Quality, Cost, and Agility
Spotfire Deployment Case Study at Hemlock Semiconductor

Kevin Britton & Keith Carey
TIBCO NOW 2018
Quality, Cost & Agility - Outline

• About HSC
  – Company Overview
  – Market Opportunities for Analytics

• HSC’s Approach to TIBCO Deployment
  – Deployment Structure
  – User Engagement Approach

• Examples from Across the Enterprise
  – Dashboarding vs. Data Science / Modeling
  – Manufacturing, Science & Technology, and Governance Functions

• Lessons Learned / Q&A
Speakers

Kevin Britton
Project and Program Leader

- Deployment Manager
- 20+ years in Automation, Design, and Continuous Improvement Leadership
- BSME, Michigan Tech; MSE, Purdue
- ASQ Certified Six Sigma Black Belt

Keith Carey
Enterprise Architect and IT Director

- Deployment Sponsor
- 30+ years in architecture design, manufacturing integration, business intelligence, and IT Leadership
- BSCIS, Saginaw Valley State University
About Hemlock Semiconductor

- A world-leading producer of polycrystalline silicon, a raw material used in global semiconductor and solar industries
- Began production in Hemlock, Michigan in 1961
- Joint Venture between The Dow Chemical Company, Corning, Inc. and Shin-Etsu Handotai.
- 24/7/365 production operations with ~700 employees
Basic Polysilicon Manufacturing

Polysilicon Manufacturing at HSC


HSC’s Manufacturing Challenge

Control several production plants on one manufacturing site
- Job #1: Operate safely
- Scheduling production
- Minimizing cost
- Maximizing yield and efficiency of equipment
- Significant testing required to guarantee performance of product

Identify Cause & Effect relationships buried in mountains of data
- Process Data
- Quality Data
- Business Data
Hemlock Semiconductor Market Drivers

• Product Quality Demands are Extremely High
  – 99.999999999%+ elemental purity for Semiconductor Applications
  – Ever increasing for both Semi and Solar Markets

• Commoditization within the Polysilicon Market
  – Highly Cost Sensitive
Key Analytics Opportunities for HSC

• Visualize and Optimize Production Costs
  – Energy Usage
  – Manufacturing Processes
  – Unit Cost Contribution from Support Functions (Testing, Logistics, etc)

• Maximize First-Time Quality (Yield to Intended Product)

• Safe, Highly Reliable Organization
  – More Proactive, Less Reactive (High Volume manufacturing)
  – Continuous Improvement Culture
  – IT as an Enabler
Business & IT Challenge

Historical – System Focus

Systems developed and maintained to provide data “snapshots” for offline analysis. A small subset of users have access to statistical analysis tools, while rest use spreadsheets. Data science and machine learning are not utilized.

Desired State – User Focus

Self-Service data discovery using live, vetted, controlled, & automatically prepped data accelerates learning and decision making. Off-the-shelf visualization and analytics capability simplifies landscape, frees IT resources.

Align IT

IT

Creates custom extracts and reports

Excel

Serves as de facto standard for most users

Stats

Analytics limited; specialists use statistical tools

Accelerate!

Partner with outside services to accelerate scientific understanding, root cause investigations, process optimization & real-time decision-making.

Advanced analytics competency including machine learning to reduce the analysis cycle: “fail-fast” and pivot quickly to obtain business outcomes.
Analytics Deployment Approach

Architecture
- TIBCO SPOTFIRE
- DATA VIRTUALIZATION
- WEB SERVICES
- STATISTICA

Data Sources
- SQL
- ORACLE
- PI FILES
- SHAREPOINT
- DELIVERY OPTIMIZED

Use Cases
- NEAR REAL TIME DASHBOARDS
- DATA SCIENCE APPLICATIONS

DELIVER A SOLID USER EXPERIENCE
- TRAINING
- NATURAL WORK GROUP
- CENTER FOR ENABLEMENT
Initial Deployment Goals

- Quick Start (6-9 month Phase)
- Trained, Engaged, and Supported User Base
  - 50+ Analysts and 500 Consumers
- Critical data sources established with semantic layer
  - Mfg. Process Parameters, Quality, Governance, etc.
- Initial Use Cases published and support business improvement
- Business Processes Established for continued growth and governance
  - Architecture Scalability Plan and Data Source Management
  - Training and Support Model
  - Visualization Publishing and Lifecycle Management
Developing the User Experience

• “LEAP” Team* (UX Steering Committee)
  – Training and Coaching of Users
  – Lead Through Example (Super Users)
  – Best Practice Development, Optimization & Governance
  – Communicate Successes!

• Power Users
  – Demonstrate high capability

• User Support Model
  – **Self-Service** through Center for Enablement (SharePoint)
  – **1-on-1 coaching** through weekly Spotfire Office Hours
  – **Training & Peer Learning** via monthly Natural Work Group
  – Additional Support / Training from TIBCO
User Development

Plan

Quick Start

Train

Self-Service Single Point Lessons
- What
- Why
- Basic How
- Demo Video
- References to Add’l Self-Serve Learning

Classroom Training
- Focus on high-impact, HSC-specific topics (e.g. data sources)

External (TIBCO) Training
1-on-1 Coaching (Office Hours)
Monthly Natural Work Group
USE-CASE EXAMPLES
Cost of Quality Analysis Dashboard

• **Goal:**
  – Peer into the “black box” to visualize testing processes, identify cost drivers & CI opportunities

• **Key Features:**
  – Interconnect Analytical, Business, and Manufacturing “big data” from disparate sources
  – Visualize testing activities by department, product line, test type, purpose, and cost
  – Model employee utilization
  – Pareto by Marking to understand segments that drive cost, target improvements

• **Output:**
  – $1M Improvement Project Portfolio
Customer Reporting Automation

• Goal:
  – Automate preparation of monthly Customer Quality Reporting

• Key Features:
  – Aggregate quality data over reporting windows
  – Summarize product quality by material, customer, and process
  – Provide internal stakeholders background information on trend drivers

• Output:
  – Eliminated 400 hr/year (0.2 FTE) in manual data wrangling, standardized reporting format
Supply Management Dashboard

- **Goal:**
  - Manage key supplier’s just-in-time delivery performance for raw materials.

- **Key Features:**
  - Centralizes data from department-specific tracking sources into a single view
  - Visualizes deliveries (plan vs. actual) for multiple product types

- **Output:**
  - From near-zero visibility to proactively addressing raw material delivery deficiencies to improve performance to annual production targets
Process Optimization Model

• **Goal:**
  – Improve understanding of leading indicators for a manufacturing process.

• **Key Features:**
  – Connects historical process sensor data from multiple manufacturing processes for a particular product.
  – Statistica Model uses a variety of data science techniques (trees, clustering, boosting, etc) to seek out leading indicators driving best-of-best and worst-of-worst outputs.
  – Results feed into Spotfire for visualization.

• **Output:**
  – Direct scientific inquiry – Is it more fruitful to pursue global (between processes) or local (intra-process) controls?
  – Driving towards a predictive model that improves downstream planning (“This will produce X”)
Where do we Go From Here?

• Expand accessibility to Enterprise Data

• Continue to expand Center for Enablement

• Migration of stand-alone data wrangling & display web applications to Spotfire

• Evolve key uses cases toward Real-time Dashboarding with Alerting (Streambase)
  – Improve responsiveness to out of control signals

• Expand application of Data Science techniques
  – Drive to “step change” improvement through leading indicators
Lessons From HSC’s Journey

• Start Strong!
  – Strong, Committed Executive Sponsorship sets Vision
  – Choosing the right Partner(s) can help light the way

• User Focus
  – It’s all about Change Management! (“You can have my spreadsheets when….”)  
  – Identify and Capitalize on Early Adopters, Celebrate Successes!

• Care and Feeding
  – Expect to Grow (Hardware, Data Sources)
  – Recognize that Speed is a function of Resource Commitment
  – Manage Expectations (Sponsors and Users)

• Bias for Action – Just Go!
The information contained in this communication does not constitute an offer, does not give rise to binding obligations, and is subject to change without notice to you. The creation of binding obligations will occur only if an agreement is signed by authorized representatives of Hemlock Semiconductor Corporation or Hemlock Semiconductor, L.L.C. and your company. Any reference to competitor materials contained in this communication is not an endorsement of those materials by Hemlock Semiconductor Corporation or Hemlock Semiconductor, L.L.C. or an endorsement by the competitor of Hemlock Semiconductor Corporation or Hemlock Semiconductor, L.L.C. materials.

To the fullest extent permitted by applicable law, Hemlock Semiconductor Corporation and Hemlock Semiconductor, L.L.C. disclaim any and all liability with respect to your use or reliance upon the information. HEMLOCK SEMICONDUCTOR CORPORATION AND HEMLOCK SEMICONDUCTOR, L.L.C. DO NOT MAKE ANY WARRANTY OR REPRESENTATION, EXPRESS OR IMPLIED, WITH RESPECT TO THE UTILITY OR COMPLETENESS OF THE INFORMATION AND DISCLAIM THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. HEMLOCK SEMICONDUCTOR CORPORATION AND HEMLOCK SEMICONDUCTOR, L.L.C. DISCLAIM LIABILITY FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES.