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Improving the Efficiency of Large Manufacturing Assembly Plants

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Abstract

Large manufacturing assembly plants with sub assembly lines, sequenced material deliveries, and batch driven primary manufacturing operations often struggle with coordinating their sequenced part manufacturing and kitting operations with the dynamic constraints of the main final assembly line. This paper will outline the high level data model, workflow and use-case scenarios of how the Factboard system integrates into the factory's engineering and transactional data sources as well as how users have been able to use this more accurate, detailed and timely information to make better decisions.

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1. Introduction

Large manufacturing assembly plants with sub assembly lines, sequenced material deliveries, and batch driven primary manufacturing operations often struggle with coordinating their sequenced part manufacturing and kitting operations with the dynamic constraints of the main final assembly line. Additional challenges arise from the many disconnected information streams available to each group which provide delayed information with not enough part and location specific details.

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Iowa State University (ISU), Proplanner and Factory Right partnered with a major Aircraft manufacturer and also a major Industrial/Ag Equipment maker to address this specific challenge with a product called Factboard. The team is being supported by the United States Army via the Digital Manufacturing and Design Innovation Institute (DMDII). DMDII is a federally-funded research and development organization of UI LABS, with a goal of increasing efficiencies of factories throughout the United States.

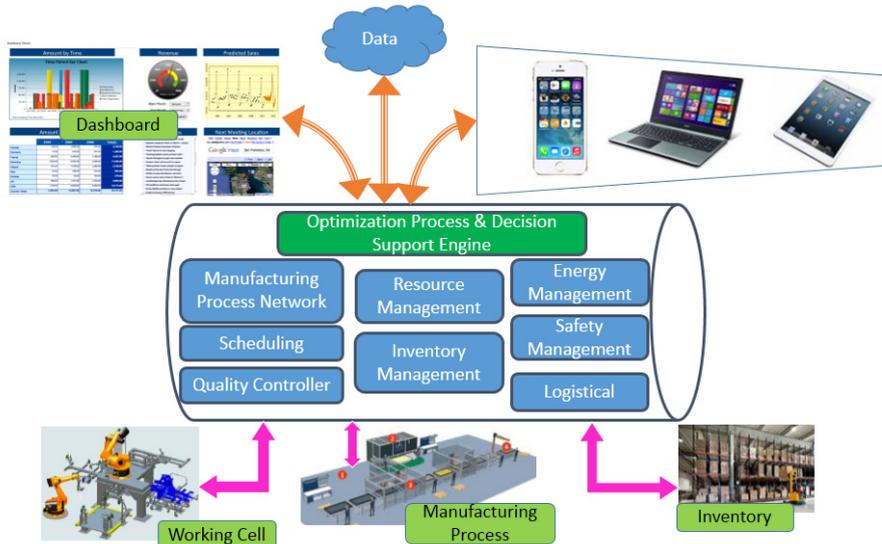


Fig. 1. Factboard Data Flow Model

Making improper decisions with incomplete data reduces a factory's throughput rate, and can result in substantial inventory increases and low overall equipment effectiveness. Pilot studies of Factboard components have demonstrated 98% reductions in line stoppages due to logistics issues, 86% reductions in on-site inventory, and 50% reductions in indirect material handling labor, all while simultaneously increasing productive throughput by nearly 10%. All of this contributes to reducing operational costs and increasing the ability of the factory and its supply chain to respond faster to changes in requirements. The trial-case factory made large 4-wheel drive tractors and large bucket loaders. The reductions were exclusively due to increased line-side inventory availability using e-Kanban and e-Kitting as described in Kouri [1]. In particular, alerts sent to management at the first onset of a materials issue, such as a delayed delivery, or a stock-out at the inventory supermarket (mini-warehouse), allowed time to resolve the problem before a line stoppage occurred. In addition, extensive data on actual inventory replenishment times allowed for safe and substantial reductions with line-side inventory quantities as the workers became trustworthy of the logistics system. These improvements virtually eliminated inventory expediting and allowed for material delivery via fixed route tuggers which greatly reduced fork truck usage, and thus indirect labor, within the plant.

A key innovation of Factboard is its ability to utilize existing transactional data within the enterprise and dynamically respond to increases, or even temporary decreases, in the quantity and quality of these real-time inputs. Because companies are often not in a position to make major upfront investments in shop floor data collection, Factboard can utilize the available information and attempt to fill in the holes to provide a real-time picture of "current events" occurring within the production systems internal to, and supplying, the final assembly line.

This is accomplished by Factboard's ability to map engineering production life-cycle management (PLM) data sets with factory-specific build schedules and real-time transactional production and logistics data to create a series of information-rich and visually effective views designed around the needs of shop floor personas (user-defined dashboard views of production). Factboard's decision support engine then provides specific calculations and probabilistic recommendations about inventory and resource availability at multiple points within the production system.

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