The New Industrial (and Systems) Engineering:

Case Studies—Integrated LeanSigma Black/Green Belt Certification Capstone Projects

Session Leaders

**D. Scott Sink**, Ph.D., P.E., Director, Integrated LeanSigma Certification Program, ISE at OSU

**Maria Pandolfi and Gunnar Smyth**—Health Care Flow Improvement Projects

**Joseph Weger**—Employee Engagement with Lean to accelerate continuous improvement in Manufacturing

**Allen Drown**—Risk Management (labor turnover/loss) with Knowledge Management Systems
# Agenda

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
</tr>
</thead>
<tbody>
<tr>
<td>12:00 pm</td>
<td><strong>Scott Tee-up</strong>&lt;br&gt;Quick Review from Part I—the Framework for the Series</td>
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<td>12:10</td>
<td>Maria and Gunnar: OSU Med Center and Mount Carmel</td>
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</tr>
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<td>12:40</td>
<td>Allen Drown: Transmet</td>
</tr>
<tr>
<td>12:55 pm</td>
<td>Scott: Closing Comments</td>
</tr>
<tr>
<td>1:00 pm</td>
<td>Adjourn</td>
</tr>
</tbody>
</table>
ISE and IIE for Life—how IIE supports you for your entire career.

Council on Industrial and Systems Engineering—Senior Leadership of ISE function

Industry Advisory Board—Mid Career, Mgs in ISE related functions

Young Professionals—Early Career 1-15 years out

Career Path and Timeline

You can get involved in Societies, Divisions and also 'Affinity Groups' like Young Professionals, Industry Advisory Board and the Council on Industrial and Systems Engineering.
Questions?

How We’ll Handle

Please write your question in the webinar question web form. We will address as many as we can at the end of the webinar and send and email with follow up’s to attendees for those not able to be responded to.
Chapter #1 Highlights—
IIE’s First Chapter (1949) and also the first Virtual IIESE Professional Chapter (2016)

1. 186 Professional Members in Eastern Ohio but also from around the Country

2. Support, partner with the Youngstown State, Ohio University and Ohio State University Student Chapters.

3. Partner with the Industry Advisory Board, CISE, and the Young Professionals Group

4. Partner with our Dayton/Cincinnati Professional Chapter on our Annual IIESE All Ohio Event and other things

5. 6 Timely, Valuable Webinars each year; topics developed from Voice of Member

6. 12 Monthly Memo’s help Members get to know each other and keep members aware of upcoming opportunities AND also provide Self-Help Features on personal and professional mastery

7. quarterly GoToMeeting small group calls with members that focus on topics of interest from ‘affinity groups’/segments of our members.
Design for the Series of Operational Analytics Webinars (series of 5 at this point)

Webinar #1: Foundations  7 Dec 2017 (and GLR Conference)
Share the Framework, the Models, the Abstractions, the Principles
Management Systems Model
Intel “Triangle” Model

Webinar #2: Foundational Data Role--Measurement and Analysis Planning  20 March 2018
Measurement Planning using Value Stream Maps, Data Models derive from refining the
Management System Model, The Data Management Role of ISE’s in Process Improvement Projects

Webinar #3: Best in Class ILSS Project Final TG’s  25 April 2018
Showcase best in class projects, shine spotlight on Op Analytics

Webinar #4: Decision Support Role—M&A Execution 12 June 2018
Feature and Knowledge Extraction, Creating Chartbooks and VSM’s, supporting the
evaluation phase of DMAIC projects and then also the Control Stage.

Webinar #5: Putting it all together 24 July 2018
Revisiting the Management Systems Model with Case Examples
12:00 pm  Scott Tee-up
Quick Review from Part I—the Framework for the Series

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1:00 pm  Adjourn
Improving Flow to Reduce Overall Wait in Healthcare

Green Belt Projects

THE OHIO STATE UNIVERSITY
WEXNER MEDICAL CENTER

BECAUSE OF YOU
MOUNT CARMEL

After College

PEPSICO
Supply Chain Analyst

Past Experience

Whirlpool
Honeywell
Intelligrated

Past Experience

Disney Cruise Line
Walt Disney World

After College

The Walt Disney Company
Business Integration Analyst
**Defining our Projects**

**Problem Statement:** Patient wait times were approaching 2+ hours despite appointment times of 40 min max. Appointments often fall behind resulting in overtime hours.

**Project Goal:** Reduce patient wait time so that 95% of patients wait less than 20 min total.

**Problem Statement:** Within the process there are delays that causes higher than normal workloads for provider, preceptor and nurses.

**Project Goal:** Decrease the number of bad flow days by improving the staff and patient schedule, patient arrival behavior, and other critical factors.
Improving Flow to Reduce Overall Wait in Healthcare

Measurement Systems

Data: 59 Samples of Daily Patient Lead Time. (October ’17 – January ’18)

Current State
Lead Time: 56%
Spend more than 45 min at the clinic
Wait Time: 50%
Wait more than 20 min

Diabetes Patients experience most variability in wait and lead time

What does this mean?
• Bad flow days occur ~15% of the time (about 1-2 times a week)
• Both patients & staff feel the effects of bad flow days:
  • Longer Patient Wait Times and Lead Times
  • Later Work Days for Staff (last patient doesn’t check out until after hours)
### Team Identification of Process Pain Points

<table>
<thead>
<tr>
<th>Pain Point</th>
<th>Severity</th>
<th>Occurrence</th>
<th>Detection</th>
<th>Impact</th>
<th>Factors</th>
<th>Time Added to Process</th>
<th>Counter Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient A1C not available when provider is ready (waits 3 – 15 min)</td>
<td>7</td>
<td>6</td>
<td>3</td>
<td>126</td>
<td>Download resources not working</td>
<td>6.3 to 4.73 min</td>
<td>Visual reminder to input A1C data</td>
</tr>
<tr>
<td>Patient paperwork not in door when provider is ready (waits 3 – 15 min)</td>
<td>7</td>
<td>6</td>
<td>3</td>
<td>126</td>
<td>Triage nurses did not request labs</td>
<td>1.04 to 7.76 min</td>
<td>Visual reminder for new patients to get FPA</td>
</tr>
<tr>
<td>Patient not ready to see the provider within first 15 min of appt.</td>
<td>8</td>
<td>3</td>
<td>5</td>
<td>120</td>
<td>Patient has not completed when provider is ready</td>
<td>3.75 to 2.81 min</td>
<td>MA to work specifically in the lab</td>
</tr>
<tr>
<td>Patients are not brought back within the first 1.0 min of arrival</td>
<td>8</td>
<td>2</td>
<td>5</td>
<td>80</td>
<td>Unavailable exam room</td>
<td>4 to 2 min</td>
<td>Reminder providers when they spend 20+ min with patients to free up rooms</td>
</tr>
<tr>
<td>Patient device download info not ready when provider is ready (waits 3 – 15 min)</td>
<td>7</td>
<td>6</td>
<td>3</td>
<td>126</td>
<td>Patient needs lab work or device download</td>
<td>Impacted in device download and A1C</td>
<td>Collect devices when patients arrive, send reminder message to patients to download</td>
</tr>
</tbody>
</table>

**Pain points adding an additional 2.45 to 17.3 min to each appt.**

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### Analyzing the Data

A **binary regression analysis** was used to determine the impact each factor above has on the output variable, flow ("good" or "bad"). Only days with high demand were analyzed.

<table>
<thead>
<tr>
<th>Factors</th>
<th>Impact</th>
<th>Treatable</th>
<th>Should We Treat It?</th>
<th>Goal</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient Arrival</td>
<td>High</td>
<td>Yes</td>
<td>Yes</td>
<td>Patients arrive early or on-time</td>
<td>Change appt. times to reflect when patients should arrive</td>
</tr>
<tr>
<td>Communication and Coordination</td>
<td>High</td>
<td>Yes</td>
<td>Yes</td>
<td>Be Proactive</td>
<td>Implement “Team Huddles”</td>
</tr>
<tr>
<td>Total Lead Time</td>
<td>Medium</td>
<td>Yes</td>
<td>No</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Resident-to-Preceptor Ratio</td>
<td>Medium</td>
<td>Yes</td>
<td>Possibly</td>
<td>Lower Resident-to-Preceptor Ratio</td>
<td>Strategically schedule preceptors when needed</td>
</tr>
<tr>
<td>No-Shows</td>
<td>Medium</td>
<td>Yes</td>
<td>Possibly</td>
<td>Decrease no-shows</td>
<td>??</td>
</tr>
<tr>
<td>Appointment Structure</td>
<td>Medium</td>
<td>Yes</td>
<td>Possibly</td>
<td>Appointment slots match exam times</td>
<td>Create larger time slots for patients</td>
</tr>
<tr>
<td>Non-English Speaking Patients</td>
<td>Low</td>
<td>No</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Patient Type Variation</td>
<td>Low</td>
<td>No</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>
### Improvement Implementations

1. Visually Tracking Patient Progress
2. Collecting Patient Devices Upon Arrival
3. Diabetes Patient Reminder to Download Devices Prior to Appointment

#### Pilot Phase of Solution Elements

- Lasted 3 weeks allowing 9 potential days of data capture
- All solution elements used on 4 low appt. demand days

#### Pre-Improvement Data:
59 Samples of Patient Lead Time.
(October ‘17 – January ‘18)

#### Post-Improvement Data:
21 Samples of Patient Lead Time.
(February ‘18 – March ‘18)

No Statistical Difference in Lead Time

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**I-MR Chart of Lead Time by Stages**

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**Staged Control Chart**

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**Pre-Improvement Data:**
59 Samples of Patient Lead Time.
(October ‘17 – January ‘18)

- **Bad Days (15%)**

**Post-Improvement Data:**
21 Samples of Patient Lead Time.
(February ‘18 – March ‘18)

- **Bad Days (9%)**
Improving Flow to Reduce Overall Wait in Healthcare

Ensuring Sustainability

Control Plan for Continuous Use of Solution Elements

<table>
<thead>
<tr>
<th>March 2018</th>
<th>April 2018</th>
<th>May 2018</th>
<th>June 2018</th>
<th>July 2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pilot Phase</td>
<td>Normalization</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Utilize Solution Elements on High Demand Day
- Solution Elements Utilized for 21 days (7 clinic weeks) to build habit of use
- Initial Implementation of Solution Elements
- Utilize Solution Elements for Continuous Week
- Re-evaluate Impact of Lead and Wait Time

Projected Impact After Continuous Use

<table>
<thead>
<tr>
<th>Pain Point</th>
<th>Factors Targeted with Solution Elements</th>
<th>Projection Reduction in Process Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient A1C</td>
<td>2 out of 3 factors targeted</td>
<td>1.04 to 7.76 min</td>
</tr>
<tr>
<td>Patient Paperwork</td>
<td>1 out of 2 factors targeted</td>
<td>.375 to 2.81 min</td>
</tr>
<tr>
<td>Patient Device Downloads</td>
<td>1 out of 3 factors targeted</td>
<td>.63 to 4.73 min</td>
</tr>
<tr>
<td>Total Projected Reduction in Process Time: 2.05 – 9.23 min</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Late Patients
Initial State: 50%
Final State: 38%

Most patients were late

Wait Time
Initial State: 9.6 min
Final State: 7.4 min

Patients are given more value-add time

Projected Reduction in Process Time After Normalization of Solution Elements Utilizing "Time Added to Process" from FMEA

<table>
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<th>Pain Point</th>
<th>Factors Targeted with Solution Elements</th>
<th>Projection Reduction in Process Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wait for Exam</td>
<td>Pre-Median: 4.0, Change 95th %: 39.6</td>
<td>.04 to 7.76 min</td>
</tr>
<tr>
<td>Pre-Change Data: 3342 Samples (February '17 – October '17)</td>
<td>Post-Change #1 Data: 2302 Samples (October '17 – January '18)</td>
<td></td>
</tr>
<tr>
<td>For Total Exam</td>
<td>Post-Median: 3.1, Change 95th %: 35.9</td>
<td>.04 to 7.76 min</td>
</tr>
<tr>
<td>For Total Check</td>
<td>Pre-Median: 3.0, Change 95th %: 22.9</td>
<td>.04 to 7.76 min</td>
</tr>
<tr>
<td>For Total Out</td>
<td>Post-Median: 2.1, Change 95th %: 20.5</td>
<td>.04 to 7.76 min</td>
</tr>
<tr>
<td>For Total Time</td>
<td>Pre-Median: 2.0, Change 95th %: 18.3</td>
<td>.04 to 7.76 min</td>
</tr>
<tr>
<td>For Total Check</td>
<td>Post-Median: 1.2, Change 95th %: 16.8</td>
<td>.04 to 7.76 min</td>
</tr>
<tr>
<td>For Total Out</td>
<td>Post-Median: 4.5, Change 95th %: 14.2</td>
<td>.04 to 7.76 min</td>
</tr>
<tr>
<td>For Total Time</td>
<td>Post-Median: 7.4, Change 95th %: 13.1</td>
<td>.04 to 7.76 min</td>
</tr>
</tbody>
</table>

Pre-Change Data: 3342 Samples (February '17 – October '17)
Post-Change #1 Data: 2302 Samples (October '17 – January '18)
Post-Change #2 Data: 2143 Samples (January '17 – March '18)
12:00 pm  Scott Tee-up
Quick Review from Part I—the Framework for the Series

12:10    Maria and Gunnar: OSU Med Center and Mount Carmel

12:25    Joseph Weger: Peerless Saw

12:40    Allen Drown: Transmet

12:55 pm  Scott: Closing Comments

1:00 pm   Adjourn
About Me

Name: Joseph Weger
Year: 4
Major: Industrial Systems Engineering
Track: Manufacturing
From: Cleveland, Ohio
Hobbies: Skiing, Hockey, and Baseball

Past Experiences:
- Manufacturing Engineer intern at Libra Industries
- Service Operations Intern Bruner Corporation
## Project Background

<table>
<thead>
<tr>
<th>What is Peerless Saw?</th>
<th>Peerless is an ESOP-run saw manufacturer that produces custom-made industrial saws ranging from 4” to 40”.</th>
</tr>
</thead>
<tbody>
<tr>
<td>What are the project requirements?</td>
<td>The executive sponsor at Peerless wanted to increase employee engagement, lean culture, and create a continuous improvement system within the company.</td>
</tr>
<tr>
<td>What the intended benefits?</td>
<td>The company hopes the process implemented gets employees more engaged in the company and will bring collaboration and idea spreading throughout the plant. Peerless also has a goal set for under $100,000 of total rework that this process will help to achieve.</td>
</tr>
</tbody>
</table>
Benchmarking: elements from Transmet’s similar “Walk and Talk” process

Lean Foundations: production waste identification

Background Research: methodology of the process.

Executive Sponsor Requirements: process must be made in respect to the requirements

Design of the Program

How the process was constructed

How the process is run

Continuous Improvements

Process Awareness

Collaboration

Idea Spreading

Communication

Improvement Documentation/ Monitoring

Define

Concept

Design

Implement

Optimize

Verify
What is different in the organization?

- Engagement in lean operations from the walkthrough system breeds collaboration and continuous improvement.
- Employees make lean simple and can identify how waste manifests itself within the plant floor and operations.
- Improvements have flourished throughout all the different plant floor operations and office.
- All different employees run the walkthroughs and are engaged in leadership roles.
How did the project effect other performance metric dials in the company?

Actions by Peerless to reduce rework and obtain a goal of under $100,000 in annual rework.

Awareness  Incentive  Engagement

After the process was implemented, the total rework costs for 2018 are projected to be under $100,000 annually based on the results achieved in the 6 months since implementation.

Statistical and practical difference in combined rework.

Total rework costs for 2018 are projected to be under $100,000 annually based on the results achieved in the 6 months since implementation.
How does this project tie in with the operational goals and future projects of Peerless?

Through self-reported time savings, 52 hours a week are saved around the plant. This translates to an annual throughput increase of $72,489.36.

51 cents less in Labor dollars per saw!
Key Takeaways

- Individual operators know their processes best. Engaging and empowering them to become creative and provide impact to the company is a very powerful tool that can be applicable in many manufacturing and transactional settings.

- Educating employees using universal terms in a clear, easy, concise manner is critical to understanding. Lean elements can be simplified to “learning to see waste” and “how to fix it”. Once the groundwork is done you will be amazed by the creativity and improvements from all different types of employees.
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| 12:40  | Allen Drown: Transmet                           |
| 12:55 pm | Scott: Closing Comments                         |
| 1:00 pm | Adjourn                                         |
Transmet Process Maturity Level Improvement

Allen Drown – Project Lead and Belt Candidate
Justin Clarke & Robin Gates – Project Sponsor
Scott Sink – Project Coach
Agenda

Purpose:
• To provide plans for implementation of Standard Work Knowledge Dashboard for use by workers on the Production Lines

Objectives/Topics to be covered:
• About Me
• Process Maturity Analysis
• Creating a Modern Knowledge Management System
• Creating a Modern Preventative Maintenance Program
• Conclusions
About Me

Name: Allen Drown
Hometown: Cleveland, Ohio
Education: Industrial Engineering, May ‘19
Upcoming Plans: United Airlines (CIEO Group, Co-op Summer & Fall)
Interests: Humanitarian Engineering, Robotics, former IISE VP of Operations for OSU Chapter
Project Overview

Motivation
Market outlook predictors show an increase in demand for their products. The company is looking to increase production of it’s products.

Problem Statement
In order to ensure quality expected by their customers, the company needs to reduce the risk of lost process knowledge in the event of process owner turnover.

Objective
Create a Central Knowledge Management System (KMS), though a Process Maturity Framework, to control for human and process variation and failures.

PROCESS MATURITY ANALYSIS
Process Maturity is a Model that describes how well a process can deal with stress as well as allow for continuous improvement. The model is defined by 5 stages: (1) Initial, (2) Repeatable, (3) Defined, (4) Measured, (5) Optimized.

Market outlook predictors show an increase in demand for their products. The company is looking to increase production of its products.

In order to ensure quality expected by their customers, the company needs to reduce the risk of lost process knowledge in the event of process owner turnover.

Create a Central Knowledge Management System (KMS), though a Process Maturity Framework, to control for human and process variation and failures.
Knowledge Management System Design

- Central Knowledge Database Dashboard hosted through SharePoint 365
- Optimized for accessed on the Microsoft Surface Tablet
- Modernized Standard Work Documents by making technical Details in simple English and incorporating Visuals
- Creation of a “Smart” Calendar for TPM and SMED activities
Preventative Maintenance Calendar

- Biggest problems occurred with delays because of Machine Breakdowns
- Creating Standard Work Documents on preventative maintenance and how to fix downed systems
- Preventative maintenance now housed on a Company Wide Calendar accessed through the KMS dashboard
- Calendar Sends Email reminders to people tasked to complete those jobs
- SOPs attached to calendar events
Conclusions

• Creating Standard Work Documentation is not as easy of a task as I thought it would be. There is much variability in processes that is needed to be accounted for.

• Having a set schedule for machine repairs is important as the company had two easily preventable machine breakdowns this past year that costed them a lot of money.

• Transmet has an amazing company culture that allows for its employees the freedom to innovate and improve processes.

• Convincing people that an IT implementation would be useful for the company is a tough sell.

• Involving Employees in the project is very important to get good information and to gain trust.
Questions
Webinar #1: Foundations  7 Dec 2017 (and GLR Conference)

Share the Framework, the Models, the Abstractions, the Principles
Management Systems Model
Intel “Triangle” Model

Webinar #2:  Foundational Data Role--Measurement and Analysis Planning  20 March 2018

Measurement Planning using Value Stream Maps, Data Models derive from refining the Management System Model, The Data Management Role of ISE’s in Process Improvement Projects

Webinar #3:  Best in Class ILSS Project Final TG’s  25 April 2018

Showcase best in class projects, shine spotlight on Op Analytics

Webinar #4:  Decision Support Role—M&A Execution  12 June 2018

Feature and Knowledge Extraction, Creating Chartbooks and VSM’s, supporting the evaluation phase of DMAIC projects and then also the Control Stage.

Webinar #5:  Putting it all together  24 July 2018

Operational Analytics—the Whole Chalupa…
Provoke timely and effective decisions and actions (shorten ‘latency’)

- “Above the line” analyst role
  - Extract features based on questions you have to answer by ‘torturing’ the data until it speaks to you and others. Pick right metrics of interest!!
  - Apply curiosity & business acumen to data & analyses – create new knowledge, insights, ‘aha’s’
  - Apply data visualization techniques to aid in telling the right story – as in life, so in business: the best story wins … Develop the Art of Powerful Visualizations and stay focused on driving the ‘end game’
Upcoming Lunch and Learn Webinars: FREE, over lunch time, Usually Tuesdays, GoToWebinar Format!!

- 19-22 May: IISE Annual Conference, Orlando, Universal Loew’s International
- 12 June: Operational Analytics Part III—The Top Half of the Intel Analytics Triangle—Decision Support
- 24 July: Operational Analytics Part IV—Putting it all Together, how to master Operational Analytics and drive faster Improvement
- 21 Aug: Balancing your ISE and ILSS Technical Skills with the right ‘soft skills’: Mastering Change Leadership and Management
- 6 Sept. CISE Career Choice Points #3 (Jim Dobson, Disney; Rudy Santacroce, CarlsonRTKL (health care architecture firm); Kelli Franklin-Joyner, UPS.)