# Failure Mode and Cause (FM&C) Document Automation Agent PRD

ESW (Engineering solutions that Work) teams spend significant time manually updating/revising FM&C documents with new data and ensuring everything is logged for compliance in RV&S (Windchill), leading to inefficiencies and errors. The FM&C Automation Agent automates these updates, streamlining workflows and reducing manual effort for document owners and librarians. The solution targets FM&C teams seeking to improve accuracy, save time, and focus on higher-value tasks.

## Goals

### Business Goals

* Reduce manual labor hours spent on FM&C document management by 50% within 3 months.
* Enable faster turnaround for document status updates and reporting.
* Improve input accuracy.
* Increase team productivity and satisfaction by automating repetitive tasks.

### User Goals

* Automate routine updates to FM&C tracking spreadsheets.
* Receive timely, accurate feedback on document status and next steps.
* Minimize errors and inconsistencies in document tracking.
* Easily review and audit changes made by the automation agent.

### Non-Goals

* The agent will not automate document creation or content editing.
* The agent will not integrate with external document management systems in the initial release.
* The agent will not provide advanced analytics or dashboarding beyond Excel outputs.

## User Stories

**Persona 1: Document Owner**

* As a document owner, I want to input and upload bulk content needed to fill a document.
* As a document owner, I want to perform tasks such as; Revise fail modes, create fail modes, remove functions, remove tasks from causes, remove ratings & mech., revise causes, delete causes modes, add tasks to causes, and/or create causes within the excel file.
* As a Document owner, I want to easily revert or audit changes, so that I can ensure compliance and accuracy.

**Persona 2: Librarian**

* As a Librarian, I want to ensure all document updates are logged, so that I can audit changes for regulatory purposes.
* As a Librarian, I want to be able to perform all the functions listed in the document owner’s capabilities within the excel file.

## Functional Requirements

### Excel Integration (Priority: High)

* **Multi-Operation Data Reading:** The agent must read FM&C operation data from multiple worksheets within the template (Create FM's, Remove Ratings & Mech., Create Causes, etc.) and identify which operations contain data to be processed.
* **Bidirectional Data Flow:** After executing RV&S operations, the agent must write generated IDs and status updates back to the Excel template, creating a traceable link between input data and created RV&S objects.
* **Configuration Extraction:** Automatically extract user credentials (WWID), FM&C IDs, and RV&S connection parameters from the "Start Here (Req'd)" worksheet.

### RV&S (Windchill) Integration (Priority: High)

* **Multi-Command Execution:** Execute various RV&S commands including im createcontent (failure modes), im editissue (remove ratings), im createissue (create causes), and other FM&C operations via command-line interface.
* **Response Parsing:** Parse RV&S command outputs to extract newly created object IDs and operation results for writing back to Excel.
* **Connection Validation:** Verify RV&S connectivity and user authentication before executing any operations.

### Data Validation & Error Prevention (Priority: High)

* **Pre-Execution Data Check:** Mandatory validation of all Excel data structure, FM&C references, and cause ID existence in RV&S before executing any operations.
* **Cross-Reference Validation:** Verify all referenced IDs exist in RV&S and are accessible to the user to prevent failed operations.
* **Operation Dependency Checking:** Validate operation sequences and dependencies (e.g., failure modes must exist before creating associated causes).

### User Feedback & Reporting (Priority: High)

* **Real-Time Progress:** Provide command-line progress updates during batch operations, showing current operation status and completion percentage.
* **Error Reporting:** Clear, actionable error messages with specific cell references and remediation guidance when data validation fails.

### Unified Command Interface (Priority: High)

* **Single Script Execution:** One unified script that processes all FM&C operations from a single command, eliminating the need for multiple operation-specific scripts.
* **Dry-Run Capability:** Preview mode that shows exactly what operations will be performed without executing them in RV&S.
* **Operation Selection:** Ability to execute specific operations or all detected operations based on Excel content.

### Performance & Reliability (Priority: Medium)

* **Batch Processing:** Efficiently process one FM&C document with multiple operations per document without timeouts or connection issues.
* **Error Recovery:** Graceful handling of RV&S connection failures with clear indication of completed vs. pending operations.
* **Windows Command-Line Optimization:** Suppress command windows and handle subprocess execution efficiently for Windows environment integration.

### Configuration & Customization (Priority: low)

* **Template Flexibility:** Support for different versions of the FM&C Modification Template with configurable row/column offsets and sheet names.
* **Operation Prioritization:** Configurable execution order for multiple operations to handle dependencies correctly.

## User Experience

**Entry Point & First-Time User Experience**

* Users access the agent via a dedicated Excel add-in or macro-enabled workbook.
* On first use, a brief onboarding guide or tooltip explains how to run the agent and configure rules.
* Users are prompted to review or set up configuration options (e.g., which columns to update, rule definitions).

**Core Experience**

1. **Step 1:** User opens the FM&C tracking spreadsheet in Excel.
   1. User makes edits to the sheet, filling out rows and cells for their desired output.
   2. User then saves the file and exits out of the excel application. The agent will need to run this entire file in the next step.
2. **Step 2:** User navigates to their command prompt application and runs script for the specific excel file.
   * The agent scans the spreadsheet, applies update rules, and processes document statuses.
   * Real-time progress indicator or status bar is shown.
3. **Step 3:** Upon completion, a summary pop-up or message displays the number of updates, errors, and next steps.
   * Users can click to view detailed logs or revert changes if needed.
4. **Step 4:** User reviews changes, addresses any flagged errors, and saves the updated spreadsheet.

**Advanced Features & Edge Cases**

* If the agent encounters locked cells or missing data, it provides specific error messages and skips affected rows.

**UI/UX Highlights**

* High-contrast color coding for errors and updates.
* Simple, intuitive controls with clear labeling.
* Minimal disruption to existing Excel workflows.

### Error Handling, Logging, and Audit Requirements

**Pre-Execution Data Validation**

The system implements mandatory data validation checks before executing any Failure Mode and Cause (FM&C) operations to prevent costly errors in RV&S (Windchill). This validation approach is critical because certain RV&S objects (e.g., Change Configurations) cannot be easily deleted once created.

**Validation Components:**

* **Excel Structure Verification:** Validates file format, required sheets, column headers, and data table boundaries to ensure proper template structure.
* **Data Integrity Checks:** Verifies question hierarchies, cause-to-question mappings, and required field completeness.
* **RV&S Connectivity Testing:** Confirms user authentication and server accessibility before processing.
* **Reference Validation:** Queries RV&S to verify all referenced IDs (Cause IDs, FM&C IDs, etc.) exist and are accessible.
* **Cross-Reference Mapping:** Validates relationships between questions, causes, and other FM&C components.

**Error Prevention Strategy:**

* All operations must pass validation before execution.
* Invalid data structures trigger specific error messages with remediation guidance.
* Missing or invalid RV&S references are caught before attempting modifications.
* Excel formatting errors are identified with precise cell locations.

**Audit and Logging Requirements:**

* Pre-execution validation results logged for compliance tracking.
* All data transformations and RV&S queries recorded with timestamps.
* User credentials and FM&C IDs captured for operation traceability.
* Validation failures documented with specific error details for troubleshooting.

**Scalability Consideration:** The current validation framework (implemented for Question Upload Template) requires extension to cover all FM&C template functions including: Create/Revise Failure Modes, Remove Functions, Create/Delete Causes, and Rating/Mechanism operations. An integrated validation system will standardize error prevention across all automation workflows.

## Narrative

Every month, the ESW team at a large-sized company faces the tedious task of updating hundreds of documents in the RV&S (Windchill) application. Library FM&C document owner Jamie spends hours each week manually updating/revising documents with new data and ensuring everything is logged for compliance. Mistakes are easy to make, and the process is draining.

With the FM&C Automation Agent, Jamie simply opens the familiar Excel sheet, fills in the required/desired inputs, and saves the file as is. She then, opens her command prompt and runs the “data check” file (or dry run script). Instantly, the prompt reviews all entries, updates statuses according to the latest rules, and highlights any issues that need attention. A summary pops up, showing what was inputted and if anything needs review. Jamie can quickly check the change log, make updates as needed and procced with running the automation script that inputs this data into the RV&S (Windchill).

Now, instead of spending hours on repetitive updates, Jamie and the team focus on analysis and higher-value work. The document owner can easily audit changes, and the Team Lead reports a significant boost in productivity. The FM&C Automation Agent transforms a manual, error-prone process into a streamlined, reliable workflow—delivering value to both users and the business.

## Success Metrics

### User-Centric Metrics

* 80% of FM&C team members adopt the agent within the first month.
* 90% user satisfaction score in post-launch survey.
* 70% reduction in manual update time per week.

### Business Metrics

* 50% reduction in document tracking errors within 3 months.
* 30% increase in FM&C team productivity (measured by time reallocated to analysis).
* Demonstrable compliance improvements (e.g., audit pass rate).

### Technical Metrics

* 99% successful run rate (no critical errors or crashes).
* Average processing time under 10 minutes for 10,000-row spreadsheets.
* Less than 1% error rate in automated updates.

### Tracking Plan

* Number of agent runs per user per week.
* Number of documents updated per run.
* Number and type of errors encountered.
* User feedback submissions and satisfaction ratings.
* Frequency of change log and undo feature usage.

## Technical Considerations

### Technical Needs

* Command prompt automation via python script
* User authentication for sensitive actions.

### Integration Points

* Microsoft Excel (desktop, possibly Office 365 compatibility).
* Internal FM&C process documentation (for rule definitions).
* (Future) Potential integration with document management systems.

### Data Storage & Privacy

* All data remains within the user’s Excel files; no external storage.
* Compliance with internal data handling and privacy policies.

### Scalability & Performance

* Designed to handle large spreadsheets (up to 10,000 columns) efficiently.
* Minimal impact on Excel performance; optimized for batch processing.

### Potential Challenges

* Handling diverse document formats and user customizations.
* Ensuring compatibility across different Excel versions.
* Managing user permissions and preventing unauthorized changes.
* Providing robust error handling and recovery for interrupted runs.

## Milestones & Sequencing

### Project Estimate

* Small Team: 1–2 weeks for MVP delivery.

### Team Size & Composition

* Small Team: 2 people
  + 1 Product/Project Owner (requirements, user feedback, testing)
  + 1 Engineer (Excel automation, scripting, UI/UX)

### Suggested Phases

**Phase 1: Requirements & Design**

* Key Deliverables: Engineer reviews technical feasibility.
* Dependencies: Access to sample FM&C spreadsheet.

**Phase 2: MVP Development**

* Key Deliverables: Engineer builds proven scripts for the functions within the excel sheet, tests and iterates. Then begins to unify into one script.
* Dependencies: Finalized update rules, user feedback on initial prototype.

**Phase 3: User Testing & Feedback (2 days)**

* Key Deliverables: Pilot with FM&C team, collect feedback, fix critical issues.
* Dependencies: Availability of pilot users.

**Phase 4: Launch & Support (1–2 days)**

* Key Deliverables: Release to all users, provide onboarding materials, monitor adoption.
* Dependencies: Internal communications, user support channel.