AI Sourcing Agent – Detailed Requirement Document

1. Concept Overview: Attribute-Based SKU Matching via PIM

The **AI Sourcing Agent** is designed to **automate and optimize procurement** by dynamically **matching BOQ items to pre-filtered PIM data** while ensuring **traceability, accuracy, and efficiency**. Instead of performing product filtering, the AI **leverages structured PIM attributes** to match user requirements with **the most relevant SKU variations**.

Key Features of Attribute-Based SKU Matching:

✅ **Extracts all product attributes from BOQ input** (structured BOQs, free-text queries, or tender-style descriptions).
✅ **Retrieves attribute variations from PIM** and **only prompts for missing or ambiguous details**.
✅ **Ensures category-wise group-level brand recommendations** to streamline multi-line procurement.
✅ **Generates traceable draft quotations**, linking **original BOQ text to matched SKUs** without altering input data.

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2. System Architecture & Data Flow

The **AI Sourcing Agent** functions as an **intelligent layer over the PIM & backend system**, dynamically interpreting **filtered** data and structuring procurement queries.

System Workflow:

1. **User Input (BOQ / Free-Text Query) → AI Classifies BOQ Type**
2. **AI Extracts Product Attributes → Fetches Attribute Variations from PIM**
3. **AI Detects Missing Specifications → Prompts Dynamic Clarifications via Multiple-Choice Questions**
4. **AI Matches Extracted Attributes to SKU Variations → Finds Best SKU**
5. **AI Groups Items by Category → Suggests Brands at the Category Level**
6. **AI Generates Category-Wise Draft Quotations → User Reviews & Finalizes**

System Components & Flow

Component	Function
BOQ Classification Engine	Detects whether BOQ is structured, tender-based, or hybrid.
Entity Extraction Module	Extracts product type, quantity, compliance, and specifications.
Attribute Fetcher	Fetches all possible variations from PIM for attribute-based SKU matching.
Clarification Engine	Generates dynamic multiple-choice questions for missing specifications.
Group-Level Brand Selection Module	Recommends brands for categories instead of per item.
SKU Matching Engine	Maps extracted attributes to the most relevant SKUs.
Draft Quotation Generator	Generates traceable draft quotations with BOQ text & SKU links.

3. Step-by-Step Workflow for AI Query Processing

Step 1: User Submits Requirement

Input Type	Examples	Processing Approach
Structured BOQ Upload	Excel, PDF BOQ with itemized product details.	Extract structured data directly.
Text-Based Tender BOQ	Free-text procurement descriptions.	NLP to extract product details.
Chat-Based Query	"I need 500M of 25mm pipes."	NLP to extract product type, quantity, specifications.

Step 2: BOQ Categorization & Attribute Extraction

- AI **groups products by category** (e.g., Electrical, Plumbing, Structural).
- Extracts **attributes from BOQ input** without modification.
- Fetches **product attribute variations from PIM**.

BOQ Item	Extracted Attributes from BOQ	Fetched Variations from PIM
3.5 Core, 300 Sq.mm XLPE Cable	Core: 3.5, Size: 300 Sq.mm, Insulation: XLPE	Voltage: 1.1kV, 3.3kV, 6.6kV, 11kV
25mm GI Pipe	Size: 25mm	Class: Medium, Heavy; Galvanization: Hot-Dip, Pre-Galvanized

Step 3: Dynamic Clarification for Missing Attributes

BOQ Item	AI Clarification Required?	Why?	Prompt Example
3.5 Core, 300 Sq.mm XLPE Cable	❌ No	All attributes present in BOQ.	No prompt needed.
25mm GI Pipe	✅ Yes	No class (Medium/Heavy) mentioned.	*"Select class for 25mm GI Pipe:"* → Options: Medium / Heavy
250A MCCB	✅ Yes	No pole configuration (3P/4P) provided.	*"Select MCCB configuration:"* → Options: 3P / 4P

Step 4: Group-Level Brand Recommendation

Category	AI Suggested Brands (Based on PIM)	User Prompt
LT Cables & Earthing	Polycab, RR Kabel, KEI	*"Would you like to obtain quotes from these brands for all LT cables?"*
Plumbing Materials	Finolex, Supreme, Astral	*"Would you like to source all plumbing materials from these brands?"*

Step 5: SKU Matching via Attribute Mapping

BOQ Item	Extracted Attributes	Final Matched SKU (From PIM)
3.5 Core, 300 Sq.mm XLPE Cable	Core: 3.5, Size: 300 Sq.mm, Insulation: XLPE, Voltage: 1.1kV	SKU: **FRLS-3.5C-300-XLPE-1.1KV**
25mm GI Pipe	Size: 25mm, Galvanization: Hot-Dip, Class: Medium	SKU: **GI-25-HDG-M**
250A MCCB	Rating: 250A, Configuration: 3P	SKU: **MCCB-250A-3P**

Step 6: Draft Quotation Generation

- AI generates **category-wise draft quotations** linking **original BOQ text to matched SKUs**.

Example Draft Quotation Output:

json
CopyEdit
```
{
  "quotation_id": "RFQ-2025-PUNE-001",
  "categories": [
```

```
    {
        "category": "LT Cables & Earthing",
        "selected_brands": ["Polycab", "RR Kabel", "KEI"],
        "items": [
            {
                "original_BOQ": "3.5 core, 300 Sq.mm XLPE Cable",
                "matched_sku": "FRLS-3.5C-300-XLPE-1.1KV",
                "brand": "Polycab",
                "quantity": 700,
                "unit": "M"
            }
        ]
    }
  ],
  "status": "Draft"
}
```

4. Edge Case Handling for Advanced Query Parsing

Edge Case	AI Handling Mechanism
BOQ is missing a critical attribute (e.g., MCCB doesn't specify poles)	AI fetches variations from PIM and asks user to confirm.
BOQ is fully detailed and has all attributes defined	AI **does NOT prompt for missing details** and proceeds to SKU matching.
BOQ specifies full work-based procurement (e.g., "Supply & Installation of Fire Fighting System")	AI **breaks down scope** into **sub-components** and ensures all necessary parts are included.
User requests multi-brand quotes	AI **fetches available SKUs per selected brand** and generates a comparative quotation.

Scenario 1: Multi-Category BOQ with Cross-Dependencies

- **User Uploads BOQ**
- **AI Groups Items into Categories (Electrical, Plumbing, Structural).**
- **AI Suggests Category-Wise Brands Instead of Per Item.**
- **AI Prompts Clarifications for Missing Details.**
- **AI Identifies Dependencies (e.g., Fasteners for Steel Items).**
- **Draft Quotations Are Generated Per Category.**
- **User Reviews & Finalizes Quotations.**

Scenario 2: Tender BOQ (Text-Based)

- **User Submits Free-Text Query.**
- **AI Extracts Product Names, Compliance, and Quantities.**
- **AI Asks Clarifications for Missing Details.**

- **AI Groups Items into Categories.**
- **User Selects Preferred Brands Per Category.**
- **Draft Quotation Generated with Original Text References.**

Scenario 3: Bulk Work-Based Procurement

- **BOQ Specifies Full Work Item (e.g., Fire Fighting System).**
- **AI Identifies Required Components (Pipes, Fittings, Valves).**
- **AI Suggests Category-Level Brands.**
- **AI Ensures All Components Are Included.**
- **Draft Quotation Generated.**

Scenario 4: Handling Associated Services & Bundled Items

- **User Uploads BOQ with Service-Linked Items (e.g., Rebar Couplers).**
- **AI Detects Required Services (e.g., Threading, Installation).**
- **AI Suggests Complementary Items (e.g., Fasteners for Structural Steel).**
- **AI Generates Category-Based Quotations with Service Add-Ons.**
- **User Reviews, Modifies, and Finalizes Quotation.**

User Workflow Scenarios with Examples

This section provides **real-world examples** of how the AI Sourcing Agent processes **structured BOQs, tender-style unstructured BOQs, work-based procurement requests, dependency-heavy sourcing, and group-level brand selection**. Each example follows the **step-by-step AI workflow**, demonstrating **attribute-based SKU matching via PIM**, **clarifications using multiple-choice prompts**, and **draft quotation generation**.

🔷 Scenario 1: Processing a Structured Multi-Category BOQ with Cross-Dependencies

Example Use Case

User: Vikram, an Industrial Procurement Manager for a facility in Pune.
BOQ Uploaded:

Sr. No.	Item Description	HSN Code	Quantity	Unit
1	3.5 Core, 300 Sq.mm XLPE Cable	85444999	700	M
2	25mm GI Pipe	73063010	500	M
3	MS Channels for Cable Tray Support	72163100	50	KG
4	M16 Hex Nuts	73181600	100	NOS

Step 1: BOQ Upload & AI Analysis

- The AI **detects a structured BOQ** and categorizes items into:
  - **Electrical:** LT Cables
  - **Plumbing:** Pipes & Fittings
  - **Structural:** Steel & Fasteners

Step 2: Attribute Extraction & Clarifications

BOQ Item	Extracted Attributes from BOQ	Fetched Variations from PIM	AI Prompt (If Needed)
3.5 Core, 300 Sq.mm XLPE Cable	Core: 3.5, Size: 300 Sq.mm, Insulation: XLPE	Voltage: 1.1kV, 3.3kV, 6.6kV, 11kV	✅ *"Please confirm voltage rating: 1.1kV, 3.3kV, 6.6kV, 11kV"*
25mm GI Pipe	Size: 25mm	Class: Medium, Heavy; Galvanization: Hot-Dip, Pre-Galvanized	✅ *"Select class: Medium / Heavy. Select galvanization*

			type: Hot-Dip / Pre-Galvanized."
MS Channels for Cable Tray Support	Material: Mild Steel	Sizes: 75x40mm, 100x50mm, 150x75mm	✅ *"Select size for MS Channels: 75x40mm, 100x50mm, 150x75mm."*

Step 3: Group-Level Brand Recommendation

- The AI **suggests brands per category instead of per item**:
    - **Electrical Components:** *"Would you like to get quotes from Polycab, RR Kabel, or KEI?"*
    - **Plumbing Materials:** *"Would you like to source from Finolex, Supreme, or Astral?"*

User selects brands:

- **Electrical:** Polycab
- **Plumbing:** Finolex
- **Structural:** Tata Steel

Step 4: SKU Matching via Attribute Mapping

BOQ Item	Final Matched SKU (From PIM)	Selected Brand
3.5 Core, 300 Sq.mm XLPE Cable	**FRLS-3.5C-300-XLPE-1.1KV**	Polycab
25mm GI Pipe	**GI-25-HDG-M**	Finolex
MS Channels for Cable Tray Support	**MS-CHNL-100X50-TATA**	Tata Steel

Step 5: Draft Quotation Generation

- AI **creates category-wise draft quotations**, linking **BOQ text to SKU matches**.

Example Draft Quotation Output

json
CopyEdit
```json
{
  "quotation_id": "RFQ-2025-PUNE-001",
  "categories": [
    {
      "category": "LT Cables & Earthing",
      "selected_brands": ["Polycab"],
      "items": [
        {
          "original_BOQ": "3.5 Core, 300 Sq.mm XLPE Cable",
          "matched_sku": "FRLS-3.5C-300-XLPE-1.1KV",
```

```
          "brand": "Polycab",
          "quantity": 700,
          "unit": "M"
        }
      ]
    },
    {
      "category": "Plumbing Materials",
      "selected_brands": ["Finolex"],
      "items": [
        {
          "original_BOQ": "25mm GI Pipe",
          "matched_sku": "GI-25-HDG-M",
          "brand": "Finolex",
          "quantity": 500,
          "unit": "M"
        }
      ]
    }
  ],
  "status": "Draft"
}
```

🔷 Scenario 2: Processing a Free-Text Tender BOQ Query

Example Use Case

User: Meera, a Procurement Manager for a High-Rise Project in Delhi.
User Input:
"We need 1.1 kV FRLS XLPE armoured cables as per IS 7098:1988, 500M. Also, supply fire-rated doors complying with IS 3614."

Step 1: AI Extracts Key Entities

Extracted Entity	Detected Details
Product 1	LT Cables & Earthing
Voltage	1.1 kV
Insulation	FRLS XLPE
Compliance	IS 7098:1988
Product 2	Fire-Rated Doors
Compliance	IS 3614

Step 2: Attribute-Based SKU Matching via PIM

Product	Matched SKU	Brand Recommendation
1.1 kV FRLS XLPE Cable	**FRLS-XLPE-1.1KV-POLYCAB**	Polycab, RR Kabel, KEI

Fire-Rated Door (IS 3614)	FD-IS3614-120M	Godrej, Dorset

Step 3: AI Prompts for Additional Clarifications

Query	AI Prompt

Fire-rated doors *"Please confirm fire rating duration: 60 min / 120 min."*

Step 4: Group-Level Brand Selection & Draft Quotation Generation

- AI suggests **group-level brands** instead of per product.
- User **selects** Polycab for cables and Godrej for doors.
- AI **matches the products**, ensuring compliance with **IS 7098 & IS 3614**.

Example Draft Quotation Output

```json
CopyEdit
{
  "quotation_id": "RFQ-2025-DELHI-002",
  "categories": [
    {
      "category": "LT Cables & Earthing",
      "selected_brands": ["Polycab"],
      "items": [
        {
          "original_BOQ": "1.1 kV FRLS XLPE armoured cable",
          "matched_sku": "FRLS-XLPE-1.1KV-POLYCAB",
          "brand": "Polycab",
          "quantity": 500,
          "unit": "M"
        }
      ]
    },
    {
      "category": "Fire-Rated Doors",
      "selected_brands": ["Godrej"],
      "items": [
        {
          "original_BOQ": "Fire-rated doors complying with IS 3614",
          "matched_sku": "FD-IS3614-120M",
          "brand": "Godrej",
          "quantity": "TBD",
          "unit": "NOS"
        }
      ]
    }
  ],
  "status": "Draft"
}
```

No redundant questions → AI **only asks for missing attributes**.

Smart SKU matching → AI **uses PIM variations for attribute-based SKU selection**.

Group-level brand selection → Eliminates **per-product brand selection**, streamlining bulk procurement.

Traceable draft quotations → Each **BOQ item is linked to its SKU**, ensuring procurement accuracy.

Handles work-based procurement → Ensures **all required components are included for bulk purchases**.