your bank's internal policies.

- **Base Lending Ratio:** 15% of financials\_annual\_revenue<sup>1</sup>.
  - *Rationale:* A line of credit is typically a fraction of a company's annual revenue, covering short-term operational needs. 15% is a reasonable starting point for an average-risk company.

### Step 2: Calculate Financial Risk and ESG Adjustments

Next, use the **Weighted Risk Score** and **Final ESG Score** you've already calculated to determine adjustments to this base ratio. A better score results in a positive adjustment, allowing for a larger loan.

Financial Risk Adjustment (Based on your 1-5 Weighted Risk Score):

Weighted Risk Score	Risk Category	Adjustment to Ratio
:---   :---   :---		
4.5 - 5.0   Excellent   +5.0%		
3.5 - 4.49   Good   +2.5%		
2.5 - 3.49   Average   +0.0%		
1.5 - 2.49   Sub-par   -5.0%		
< 1.5   High-Risk   -10.0%		

ESG Opportunity Adjustment (Based on your 0-100 Final ESG Score):

Final ESG Score	ESG Category	Adjustment to Ratio
:---   :---   :---		
90 - 100   ESG Leader   +2.5%		
75 - 89   ESG Strong   +1.5%		
50 - 74   ESG Average   +0.0%		
< 50   ESG Laggard   -1.0%		

### Step 3: Determine the Maximum Approved Amount

Now, combine these elements to calculate the maximum amount your bank is willing to approve.

1. Calculate the Adjusted Lending Ratio:

$$\text{AdjustedLendingRatio} = \text{BaseRatio} + \text{FinancialRiskAdjustment} + \text{ESGAdjustment}$$

2. Calculate the Maximum Approved Amount:

MaximumApprovedAmount=financials\_annual\_revenue×AdjustedLendingRatio

#### Step 4: The Final Decision Logic

The agent's final step is to compare the calculated maximum amount with the amount the company requested in its Intent<sup>2</sup>.

This logic ensures you never lend more than you've deemed safe, but you fulfill the client's request if it's within your calculated risk appetite.

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#### Example Walkthrough

A company submits an Intent with the following details:

- **Requested Amount:** \$1,000,000 <sup>3</sup>
- **Annual Revenue:** \$5,000,000 <sup>4</sup>
- **Calculated Weighted Risk Score:** 2.8 (Average)
- **Calculated Final ESG Score:** 92 (ESG Leader)

#### Your agent's decision process:

1. **Base Ratio:** Starts at 15%.
2. **Adjustments:**
  - **Financial Risk Adjustment:** A score of 2.8 is "Average," so the adjustment is **+0.0%**.
  - **ESG Adjustment:** A score of 92 is an "ESG Leader," so the adjustment is **+2.5%**.
3. **Calculations:**
  - **Adjusted Lending Ratio** = 15% + 0.0% + 2.5% = **17.5%**
  - **Maximum Approved Amount** = \$5,000,000 \* 0.175 = **\$875,000**
4. **Final Decision:**
  - The agent compares the **Requested Amount (\$1,000,000)** to the **Maximum Approved Amount (\$875,000)**.
  - Since the requested amount is higher than the calculated maximum, the agent approves the lower amount.
  - **Final Approved Amount = \$875,000.**

This amount would then be included in the signed Offer Packet your agent sends back, providing a risk-adjusted offer rather than a simple rejection.

To arrive upon a final repayment duration follow below:

Here is a structured, policy-driven method for your bank agent to determine the final approved repayment period.

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## **Step 1: Define Internal Policies for Repayment Periods**

Your agent's decision should be guided by a configuration file that defines the bank's lending standards. This involves two main criteria: the loan's purpose and the borrower's risk profile.

### **A. Policies Based on Loan Purpose**

Different loan purposes carry different risk profiles and expectations for repayment timelines. The agent should first check the

purpose field from the Intent<sup>2</sup> against its internal policy.

Policy Table Example (config.yaml):

Loan Purpose	Max Duration (Months)	Min Duration (Months)
working capital	36	12
inventory financing	24	6
equipment purchase	60	24
business expansion	84	36

### **B. Policies Based on Financial Risk**

Next, your agent should adjust the maximum allowed duration based on the borrower's calculated **Weighted Risk Score**. Higher-risk clients should be offered shorter terms to limit the bank's long-term exposure.

1. First, calculate the **Final Approved Amount** using the Dynamic Lending Ratio model.
2. Then, use that amount (along with purpose and risk) to determine the **Repayment Duration**.

Risk-Based Term Adjustment Table:

Risk Category	Weighted Risk Score	Duration Adjustment
Excellent	4.5 - 5.0	No adjustment
Good	3.5 - 4.49	Cap duration at 90% of policy maximum
Average	2.5 - 3.49	Cap duration at 75% of policy maximum
Sub-par	1.5 - 2.49	Cap duration at 50% of policy maximum
High-Risk	< 1.5	Reject or manual review

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## **Step 2: The Decision Logic**

With these policies in place, the agent can follow a clear, auditable logic to arrive at the final repayment period.

1. **Identify Request:** Get the company's preferred repayment\_duration from the Intent<sup>3</sup>.
  2. **Determine Policy Max:** Look up the maximum duration from the *Loan Purpose Policy Table* based on the request's purpose<sup>4</sup>.
  3. **Calculate Risk-Adjusted Max:** Calculate the maximum duration allowed based on the *Risk-Based Term Adjustment Table*.
  4. **Finalize Bank's Maximum Term:** The bank's absolute maximum term for this specific client is the lower of the two values calculated in steps 2 and 3.
  5. **Make Final Decision:** The approved repayment period is the shorter of the company's requested duration and the bank's finalized maximum term.
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### Example Walkthrough

#### Scenario 1: Low-Risk Client

- **Intent:** Requests repayment\_duration of **48 months** for equipment purchase<sup>5</sup>.
  - **Agent's Analysis:** Calculated Weighted Risk Score is **4.6 (Excellent)**.
1. **Client Request:** 48 months.
  2. **Policy Max:** For equipment purchase, the max is **60 months**.
  3. **Risk-Adjusted Max:** The risk is "Excellent," so there is no adjustment. The max remains **60 months**.
  4. **Bank's Final Max:**  $\min(60, 60) = 60 \text{ months}$ .
  5. **Final Decision:**  $\min(48, 60) = \mathbf{48 \text{ months}}$ .
    - **Result:** The agent approves the requested 48 months as it falls comfortably within its policy and risk limits.

#### Scenario 2: Average-Risk Client

- **Intent:** Requests repayment\_duration of **60 months** for equipment purchase<sup>6</sup>.
  - **Agent's Analysis:** Calculated Weighted Risk Score is **3.0 (Average)**.
1. **Client Request:** 60 months.
  2. **Policy Max:** For equipment purchase, the max is **60 months**.
  3. **Risk-Adjusted Max:** The risk is "Average," so the duration is capped at 75% of the policy max.  
 $60 * 0.75 = \mathbf{45 \text{ months}}$ .
  4. **Bank's Final Max:**  $\min(60, 45) = \mathbf{45 \text{ months}}$ .
  5. **Final Decision:**  $\min(60, 45) = \mathbf{45 \text{ months}}$ .

- **Result:** The agent cannot approve the requested 60 months due to the company's risk profile. It counters with an offer of 45 months, which is a key negotiable term for the consumer agent to evaluate<sup>7</sup>.
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### **Part 3: The Loan Offer Structure (Response)**

The inputs can be divided into two categories: data about the company's profile and data about the bank's specific offer.

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#### **## Company-Specific ESG Data (The "Why")**

This information provides the context for *why* the company is receiving certain terms.

- **Company Name and Industry:** For personalization and context (e.g., "As a leader in the software industry...").
  - **Final ESG Score:** The overall score (e.g., 92/100) that quantifies their ESG standing.
  - **Key ESG Metrics:** The specific data points that prove their performance.
    - **Calculated Emissions Intensity:** The company's actual carbon efficiency number.
    - **Industry Benchmark Intensity:** The average for their industry, used for comparison.
  - **Positive ESG Qualifiers:** Specific achievements to highlight.
    - **ESG Certifications:** A list of their certifications (e.g., 'B Corp Certification', 'ISO 14001').
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#### **## Bank's Offer-Specific Data (The "What")**

This information provides the tangible outcome or "impact" of the company's ESG profile on this specific line of credit<sup>2</sup>.

- **ESG Interest Rate Discount:** The exact percentage discount applied (e.g., -0.75%). This is the most critical input.
- **Final Interest Rate:** The resulting interest rate after the discount.
- **Final Approved Amount:** The amount of credit being extended.
- **Loan Purpose:** The intended use of the funds, allowing the LLM to frame the summary positively (e.g., "...to support your sustainable growth.").

## Bank Internal Policies:

### Bank 1 (Conservative/Safe Bank)

- Strict requirements, low risk tolerance
- \$5M min revenue, 5 years in business, 700+ credit score
- Lower credit limits, higher collateral requirements
- Prohibits high-risk industries

### Bank 2 (Balanced/Moderate Bank)

- Moderate requirements and balanced approach
- \$2M min revenue, 3 years in business, 650+ credit score
- Reasonable limits and standard terms
- Selective industry restrictions

### Bank 3 (Aggressive/High-Risk Bank)

- Lower barriers, higher risk tolerance
- \$500K min revenue, 1 year in business, 550+ credit score
- Higher credit limits, relaxed requirements
- Minimal restrictions

### Bank 4 (Specialty/Niche Bank) - NEW

- Focus: Tech startups, innovation, and emerging businesses
- Unique approach: Very flexible requirements but higher interest rates (12% base)
- Key features:
- \$250K min revenue, 1 year in business, 580+ credit score
- Up to 50% of revenue in credit limits
- Favors tech, fintech, AI, biotech, renewable energy (LOW risk)
- Accepts cryptocurrency businesses (MEDIUM risk)
- Minimal collateral requirements (110% coverage)
- Virtual-first approach with minimal site visits

### Bank 5 (Ultra-Premium Bank) - NEW

- Focus: Fortune 500 companies and established blue-chip businesses

- Unique approach: Extremely strict requirements but best rates (4.5% base)
- Key features:
- \$100M min revenue, 10 years in business, 750+ credit score
- Only 5% of revenue in credit limits but up to \$100M absolute
- Favors utilities, healthcare, pharmaceuticals, consumer staples
- Prohibits startups, VC-backed companies, hospitality, real estate development
- Premium rates with negative risk premiums for best industries
- Always requires audited statements and site visits
- High approval limits (\$100M loan committee limit)

Each bank now serves a distinct market segment:

- Bank 1: Risk-averse traditional lending
- Bank 2: Mainstream commercial banking
- Bank 3: High-risk, high-reward lending
- Bank 4: Innovation and startup financing
- Bank 5: Enterprise and Fortune 500 financing

The five banks provide a comprehensive spectrum of lending approaches, from ultra-conservative to startup-friendly to ultra-premium enterprise lending.