# STANLEY BLACK & DECKER

## Industry 4.0: IIOT Machine Condition Monitoring and Analytics

**Student Team:**
Janice (Yin Yin) Lau – Master of Science in Industrial & Operations Engineering
Akshay Seth – Master of Science in Industrial & Operations Engineering

**Project Sponsors:**
Nathan Dietrich – Advanced Manufacturing Engineering Deployment Manager
Aditya Mairal – Advanced Manufacturing Engineer
Ziyan Xu – Advanced Manufacturing Engineer

**Faculty Advisors:**
Lennart Baardman – Ross School of Business
Line van Nieuwstadt – College of Engineering



**Stanley Black & Decker (SBD)** is a $15.6 billion company with 58,000 employees operating in 140 facilities in 60 countries. The company is the world's largest tools and storage company, the second-largest commercial electronic security company, and a leading provider of engineered fastening systems. SBD's Industry 4.0 Team leads the efforts to rapidly adopt leading-edge technologies in manufacturing operations and leverage machine connectivity and data analytics to improve overall equipment effectiveness (OEE).

As part of the continuous efforts to improve OEE, the Tauber team was tasked with developing three deliverables to improve machine reliability: (1) use cases around machine condition monitoring with a minimum value of $150,000 with less than 2 years of payback, (2) a data analytics model that provides actionable insights, and (3) a roadmap for scaling use cases across SBD's sites. The sites in scope were Danbury and New Britain, CT and East Longmeadow, MA.

During the development phase of four use cases, the team interviewed more than 50 stakeholders to understand machine failure modes, their impact on production, and the metrics to watch for condition monitoring. Then, the team developed a Value-Effort Framework to evaluate potential condition monitoring opportunities (centered around vibration, temperature, and current monitoring) on the scale of value generation and implementation effort. Finally, the team created a Savings Flowchart to capture potential saving categories such as overtime reduction, scrap reduction, throughput increase, etc.

When developing the data analytics model, the team applied the concepts of Statistical Process Control (SPC) to analyze machine condition data and establish alert threshold limits. The model results were delivered to the end-users via real-time visualization dashboards. Using the models developed, the team successfully indicated several instances of premature machine failures and enabled an effective maintenance responses.

Lastly, the team created a scalable roadmap that documents the step-by-step approach for how the use cases were developed and how the model can be generalized. By implementing the use case developed by the Tauber team, Stanley Black and Decker would be able to achieve over $180,000/year in savings with less than 2 years of payback, preventing more than 1300 hours of downtime and more than $2 million of production loss.