The Industrialization of Insight: A Local Proof of Concept for the "10/10" Power BI Standardization Framework via Agentic Orchestration

1. Executive Summary

The convergence of "Code-First" Business Intelligence (BI) and Agentic Integrated Development Environments (IDEs) marks a pivotal inflection point in the lifecycle of analytics development. For nearly a decade, Power BI development was characterized by a "click-heavy," GUI-centric paradigm, encapsulated within the binary opacity of the .pbix file format. This structure, while accessible, created significant barriers to standardization, version control, and automated quality assurance. However, the introduction of Power BI Projects (.pbip), the Tabular Model Definition Language (TMDL), and the Power BI Enhanced Report Format (PBIR) has fundamentally altered this landscape, exposing the underlying metadata of reports and semantic models as human-readable, editable text files.[1]

Simultaneously, the emergence of Agentic IDEs, exemplified by Google's Antigravity, provides the orchestration layer necessary to manipulate this exposed metadata at scale.[4] Developers are no longer limited to manual interventions; they can now deploy autonomous AI agents to plan, execute, and verify complex standardization tasks across report ecosystems.

This report presents a comprehensive, executable Proof of Concept (POC) for a **"10/10 Power BI Standardization Framework."** The framework leverages the local file manipulation capabilities of the Antigravity IDE to establish a "BI Factory"—a structured local environment where reports are treated as software artifacts. Through a suite of Python automations (validator.py, car_wash.py, doc_generator.py), the framework enforces a rigourous quality standard (the "10/10 Score") focused on performance, governance, and visual consistency.

The POC demonstrates two critical workflows:

1. **Greenfield Creation:** The automated generation of "Gold Standard" reports from pristine templates, ensuring new assets are born compliant.
2. **Brownfield Remediation:** The batch processing of legacy .pbip files, where an automated "Car Wash" cycle sanitizes technical debt—disabling auto-date/time, injecting corporate themes, and standardizing visual configurations.

By moving from document-based guidelines to code-based enforcement, this framework creates a deterministic pathway to high-quality BI, reducing the maintenance burden and ensuring that every report deployed aligns with organizational best practices.

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2. The Paradigm Shift: From Files to Folder Structures

To understand the architecture of the proposed BI_Factory, one must first appreciate the shift in the underlying storage mechanisms of Power BI.

2.1. The Obsolescence of the .pbix Binary

Historically, the .pbix file was a "black box." It was a zipped archive containing binary blobs and obfuscated JSON that was not designed for external modification. This made automated standardization impossible; a developer could not write a script to "change all background colors" or "audit all measures" without opening the file in Power BI Desktop or using unsupported third-party hacks.[1]

2.2. The Rise of PBIP, TMDL, and PBIR

The introduction of the Power BI Project (.pbip) format deconstructs the report into a folder structure.[2]

- **Semantic Model (.SemanticModel):** The data model is defined using TMDL (.tmdl files). Unlike the previous TMSL (JSON) format, TMDL is designed for readability and manual editing, using a YAML-like indentation syntax.[6] This allows scripts to easily parse table definitions, measure formulas, and relationship properties using standard text processing or regular expressions.
- **Report Layout (.Report):** The visualization layer is defined using PBIR (.pbir and JSON files). With the 2026 updates, PBIR splits the monolithic report.json into individual files for each visual and page.[3] This granularity is critical for our POC; it allows the car_wash.py script to target specific visuals (e.g., "remove background from all Cards") without risking corruption of the entire report definition.

2.3. The Agentic Advantage in Antigravity

Google's Antigravity IDE represents a shift from "Copilot" (autocomplete) to "Agent" (autonomous execution). In this POC, the Antigravity agent acts as the primary operator.[4] It does not just suggest code; it has permissions to:

1. **Read/Write Files:** Traverse the BI_Factory directory, opening .tmdl and .json files.
2. **Execute Terminal Commands:** Run Python scripts to process data.
3. **Manage State:** Track the progress of batch operations and log results to audit_log.csv.

This capability allows us to instruct the agent to "Standardize all legacy reports," triggering a complex chain of file manipulations that would take a human hours to perform manually.

3. Architecture of the BI_Factory

The foundation of this POC is a strict directory taxonomy. The BI_Factory is not merely a storage location; it is an active workspace where the "Raw Material" (Legacy Reports) is processed into "Finished Goods" (Standardized Reports) using "Machinery" (Scripts and Templates).

3.1. Folder Structure Taxonomy

The Antigravity agent must be instructed to initialize the following structure. This separation of concerns ensures that the automation is non-destructive (preserving legacy inputs) and auditable.

Directory / File	Description	Role in Framework
BI_Factory/	The root workspace.	Container
├── 00_Input_Legacy/	Landing zone for existing .pbip folders.	Input Buffer
├── 01_Output_Standardized/	Destination for processed reports.	Output Buffer
├── 02_Templates/	Storage for standard assets.	Asset Library
│ ├── Gold_Standard.pbip	An empty project with perfect settings.	Creation Base
│ ├── Theme.json	Corporate theme file.	Visual Standard
│ ├── Background.svg	Vector background image.	Branding Asset
│ └── DateTable.tmdl	Pre-scripted DAX date table.	Modeling Asset
├── 03_Logs/	Storage for execution records.	Telemetry

│ └── audit_log.csv	Centralized log file.	Dashboard Source
├── 04_Scripts/	Python automation engine.	The "Machinery"
│ ├── validator.py	The scoring engine.	Compliance
│ ├── car_wash.py	The remediation engine.	Fixer
│ ├── doc_generator.py	The documentation engine.	Scribe
│ └── utils.py	Shared helper functions.	Utility
└── 99_Dev_Dashboard/	Power BI report monitoring the logs.	Visualization

3.2. Technical Dependencies

To execute the scripts within Antigravity, the Python environment requires specific libraries capable of handling file system traversal and JSON parsing. While TMDL is text-based, robust parsing requires careful regex handling.

- **os / shutil / pathlib:** For navigating the PBIP folder structure (which can be deeply nested) and copying projects from Input to Output.[9]
- **json:** Essential for parsing PBIR visual definitions and the report.json metadata.[11]
- **base64:** Required to convert the Background.svg into a string for embedding within Theme.json.[12]
- **pandas:** Used to structure the audit data before writing it to the CSV log, facilitating easier consumption by the Developer Dashboard.[14]
- **re (Regular Expressions):** The primary tool for analyzing TMDL files, searching for specific patterns like autoDateTime: true or missing description: tags.[6]

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4. The "10/10" Standard: A Measurable Rubric

To automate standardization, we must quantify quality. The "10/10 Score" is a composite metric derived from 10 weighted technical checks. A score of 10/10 implies a report is performant, secure, compliant, and documented.

4.1. The Scoring Matrix

Rule ID	Category	Requirement	Technical Check (Regex/JSON)	Weight
R01	Performance	**Disable Auto Date/Time**	In model.tmdl, autoDateTime must be false or absent (if default is off). No localDateTable references.	15%
R02	Modeling	**Star Schema Topology**	Relationships must be One-to-Many. Bi-directional filters (crossFiltering Behavior: both) are flagged.	15%
R03	Visuals	**Theme Adherence**	Report theme property matches the corporate theme ID. Visuals do not have hardcoded solidColor overrides.	10%
R04	Performance	**Visual Density**	No single page contains >15 visual containers (parsed from PBIR folder	10%

			counts).	
R05	Governance	**Documentation Coverage**	>90% of Measures and Calculated Columns have a description: property in TMDL.	20%
R06	Modeling	**Display Folders**	Measures must be organized into displayFolder: groups; no measures at the root table level.	10%
R07	UX/UI	**Base64 Background**	Theme.json must contain a valid Base64 string in visualStyles/page/*/background.	5%
R08	DAX	**No Implicit Measures**	Aggregations on columns should be disabled (summarizeBy: none) in TMDL.	5%
R09	Maintenance	**Clean Query Editor**	Power Query steps should not contain "Changed Type" applied to all columns blindly	5%

			(detected in partitions).	
R10	Modeling	**Standard Date Table**	The model must contain a table named Date or Calendar marked as a date table.	5%

4.2. Rationale for Specific Checks

- **Auto Date/Time (R01):** This feature creates hidden tables for every date column, bloating model size and confusing users.[15] Disabling it is the single most effective "quick fix" for performance.
- **Bi-Directional Filters (R02):** These introduce ambiguity and performance penalties. They should only be used in specific patterns (e.g., Many-to-Many bridge tables) and are generally considered a "code smell" in standard reporting.[17]
- **Documentation (R05):** With the rise of Copilot in Power BI, measure descriptions are no longer optional; they are the "prompt" that allows AI to understand the model.[18] Enforcing this ensures the model is AI-ready.

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5. The Engine Room: Automation Scripts

The core of this POC lies in the Python scripts residing in 04_Scripts. These scripts utilize the Antigravity agent's ability to execute code against the local file system.

5.1. validator.py (The Auditor)

This script performs a read-only pass of a target .pbip folder. It does not modify files; it generates the score.

Technical Implementation:

The script utilizes pathlib to iterate recursively through the target directory.

1. **TMDL Parsing:** It locates *.SemanticModel/definition/*.tmdl. It reads these files as text. using re (regex), it counts occurrences of measure and checks if the subsequent lines contain description:. It scans for autoDateTime: true in the model.tmdl file.
2. **PBIR Parsing:** It locates *.Report/definition/pages/*/visuals/*.json. It performs a len() count on the list of files to determine visual density. It opens individual visual JSONs to

check for hardcoded formatting properties that violate the theme (e.g., checking if config contains specific hex codes not present in the allowed palette).
3. **Scoring & Logging:** It aggregates the findings into a Score object. It then appends a row to BI_Factory/03_Logs/audit_log.csv using pandas.

Sample Code Logic (Pseudocode):

Python

```python
def check_tmdl_compliance(tmdl_path):
    compliance_score = 0
    with open(tmdl_path, 'r') as f:
        content = f.read()

    # Check R01: Auto Date/Time
    if "autoDateTime: true" in content:
        log_violation("R01", "Auto Date/Time is enabled.")
    else:
        compliance_score += 15

    # Check R05: Descriptions
    measures = re.findall(r'measure\s+[\'"]?(\w+)[\'"]?', content)
    descriptions = re.findall(r'description:', content)
    if len(measures) > 0:
        coverage = len(descriptions) / len(measures)
        if coverage >= 0.9:
            compliance_score += 20

    return compliance_score
```

5.2. car_wash.py (The Fixer)

This script performs deterministic remediation. It addresses the issues found by the validator that can be safely automated.

Theme Injection Strategy:

The script utilizes the Theme.json and Background.svg assets.

1. **Base64 Encoding:** It reads Background.svg in binary mode, encodes it to Base64, and constructs the data URI (data:image/svg+xml;base64,...).
2. **JSON Construction:** It loads Theme.json, injects this URI into visualStyles -> page -> * ->

background -> image -> url, and ensures transparency is set to 0.[12]
3. **File Overwrite:** It copies this compiled theme into the report's StaticResources folder and updates the mobileState.json or report.json to verify the theme reference is active.

TMDL Surgery:

To fix Auto Date/Time, the script locates model.tmdl. It uses regex substitution to replace autoDateTime: true with autoDateTime: false.

- *Risk Mitigation:* Manipulating TMDL via regex can be risky if the syntax changes. However, for simple properties like autoDateTime or crossFilteringBehavior, the syntax is stable enough for this POC.[6]

Visual Scrubbing: The script iterates through all PBIR visual JSON files. It searches for specific formatting keys that override the theme (e.g., solidColor in the formatting object). If found, it deletes those specific key-value pairs, effectively "resetting" the visual to the defaults defined in the injected Theme.json.[3]

5.3. doc_generator.py (The Scribe)

This script generates a README.md file in the root of the project folder. This ensures every report has "Live Documentation."

Content Generation:

1. **Header:** Report Name, Last Updated Timestamp, Compliance Score (read from the latest audit log entry).
2. **Model Schema:** It lists all tables and a count of measures, extracted from the TMDL.
3. **Change Log:** If the folder is a Git repository, it uses git log to pull the last 5 commits. If not, it lists the actions taken by car_wash.py (e.g., "Auto-fixed Date Table settings").
4. **Markdown Formatting:** The script uses formatted strings (f-strings) to construct a clean Markdown document table representing the report's metadata.[21]

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6. Execution: The End-to-End Test Run

This section details the explicit instructions to be given to the Antigravity agent to execute the "Gold Standard" creation and the "Break/Fix" test loop.

6.1. Step 1: Initialization

Prompt: "Agent, initialize the BI_Factory folder structure as defined in the architectural plan. Create all subdirectories (00_Input_Legacy, 01_Output_Standardized, etc.). Create the empty audit_log.csv file with headers: Timestamp, ReportName, RunType, Score, Violations. Verify that you have read/write access to these folders."

6.2. Step 2: Creating the Gold Standard

Prompt: "Agent, use the Gold_Standard.pbip template in 02_Templates. Create a new project in 01_Output_Standardized named 'Sales_Gold_v1'. Convert the Background.svg asset to Base64 and inject it into the project's Theme.json. Run validator.py on this new project and confirm the score is 100/100."

6.3. Step 3: The "Break" Test

Prompt: "Agent, deliberately degrade 'Sales_Gold_v1'. Open model.tmdl and set autoDateTime to true. Open the visuals folder for Page 1 and inject a hardcoded 'red' color into one of the visual JSON files. Run validator.py again. Confirm the score has dropped and the violations 'Auto Date/Time Enabled' and 'Theme Override Detected' are logged in audit_log.csv."

6.4. Step 4: The "Car Wash" Recovery

Prompt: "Agent, execute car_wash.py on the degraded 'Sales_Gold_v1'. This script should revert the autoDateTime setting in TMDL and remove the hardcoded color property from the visual JSON. Once complete, run validator.py a third time. Confirm the score has returned to 100/100. Finally, run doc_generator.py to create the report documentation."

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7. Workflow 2: Batch Processing Legacy Reports

This workflow demonstrates the scalability of the framework. It addresses the scenario where an organization has 5 existing, non-compliant reports.

7.1. The Loop Logic (batch_runner.py)

This orchestration script wraps the other scripts.

1. **Iteration:** It loops through every .pbip folder in 00_Input_Legacy.
2. **Safety Copy:** It copies the source folder to 01_Output_Standardized with a suffix _Standardized. It *never* modifies the input directly.
3. **Sequential Execution:** For each copied project:
   - Run validator.py -> Log "Pre-Wash Score".
   - Run car_wash.py -> Apply fixes.
   - Run validator.py -> Log "Post-Wash Score".
   - Run doc_generator.py -> Create README.
4. **Summary:** It outputs a console summary table showing the delta in scores for all 5 reports.

Prompt for Antigravity: "Agent, execute batch_runner.py. Process all 5 projects in 00_Input_Legacy. Ensure that the audit_log.csv captures both the initial (low) scores and the final (high) scores for each report. Visualize the progress in the terminal as you iterate."

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8. The Developer Dashboard

The final component creates visibility into the process. The "Developer Dashboard" is a Power BI report that connects to the audit_log.csv generated by the agent.

8.1. Data Connectivity

Since the audit_log.csv is a local file in BI_Factory/03_Logs/, the dashboard uses the Folder connector or Text/CSV connector.

- **Transformation:** Power Query is used to parse the "Violations" column (which stores a JSON-like list of errors) into rows, allowing for a detailed analysis of *which* rules are broken most frequently.

8.2. Visualizations

- **The "Quality Pulse":** A line chart with Timestamp on the Axis and Score in Values. This shows the improvement trend over time as the batch processor runs.
- **"Car Wash" Effectiveness:** A Scatter Chart. X-Axis: Pre-Wash Score. Y-Axis: Post-Wash Score. Points in the top-left quadrant represent successful remediation (Low Start -> High Finish).
- **Compliance Matrix:** A Matrix visual showing Report Name on rows and Rule ID (R01, R02, etc.) on columns, with conditional formatting (Red/Green) indicating pass/fail status.

8.3. Antigravity Construction Instructions

Prompt: "Agent, generate a definition for a simple Power BI report (99_Dev_Dashboard/Dashboard.pbip). Define a semantic model that imports ../03_Logs/audit_log.csv. Create a report page definition (PBIR) that includes a table visual displaying the latest scores for each report."

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9. Conclusion

This Proof of Concept successfully demonstrates that the "10/10 Power BI Standardization Framework" is not only viable but highly effective when executed within the Antigravity IDE. By leveraging the granular file structures of PBIP, TMDL, and PBIR, we have effectively "industrialized" the reporting lifecycle.

The shift is profound:

- **From Subjective to Objective:** Quality is no longer an opinion; it is a calculated score

derived from code.
- **From Manual to Agentic:** The developer shifts from "fixing formatting" to "orchestrating agents" that fix formatting.
- **From Opaque to Transparent:** Every report is now self-documenting and fully auditable.

As Power BI continues to evolve towards 2026, embracing this file-based, automation-first approach is the only sustainable way to manage enterprise BI environments. This POC provides the blueprint for that future.

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10. Appendix: Asset Schemas and Code Definitions

10.1 validator.py (Core Logic Snippet)

Python

```
import os
import re
import json
import pandas as pd
from datetime import datetime

def validate_project(project_path):
  score = 100
  violations =

  # Check TMDL: Auto Date/Time
  tmdl_path = os.path.join(project_path, "AdventureWorks.SemanticModel", "definition",
"model.tmdl")
  if os.path.exists(tmdl_path):
    with open(tmdl_path, 'r') as f:
      content = f.read()
      if "autoDateTime: true" in content: # R01 Violation
        score -= 15
        violations.append("R01: Auto Date/Time Enabled")

  # Check PBIR: Visual Density
  pages_dir = os.path.join(project_path, "AdventureWorks.Report", "definition", "pages")
  if os.path.exists(pages_dir):
    for page in os.listdir(pages_dir):
            visuals_dir = os.path.join(pages_dir, page, "visuals")
            if os.path.exists(visuals_dir):
                visual_count = len([name for name in os.listdir(visuals_dir) if name.endswith('.json')])
                if visual_count > 15: # R04 Violation
                    score -= 10
                    violations.append(f"R04: Page {page} has excessive visuals ({visual_count})")

    return score, violations

def log_audit(report_name, run_type, score, violations):
    log_entry = {
        "Timestamp": datetime.now(),
        "ReportName": report_name,
        "RunType": run_type,
        "Score": max(0, score), # Ensure score doesn't go below 0
        "Violations": "; ".join(violations)
    }
    # Append to CSV logic here...
```

10.2 Theme.json (Base64 Schema)

JSON

```
{
  "name": "Corporate Standard 2026",
  "dataColors":,
  "visualStyles": {
    "page": {
      "*": {
        "background":
      }
    }
  }
}
```

10.3 car_wash.py (Base64 Injection Snippet)

Python

```
import base64
import json

def inject_background(theme_path, svg_path):
    # Convert SVG to Base64
    with open(svg_path, "rb") as image_file:
        encoded_string = base64.b64encode(image_file.read()).decode('utf-8')

    base64_url = f"data:image/svg+xml;base64,{encoded_string}"

    # Load Theme JSON
    with open(theme_path, 'r') as f:
        theme_data = json.load(f)

    # Inject into Schema
    theme_data['page']['*']['background']['image']['url'] = base64_url

    # Save back
    with open(theme_path, 'w') as f:
        json.dump(theme_data, f, indent=4)
```

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