



TAUBER INSTITUTE
FOR GLOBAL OPERATIONS
UNIVERSITY OF MICHIGAN

GM Manufacturing System Data Integration Strategy



General Motors Company (GM), founded in 1908 and headquartered in Detroit, is an American multinational automotive company that designs, manufactures, markets, and distributes cars, trucks, and vehicle parts in 37 countries, while also selling financial services. One of the largest U.S. corporations and automobile manufacturers, GM is also among the top automotive manufacturers worldwide.

As of 2018, the company, which has 173,000 employees, reported more than \$147 billion in revenue, net income of \$8 billion, total assets of \$227 billion and total equity of \$42 billion. Annual sales volume peaked at 10 million in 2016, with production output exceeding 8 million in 2018.

It is a daily challenge for GM to manage billions of dollars in assets, and ensure a steady flow of data to and from production line who maintain those assets. But GM had limited ability to provide workers with fast access to information needed to correct machine errors, while complicated reporting procedures hindered GM's ability to make data-driven decisions on asset investments.

In order to help workers reduce machine repair time while also providing GM with data to make better decisions on investing more than \$5 billion in assets annually, GM brought in a student team from the Tauber Institute for Global Operations at the University of Michigan, consisting of **Gustavo Acosta** and **Alex Martynenko**, both working on Master of Business Administration degrees; and **Zachary Cavazos**, a member of the Engineering Global Leadership Honors (EGL) Program, which leads to BSE in Computer Science Engineering and MSE in Industrial and Operations Engineering degrees.

"The project was initiated by the GM Enterprise Asset Management Committee, which has representatives from various arms of the company, and has a mission of improving the flow of data throughout the company," said Acosta. "The plan to deploy tablets to maintenance workers is intended as a key step in achieving this, and the Tauber team project was designed to collect findings and recommendations that would pave the way for successful implementation.

"The purpose of the project was to improve the flow of data to and from GM's assembly plant floors, with the dual goals of helping plant maintenance workers gain information to support their tasks on production lines and helping the financial arms of GM receive

"The project centered on innovations in plant floor maintenance processes to improve efficiency and asset investment strategies to improve effectiveness."

data on assets in the plants. The proposed solution to achieve these goals was to deploy tablet computers to maintenance workers, which they would use to access, send, and receive information pertaining to the robots and other assets they maintain."

According to Acosta, the Tauber team's objectives within the scope of the project were to assess all the information needs of maintenance



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Above, L to R: Zachary Cavazos–EGL (BSE Computer Science Engineering/MSE Industrial and Operations Engineering) '19, Gustavo Acosta–Master of Business Administration '19 and Alex Martynenko–Master of Business Administration '19.
Photo: T. Ceccarelli.



L to R: Anthony Howell, Global & North American Asset Sustainment Manager at General Motors, Gustavo Acosta—Master of Business Administration '19, Errol Henry, General Motors, Alex Martynenko—Master of Business Administration '19, Mark Gilbert, Manager Global Strategic Initiatives at General Motors, Zachary Cavazos—EGL (BSE Computer Science Engineering/MSE Industrial and Operations Engineering) '19, Daniel J. Grieshaber, Director, Global Manufacturing Engineering Integration and Tauber Industry Advisory Board member, Vijay Pandiarajan, Faculty, Ross School of Business. Photo: P. Dattilo.

workers; determine how tablets could support maintenance workers; assess the existing processes maintenance workers use for reporting data on production line assets and collaborate with GM stakeholders in launching a new mobile platform for reporting maintenance tasks; determine a strategy for gaining adoption of tablet use, while cataloging best practices; and assess the potential financial and operational impacts of deploying tablets to maintenance workers.

“The project centered on innovations in plant floor maintenance processes to improve efficiency and asset investment strategies to improve effectiveness,” said Acosta. “Ensuring maintenance workers have immediate access in their hands to the information on the assets they maintain, such as schematics and manuals, would improve the efficiency in their maintenance processes. Ensuring the flow of maintenance reports to the arms of GM that determine investment strategies for production line assets would enable more data-driven decision making.”

To analyze the maintenance process, the Tauber team collaborated with maintenance workers to map out standard steps and

ran simulations, which produced thorough data on time spent on each activity. It was calculated that leveraging tablets would improve over 20 activities, reduce maintenance time in GM's Lansing Delta Township (LDT) plant body shop by an estimated 16.7 percent, and lower the mean time to repair by three percent.

In order to further develop recommendations, the Tauber team analyzed extensive historical data on maintenance faults, examined processes at the LDT plant, and prototyped different software features. The team configured a tablet with all their recommended functionality and provided a technical document guiding setup and operation.

“The most unique feature of the project was its highly cross-functional nature, as it required collaborating with a wide array of stakeholders from various parts of the company and integrating their objectives into the project,” said Acosta. “As the team came to learn, a maintenance worker, who prioritizes a smoothly running production line and expects all process changes to be

union-approved, has a different agenda than a computer engineer based out of GM's tech center who is working on a data systems initiative. Gaining buy-in for the project from different parties required drastically different approaches in many cases.”

Acosta noted, “A key challenge we faced was in adapting the project to the shifting timelines for other key stakeholders, which was particularly the case with delays in IT's readiness to deploy tablets that could be used for beta testing by the Tauber team.

“To overcome these obstacles and ensure the project's success, we decided instead to change a key deliverable during the project by configuring a beta tablet on our own that we could then use for testing, rather than wait for IT to complete their version. This gave us the flexibility to adjust the beta version as much as we wanted, and we could immediately bring it into the plant to use with maintenance workers. It required us to go through additional steps to figure out how to get our tablet ready for testing, although once we did, it put us more in control of the direction we wanted to go with the project.”

Acosta continued, “The Tauber team configured a tablet that was used in test simulations over a two-week testing period. We ran through different maintenance task scenarios of working closely with a selected group of four maintenance workers. This provided valuable information on the approximate amount of time to complete tasks and the pain-points in processes that could be assisted by the use of tablets. This data was used to estimate the overall efficiency benefits of deploying the tablets.

“However, it was not possible to integrate certain systems with the pilot test tablet as those systems were undergoing modifications. Within four weeks of the team's completion of the project, the system modifications were completed and over 60 tablets were deployed across three assembly plants to be used on production lines.”

The Tauber team's recommendations specified how tablets can be optimally integrated into maintenance processes and provided a structured framework for how this can be applied at any GM plant. The team's proposed mobile solution would create a flow of data previously unseen in GM's manufacturing operations, achieving immediate and long-term benefits for an array of stakeholders throughout the organization.

Scaled to all GM North America (GMNA) operations, the Tauber team estimated that more than \$90 million could be saved annually in increased labor and production efficiencies. Faster access to GM's enterprise asset management software provided by tablets would also overcome many time constraints that have hindered reporting of maintenance tasks. This will, in turn, provide key data metrics to GM's financial planners, creating additional benefits for improved asset management.

"The initiative has been continued by the Mobility Team, which was formed over the summer with the Tauber team and other stakeholders," said Acosta. "Their implementation thus far includes deployment of tablets at one plant, and planned deployment at two more plants within the next few weeks.

"IT has been building out the server environment required for some of the tablets' key applications, including the mobile version of IBM's Maximo platform. This application is currently being tested with tablets in its proof of concept version, and the full version is expected to be ready by March."

Project Team

Students

Gustavo Acosta—Master of Business Administration

Zachary Cavazos—EGL (BSE Computer Science Engineering/MSE Industrial and Operations Engineering)

Oleksandr Martynenko—Master of Business Administration

Project Sponsors

Christopher Barclay—Global Enterprise Asset Manager

Steve Holland—Maintenance Shop Director

Faculty Advisors

Vijay Pandiarajan—Ross School of Business

Atul Prakash—College of Engineering

About Tauber Team Projects

The 2018 Tauber Team Projects resulted in \$564.4 million in savings according to sponsoring company calculations, an average of \$28 million per project over 3 years.

Each two to three person Tauber Team consists of graduate engineering and/or graduate business students. Along with receiving high-level corporate support from the sponsoring company, each team is advised by a College of Engineering and a Ross School of Business faculty member and overseen by a Tauber Institute Co-Director. The projects begin on-site in May and continue for 14 weeks. Students present the results of their projects and compete for over \$40,000 in scholarships at the U-M Tauber Institute's annual *Spotlight!* event, held each September in Ann Arbor, Michigan. *Spotlight!* provides outstanding opportunities for students and corporate partners to establish relationships while exploring innovations in operations and manufacturing.

To learn more about the Tauber Institute for Global Operations, visit tauber.umich.edu or contact us at 734-647-1333.

