

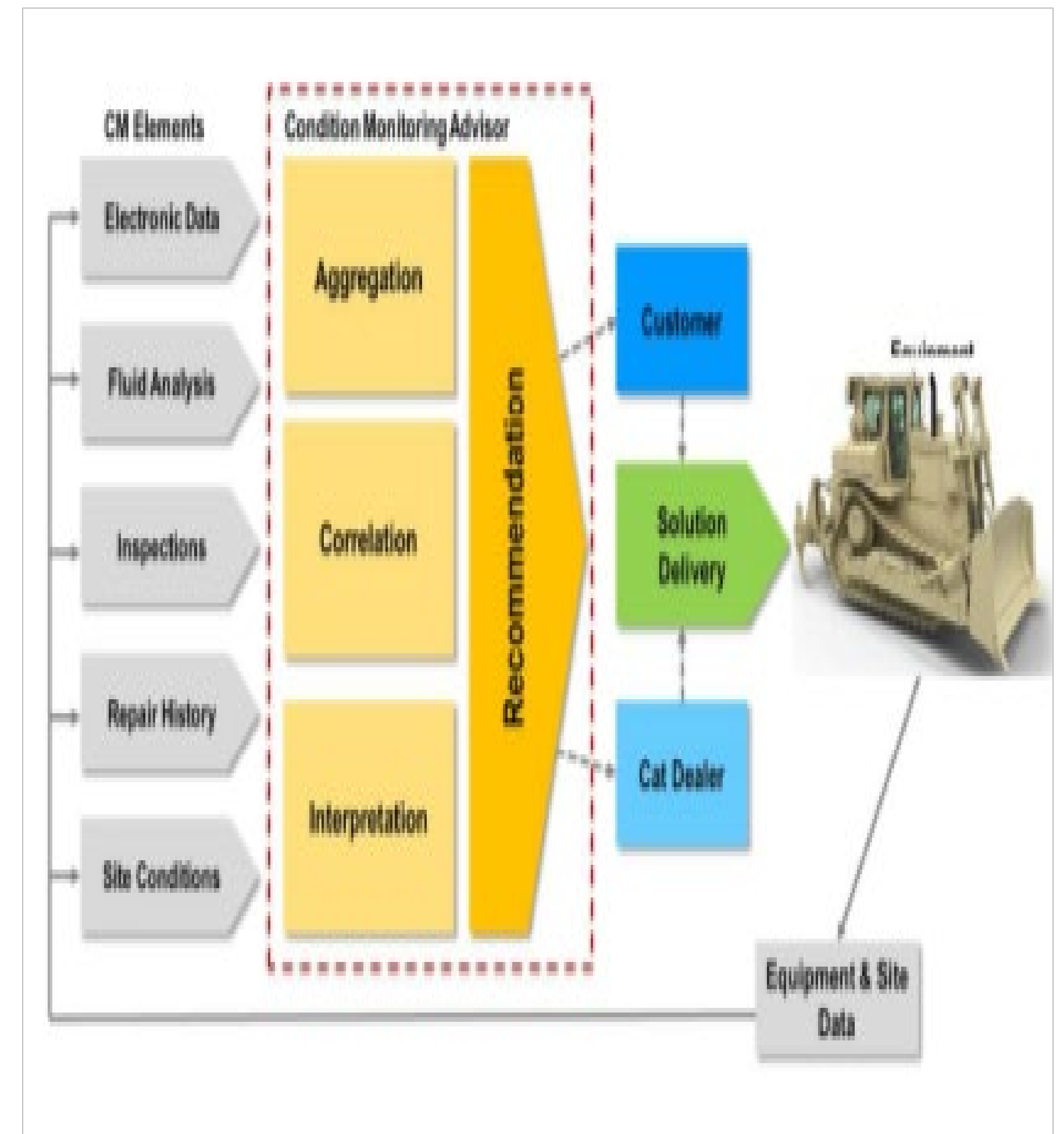
Incorporating Predictive Maintenance Best Practices Into Marine Corps Training and Operations



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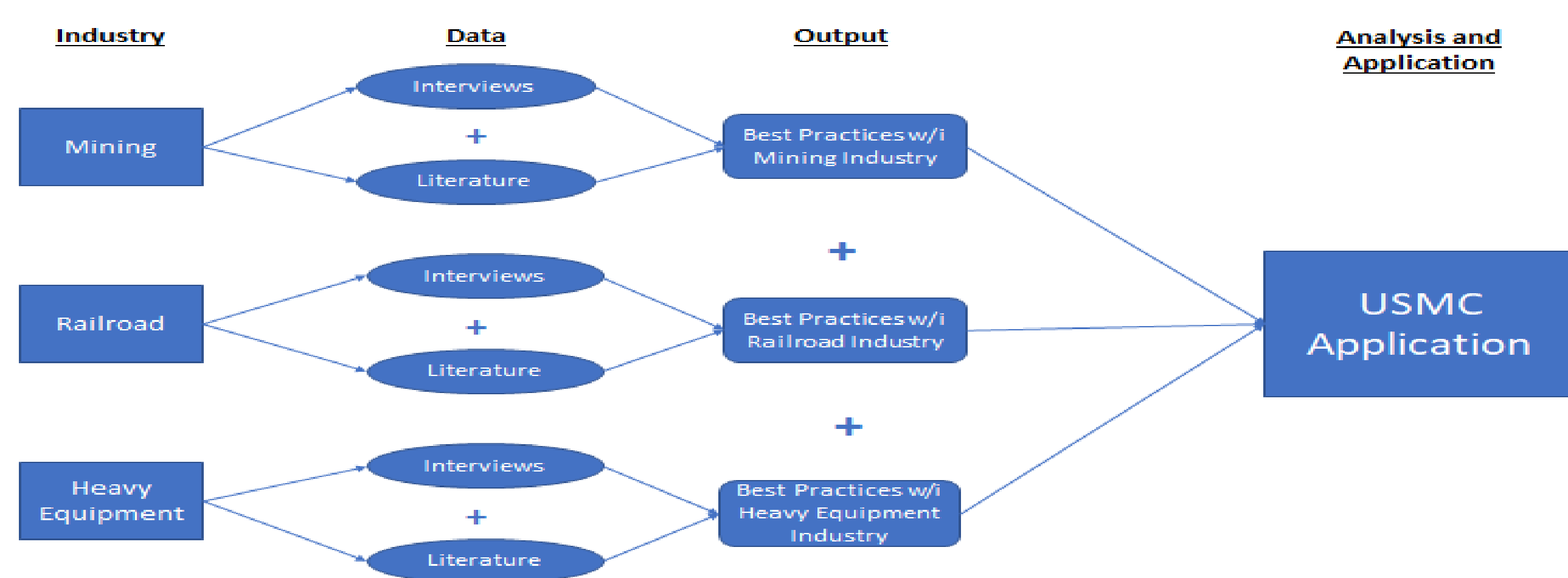
Abstract

Currently, the Marine Corps utilizes a traditional time-based approach to ground equipment maintenance that consists of conducting preventative maintenance (PM) at specified time intervals and corrective maintenance when failure occurs. However, as of 2020, the Marine Corps has initiated the transition from the legacy maintenance strategies identified above to a Condition Based Maintenance Plus (CBM+) approach that detects subcomponent anomalies in advance through data analytics for the purpose of conducting maintenance before failure occurs. Hypothetically, the directed implementation of CBM+ will generate increased cost savings, reduced man-hour requirements per repair, greater operational availability, and increases and efficiencies gained in other relevant metrics throughout the Marine Corps ground equipment inventory. Although the transition to CBM+ offers many potential benefits, it also raises questions on how to correctly adopt an emergent maintenance strategy that is heavily reliant on data and metrics that have not traditionally been used or analyzed within Marine Corps maintenance efforts. As such, this capstone project seeks to identify best practices of predictive maintenance (PdM) and condition-based maintenance (CBM) from industry that are applicable to Marine Corps ground equipment. Using the case study methodology (Yin, 2018), this project highlights current operating procedures, best practices, and PdM strategies within the mining, railroad, manufacturing, and ground transportation sectors to better inform the Marine Corps implementation of CBM+.



Caterpillar's business model for a Condition Based Maintenance strategy accounting for inputs, process, and maintenance recommendations

Methods



Results

- Companies in the private sector that utilize a successful CBM or Predictive Maintenance strategy account for:
 - Personnel Structure – most companies possessed a dedicated data analytics department and maintenance professionals that are capable of interpreting and acting on this data
 - IT Infrastructure – the procurement and use of interoperable and user-friendly systems and platforms
 - Codified Processes – Internal procedures and technologies are in place to detect a maintenance issue prior to equipment failure, capture this decision point in a timely and actionable manner, then direct applicable maintenance actions

Recommendations

- Utilize the Prevention – Failure (P-F) curve to assist with maintenance decision making and better inform operational decisions.
- Build CBM+ compatibility into future ground system acquisitions vice retrofitting legacy equipment with sensors and etc.
- GCSS-MC will require significant modifications or the purchase a new system to fully support a CBM+ strategy.
- Acquire additional data personnel structure at HQMC I&L in the form of contracted or GS employees to account for CBM+ data management and aggregation.