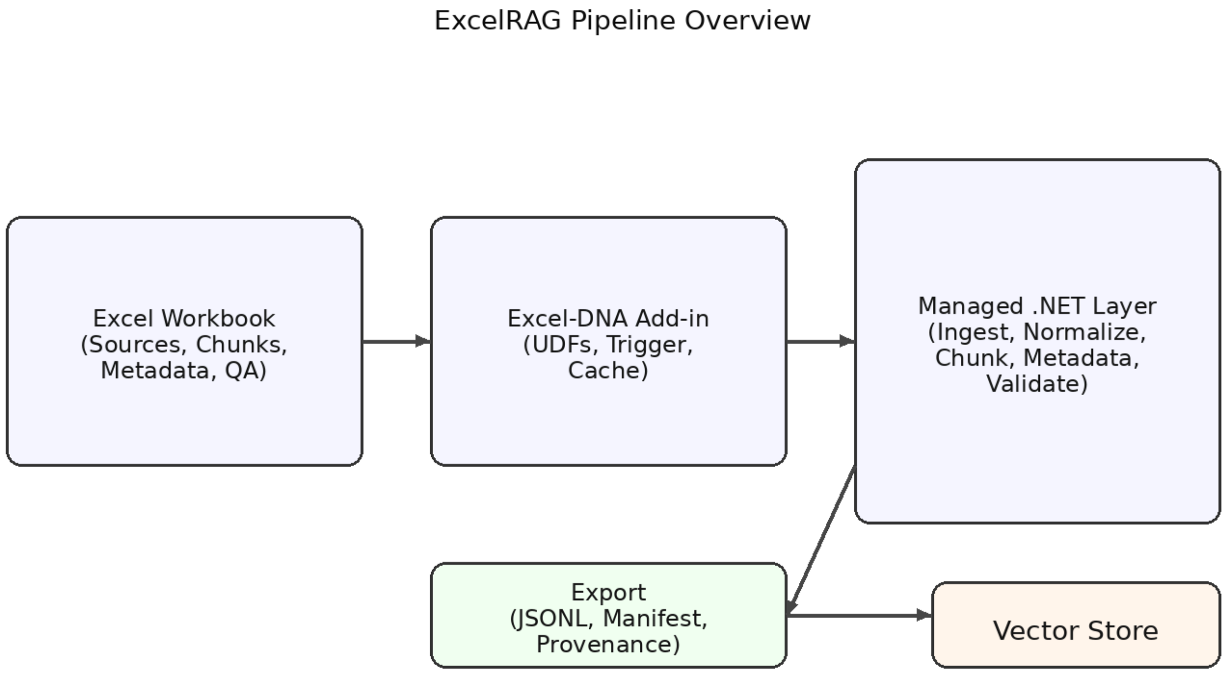
ExcelRAG

> **Turn Excel into a first-class workspace for preparing Retrieval-Augmented Generation (RAG) data — natively, transparently, and at scale.**

Vision


ExcelRAG Pipeline Overview
Excel Workbook (Sources, Chunks, Metadata, QA)
Excel-DNA Add-in (UDFs, Trigger, Cache)
Managed .NET Layer (Ingest, Normalize, Chunk, Metadata, Validate)
Export (JSONL, Manifest, Provenance)
Vector Store

Excel as a visual, auditable RAG preparation pipeline

Diagram note: data flows from Excel tables → Excel-DNA UDFs → managed processing → export packages, keeping every intermediate artifact visible in the worksheet.

ExcelRAG is an Excel-DNA add-in that transforms Excel into a powerful, trustworthy workspace for preparing data used in RAG pipelines. It brings modern data prep and knowledge-curation workflows into Excel while keeping the experience formula-driven, transparent, and fully inspectable.

The guiding idea:

> *If someone already trusts Excel to prepare business data, they should be able to prepare RAG-ready knowledge with the same mental model.*

ExcelRAG is **not** a production RAG engine. It is a **data preparation, governance, and export layer** built for:

- structured content ingestion
- chunking and normalization
- metadata enrichment
- quality checks and audits
- vector-ready export packages

Why Excel for RAG?

Excel already excels at:

- tabular structure and auditability
- formulas for transformation and enrichment
- versioned snapshots of curated knowledge
- collaborative review and approval
- quick visualization and QA checks

What it lacks is RAG-specific tooling:

- document ingestion and parsing
- chunking strategies
- metadata extraction
- deduplication and similarity checks
- vector packaging and export

ExcelRAG fills that gap using **Excel-native UDFs** and a small, explicit processing engine behind the scenes.

Core Design Principles

1) Excel remains Excel

- No VBA macros
- No external Python runtime
- No opaque background automation

Every capability is exposed as **deterministic Excel functions** that are visible, reviewable, and easy to test.

2) Explicit, user-controlled processing

ExcelRAG avoids surprise side effects by requiring a user-controlled **trigger** for any operation that mutates state or performs heavy processing.

```
=RAG.INGEST(source, options, trigger)
=RAG.CHUNK(content, strategy, options, trigger)
```

This matches Excel’s recalculation model and keeps data prep deliberate and auditable.

3) Inspectable, cell-level transparency

Every step produces tangible, inspectable outputs in the grid:

- parsed text and tables
- chunk boundaries
- metadata fields
- token counts
- validation warnings

If it can be used for RAG, it can be **seen and verified** in Excel.

4) RAG-first data quality

ExcelRAG is designed for **clean, consistent, and richly annotated** content. It prioritizes:

- normalization
- traceability to source
- metadata completeness
- data provenance
- export-ready structure

RAG Workflow Support

ExcelRAG supports a typical RAG preparation lifecycle:

1. **Ingest**
    - PDFs, DOCX, HTML, Markdown, CSV, URLs
    - Text extraction with source metadata

2. **Normalize & Clean**

    - whitespace and formatting normalization
    - boilerplate removal
    - table flattening

3. **Chunk**

    - sentence-aware or token-based chunking
    - overlap control
    - section-aware chunking for headings

4. **Enrich Metadata**

    - document titles and sections
    - author/owner fields
    - business tags
    - PII flags or sensitivity levels

5. **Quality Checks**

    - duplicate detection
    - minimum/maximum token constraints
    - missing metadata checks
    - hallucination risk flags (e.g., low coverage)

6. **Package & Export**

    - vector-store friendly JSONL
    - embeddings-ready manifests
    - provenance maps

Key Features (Planned Add-in Functions)

Ingestion & Parsing

- `RAG.INGEST` — import files or URLs with parsing options
- `RAG.EXTRACT_TEXT` — extract text from common document formats
- `RAG.EXTRACT_TABLES` — flatten tables to text or structured ranges

Chunking & Structuring

- `RAG.CHUNK` — generate chunk lists using strategies (sentence, token, heading)
- `RAG.CHUNK_STATS` — token counts, overlap metrics, and coverage
- `RAG.SECTIONS` — parse headings and structure long docs

Metadata & Enrichment

- `RAG.METADATA` — create consistent metadata records
- `RAG.TAG` — generate or validate tags against a taxonomy
- `RAG.PROVENANCE` — map chunks back to source offsets

Quality & Governance

- `RAG.DEDUP` — detect duplicate or near-duplicate chunks
- `RAG.VALIDATE` — rule-based data quality checks
- `RAG.RISK_FLAGS` — highlight content risk or low-coverage areas

Export & Packaging

- `RAG.EXPORT_JSONL` — produce vector-ready export files
- `RAG.EXPORT_MANIFEST` — embeddings manifests with metadata and source links
- `RAG.EXPORT_TRACE` — end-to-end traceability for governance

Ribbon (Planned UI)

ExcelRAG includes a dedicated **RAG** ribbon tab for guided workflows and governance-friendly actions. The ribbon complements UDFs by providing quick actions, templates, and validation panels without hiding any outputs from the worksheet.

Tab: RAG

- **Ingest**
  - Import Files (PDF, DOCX, HTML, MD)
  - Import URL
  - Manage Sources
- **Normalize**
  - Clean Text
  - Remove Boilerplate
  - Flatten Tables
- **Chunk**
  - Sentence-Aware Chunking
  - Token-Based Chunking
  - Preview Chunk Boundaries
- **Metadata**

  - Apply Metadata Template
  - Tag Validation
  - Provenance Mapping

- **Quality**

  - Duplicate Scan
  - Coverage Check
  - Missing Metadata Report

- **Export**

  - Export JSONL
  - Export Manifest
  - Open Export Folder

- **Diagnostics**

  - Processing Log
  - Cache Inspector
  - Settings

The ribbon actions generate or refresh **worksheet tables** so every step remains visible and reviewable.

Example Dataset and UDF Effects

Below is a small example dataset representing three source documents in a worksheet table.

Input: Sources

SourceId	Title	Content	Owner	Tags
DOC-001	Employee Onboarding	Welcome to Contoso. New hires must complete security training within 10 business days.	HR	onboarding;policy
DOC-002	VPN Access	VPN access is required for remote work. Submit the VPN request form and complete MFA setup.	IT	security;remote
DOC-003	Expense Policy	Receipts are required for expenses over $25.Mileageisreimbursedat$0.67 per mile.	Finance	policy;travel

Effect: RAG.CHUNK (sentence-aware, max 40 tokens, overlap 8)

ChunkId	SourceId	ChunkText	TokenCount	OffsetStart	OffsetEnd
CH-0001	DOC-001	Welcome to Contoso. New hires must complete security training within 10 business days.	20	0	97
CH-0002	DOC-002	VPN access is required for remote work. Submit the VPN request form and complete MFA setup.	23	0	101
CH-0003	DOC-003	Receipts are required for expenses over $25.Mileageisreimbursedat$ 0.67 per mile.	22	0	99

Effect: RAG.METADATA (template with SourceId, Title, Owner, Tags, Section=General)

ChunkId	SourceId	Title	Owner	Tags	Section
CH-0001	DOC-001	Employee Onboarding	HR	onboarding;policy	General
CH-0002	DOC-002	VPN Access	IT	security;remote	General
CH-0003	DOC-003	Expense Policy	Finance	policy;travel	General

Effect: RAG.DEDUP (near-duplicate scan, threshold 0.92)

ChunkId	DuplicateGroup	Similarity	Status
CH-0001	G-01	0.18	Unique
CH-0002	G-02	0.22	Unique
CH-0003	G-03	0.20	Unique

Effect: RAG.VALIDATE (rules: minTokens=10, maxTokens=250, tagsRequired=true)

ChunkId	Rule	Result	Notes
CH-0001	TagsRequired	Pass	Tags present
CH-0001	TokenRange	Pass	20 tokens
CH-0002	TagsRequired	Pass	Tags present
CH-0002	TokenRange	Pass	23 tokens
CH-0003	TagsRequired	Pass	Tags present

ChunkId	Rule	Result	Notes
CH-0003	TokenRange	Pass	22 tokens

These tables are meant to illustrate what appears directly in Excel as outputs of key UDFs, enabling quick review before export.

Architecture Overview

```
Excel
 ├─ Worksheets (tables, named ranges, checks)
 ├─ UDFs (RAG.INGEST, RAG.CHUNK, ...)
 │
Excel-DNA Add-in (.xll)
 ├─ Async-safe UDF execution
 ├─ Trigger-aware processing
 ├─ Local cache & registry
 │
Managed .NET Layer
 ├─ Parsing, chunking, metadata
 ├─ Content normalization
 ├─ Validation rules engine
 │
Export Layer
 ├─ JSONL, manifest, provenance
 └─ Vector-store ready packages
```

All logic runs **in-process** with Excel for visibility and speed, while keeping data in the workbook for auditability.

Intended Audience

ExcelRAG is for:

- analysts curating enterprise knowledge
- teams preparing documents for search and RAG
- compliance-minded organizations
- Excel power users who want a transparent, reviewable pipeline

It is **not** for:

- full-scale production inference
- large-scale embedding compute
- real-time RAG orchestration

Status

This project is **experimental and exploratory**.

The goal is to answer one question:

> *What would RAG data preparation look like if it were designed for transparency and governance first?*

See Also

- `ExcelDNA_Best_Practices_and_Architectural_Patterns_2026.md`
- `ExcelDlPlayground/README.md`