

A Statistical Model for Employee Engagement

A CASE STUDY

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Disclaimer!

All of the data within this presentation is **dummy data, generated specifically for this presentation**, and is/was not used for any analysis for 'real-world' organization projects.

This data, and it's accompanying charts, findings are indicative only.

Background to Organization



Large Technology Manufacturer

- Approx 500 Employees in Limerick site
- \$5billion in Global Annual Revenue
- 66/34% Split in Male/Female Employee Population
- Average Tenure Range: 14 years
- Average Age Range: 36-45



Value Stream Model

- Cross functional roles reporting to one line of business
- 3 Shifts – Days & Evenings (2 cycle) , Night shift
- Typically 2 layers of Management at Value Stream Level

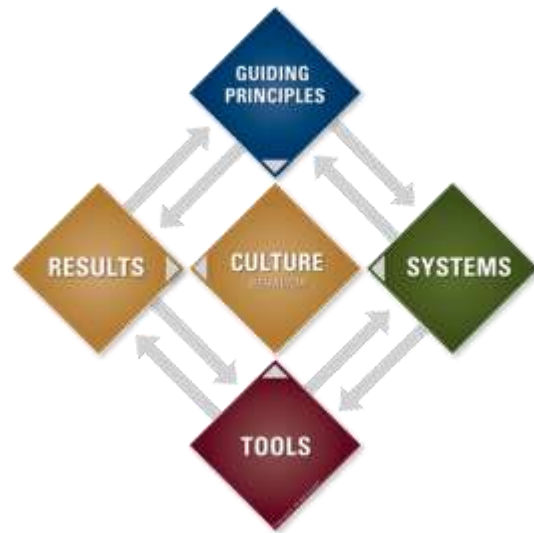


Organization Goal

- Attain Shingo Prize for Operational Excellence
- Multi-year Program to foster Op Ex Culture
- Win Employee 'hearts and minds' - crucial to journey

Shingo Prize

THE SHINGO MODEL™



THE GUIDING PRINCIPLES™



Benefits of the Shingo Prize:

- Recognition as world class, benchmark organization for Operational & Organizational Excellence
- Market Differentiator vs competitors
- Competitive advantage for the company
- Sustainable Systematic Continuous Improvement will lead to greater efficiencies

Shingo Organizational Excellence

- Ideal results require Ideal Behaviours
- Purpose & Systems Drive Behaviour
- Principles Inform behaviour

Employee Engagement: Enabling a Culture

“The harnessing of organization members’ selves to their work roles; in engagement, people employ and express themselves physically, cognitively, and emotionally during role performances.” Professor William Kahn, “Psychological Conditions of Personal Engagement and Disengagement at Work.”



Happiness



Wellness



Satisfaction



Rel. w/ Peers



Rel. w/ Mgr



Feedback



Recognition



Alignment

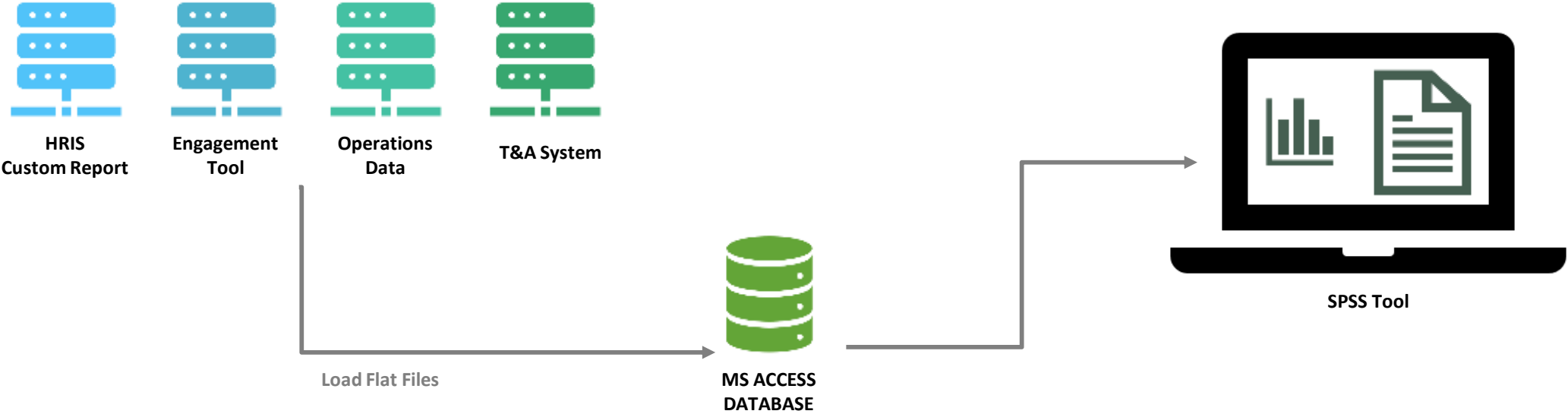


Personal
Growth

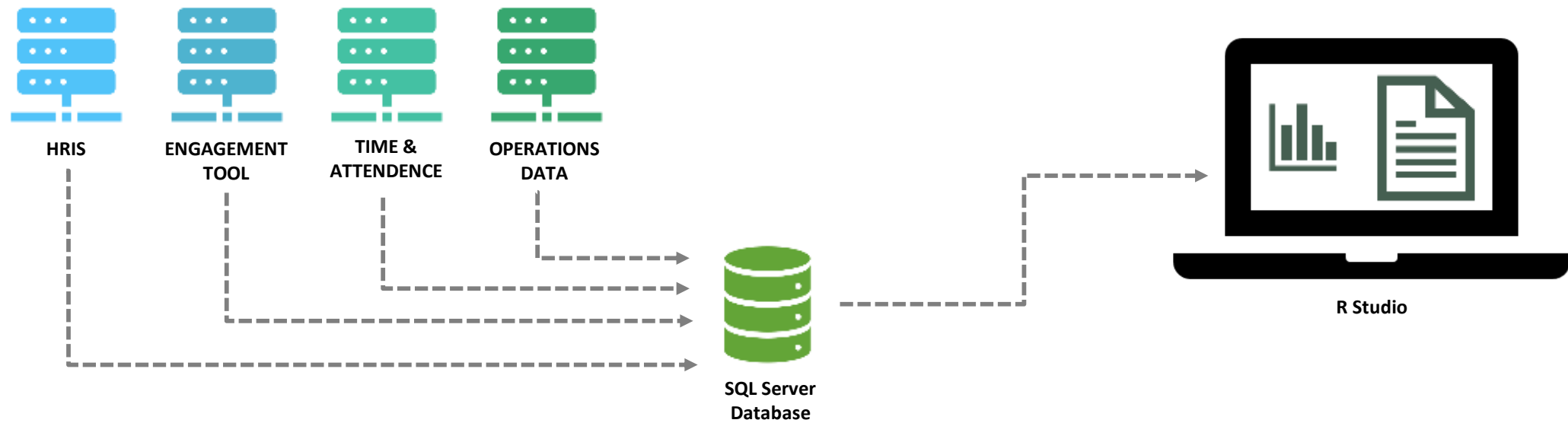
Model Objectives

- Use Employee Engagement as a cornerstone of Cultural Enablement for Shingo
- Understand and action the feedback from Employee Engagement that can help the by actively listening and responding to feedback in a timely manner
- Understand what areas of Employee Engagement influence are related
- Understand the relationship between Employee Engagement and Performance
- Understand the relationship between Employee Engagement and Absenteeism
- If applicable, leverage model for Cultural Enablement and increased Operational Excellence

Data Flow Overview - v1 (P.O.C.)



Data Flow Overview - v2



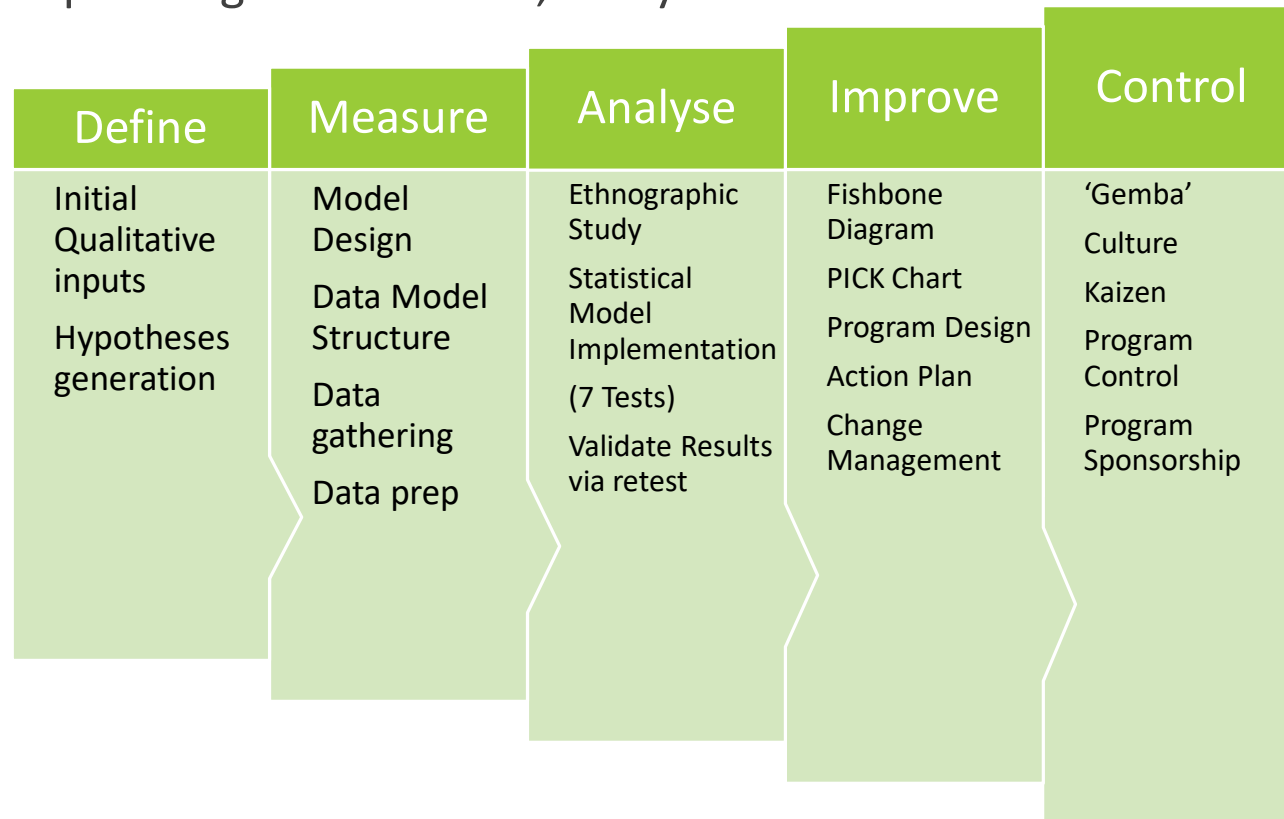
Data Privacy Considerations

GDPR:

- Data Anonymized **at source** via custom reports
- No reference to Employee IDs or any other unique identifiers anywhere
- 'Unit Test' performed to ensure no unique Employee Data existed, verified independently
- Coded Data in tool only (Nominal, Ordinal Variables)
- Aggregated data in Analysis only
- Data & Output visible to HR Function only

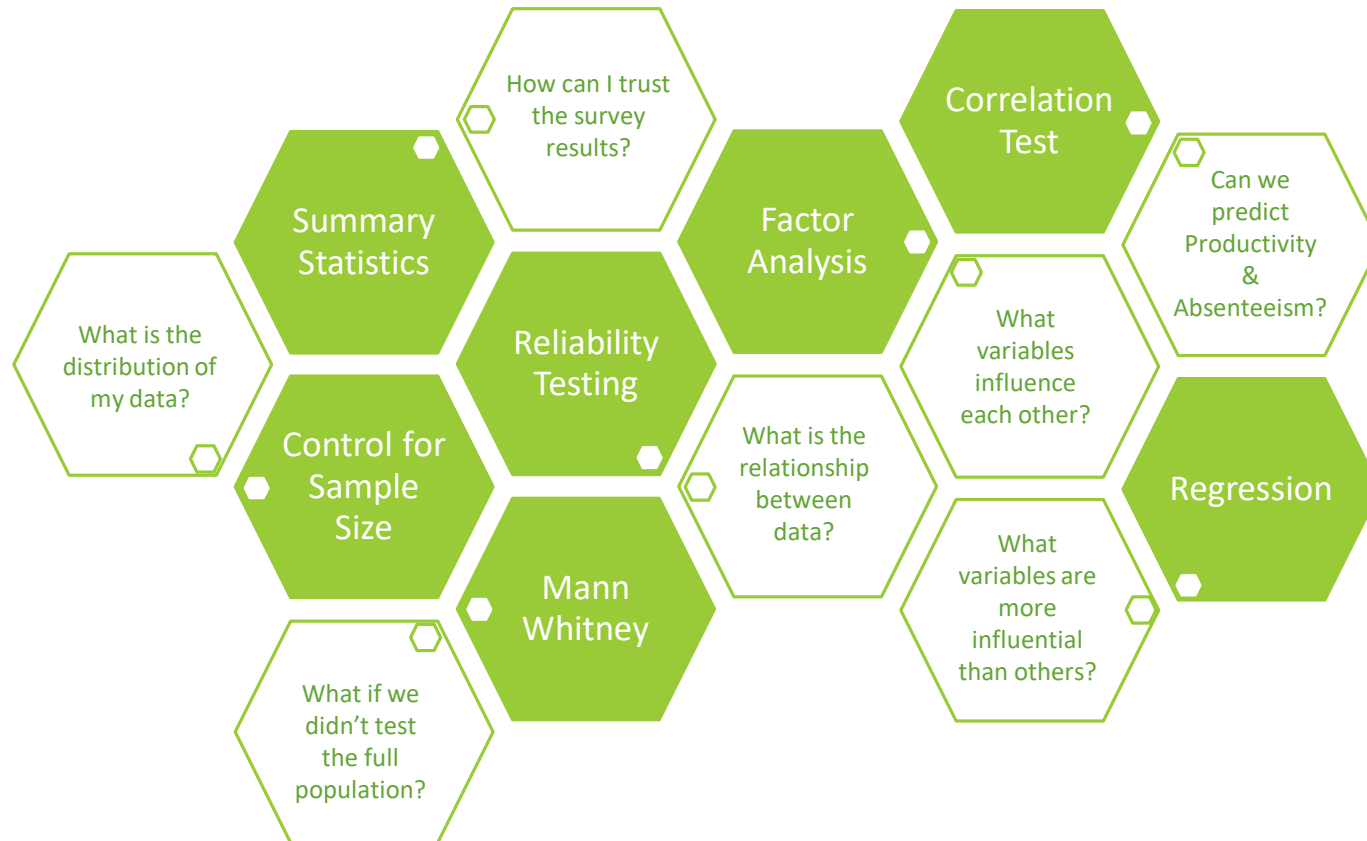
Project Structure - DMAIC

DMAIC effective for sequencing of the model, analysis & outcomes



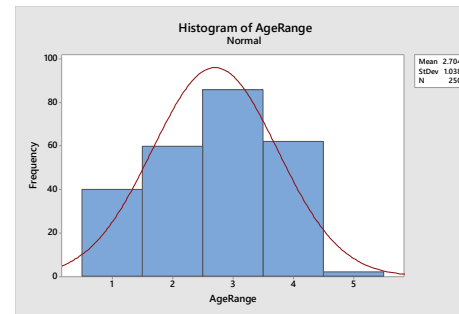
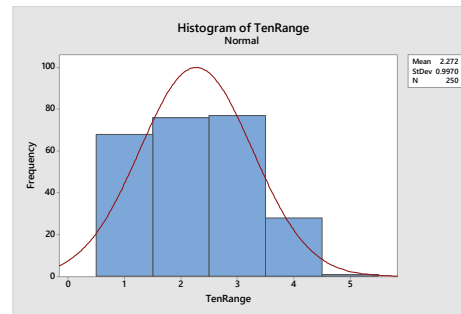
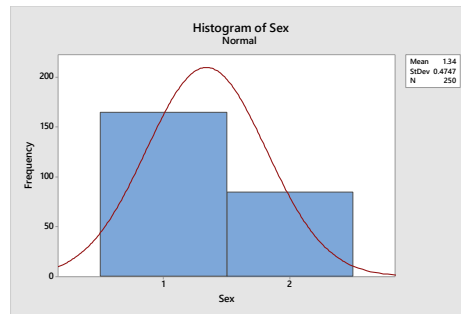
Statistical Model

What data do I have / what test will I run / what is significant / why that test



Summary Statistics

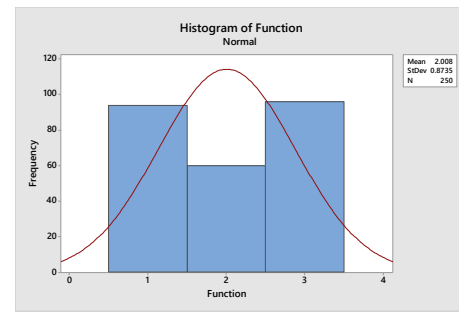
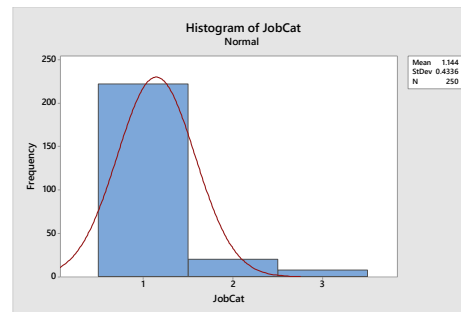
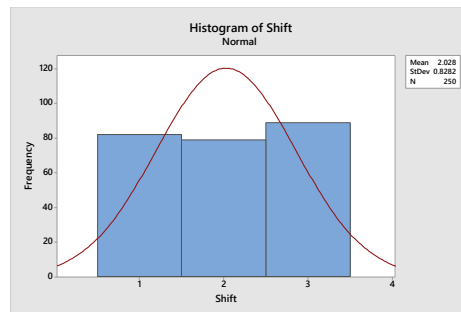
A closer look at some of the variables used



Observations

Normal Distribution of Employee Data

- Sex 66% Male / 34% Female
- Most Employees in the 6-10 years Tenure Range
- Most Employees in the 35-44 Age Group



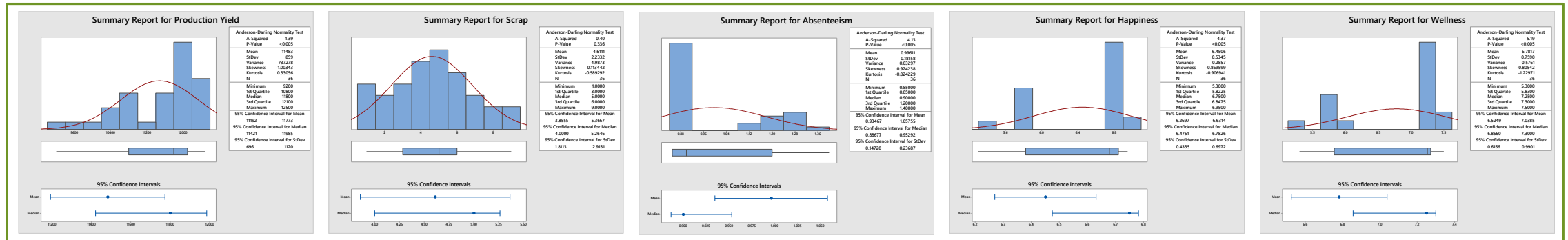
Observations

Normal Distribution of Employee Data

- Shift 3 slightly largest shift
- Vast majority of Employees Individual Contributor
- Operations the largest function, followed by Support Services (HR / IT / Finance / Procurement etc), then Engineering.

Data Distribution

What type of data did we have?



How did we control for sample size?

Sample Size for Estimation

Method

Parameter	Mean
Distribution	Normal
Standard deviation	72.31 (estimate)
Confidence level	95%
Confidence interval	Two-sided

9%
Margin of Error

Results

Sample Size	Margin of Error
250	9.00726

Observations

Skewed Distribution of Production, Absenteeism and Engagement Data

- Analysis of Data would require Non-parametric Tests as part of the analysis

(Slightly) Larger than ideal margin of error

- Sample size of 250 gave a margin of error of 9% for a Confidence Interval of 95%

Data Relationships

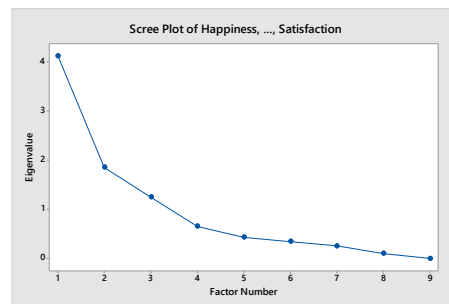
What kind of Relationships did we find in the data?

Test

Factor Analysis on all Employee Engagement Variables

Unrotated Factor Loadings and Communalities

Variable	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Factor 8	Factor 9
Engagement	0.812	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Wellness	0.719	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Relationship with Team	0.420	0.770	-0.000	-0.140	0.000	0.000	0.000	0.000	0.000
Feedback	0.440	0.307	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Recognition	0.440	0.307	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Relationship with Manager	0.337	0.460	-0.000	-0.000	0.000	0.000	0.000	0.000	0.000
Alignment	0.280	0.407	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Autonomy	0.280	0.407	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Feedback	0.280	0.407	0.000	0.000	0.000	0.000	0.000	0.000	0.000



Test: Factor Analysis

Objective: Shows the strength of relationships between multiple different variables

Observations (statistically significant, p value < .005)

- Happiness – strongest relationships with Wellness / Recognition / Relationship with Manager
- Feedback, Relationship with Manager and Recognition all had strongly associated relationships

How did the Engagement Survey Relate to Production & Absenteeism data?

Test

Mann Whitney Performed against many variables

Method

η_1 : median of Happiness
 η_2 : median of Production Yield
 Difference: $\eta_1 - \eta_2$

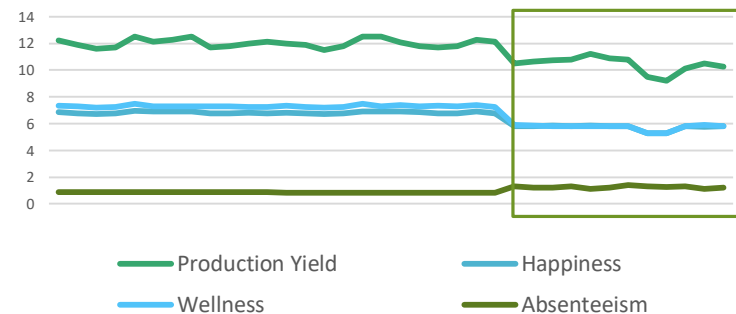
Test

Null hypothesis: $H_0: \eta_1 - \eta_2 = 0$
 Alternative hypothesis: $H_1: \eta_1 - \eta_2 \neq 0$

Method	W-Value	P-Value
Not adjusted for ties	666.00	0.000
Adjusted for ties	666.00	0.000

Observations: The Mann Whitney Tests showed statistically significant relationships between Happiness and Production Yield, Happiness and Absenteeism, Wellness and Production Yield and Wellness and Absenteeism ($p < .005$ in all cases)

Data Relationships across Shifts



These statistically significant relationships continued across shifts, where **lower Happiness and Wellness values were matched accordingly to higher rates of absenteeism and lower output** – see night shift

Correlations and Predictions

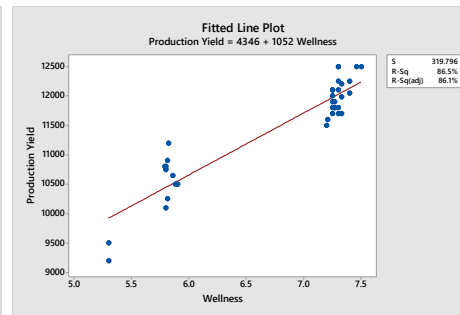
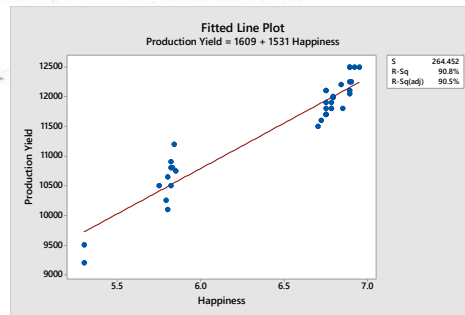
Happy and Healthy Employees are more Productive and less likely to be absent from work

Spearman Rho: Production Yield, Happiness, Wellness

Correlations

	Production Yield	Happiness
Happiness	0.940	
	0.000	
Wellness	0.849	0.906
	0.000	0.000

Cell Contents:
Spearman rho
P-Value

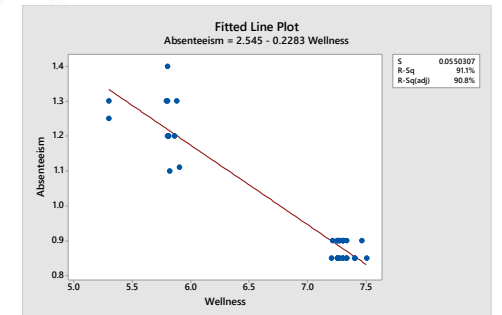


Spearman Rho: Absenteeism, Happiness, Wellness

Correlations

	Absenteeism	Happiness
Happiness	-0.687	
	0.000	
Wellness	-0.755	0.906
	0.000	0.000

Cell Contents:
Spearman rho
P-Value



Test

Spearman's Correlation

Test: Spearman's Correlation

Objective: Shows the strength of relationships between two variables

- Happiness and Wellness had overwhelmingly strong and statistically significant correlations with Productivity Yield & Absenteeism across each shift

Test

Regression Analysis

Test: Linear Regression

Objective: Predict the outcome of one variable based on it's relationship with others

- An extra unit of happiness is worth 12% increased Yield per Quarter ($p < .005$)
- An extra unit of happiness is worth 8% less Absenteeism per Quarter ($p < 00.5$)

Observation:

Other Variables such as Feedback and Rel. w/ Manager proved to have a an association with each other, none were statistically significant in Correlations or Regressions with Yield or Absenteeism

Deeper into the Data

What made Employees rate Happiness & Wellness highly? Thematic Analysis:

Happiness

What gives you happiness at work?
What would make you happier in the workplace?

Work / life balance

Team Building

Autonomy

Happiness

What makes you **unhappy** at work?

Long hours required

Inconsistent treatment of emp.

Wellness

What does Wellness at work mean to you?
How can we improve wellness?

Work from Home policy

Flexible working hours

Onsite gym

Insights

- There was a perceived difference by employees across shifts that, due to a lack of an up to date policy, Flexible working arrangements were handled on a case by case basis by the line / functional manager.
- Employees felt it was a ‘work work work’ culture
- The Night shift scored lowest on Happiness and Wellness, and both of these had a stronger negative correlation with Absenteeism for the Night shift than the 2 cycle days & evenings.
- The site Training function, moving towards a blended model with more individualised, online Programs,(MOOC’s etc) had overlooked the benefits of team based training activities.
- Employees from Specific functions – Engineering and other support services felt they had a lack of tools, resources or team members to accomplish their tasks.
- Conversations between line manager and employee, needed to improve to become more two way discussions regarding expectations, feedback and development / goal setting.

Engagement Program Design

Improve



New Flexible Working Policy



Construction of On-site gym
New Work / Life balance ERG



Team Based Activities / Training Programs

Control



More Structured Employee 1:1's



Manager's respond to Anonymously provided feedback in team setting



Going to the Gemba

- 'Go and see'
- Ask why
- Respect people

Do people have the resources needed to do their jobs?
How does this vary per shift?
How do teams work together?
How do they problem solve?

Outcomes

- Organization Awarded Shingo Prize 2019
- Increased Yield on 2 Shifts over a 6 month period
- Reduced Absenteeism on Night Shift over a 6 month period
- New Program and Employee Resource Groups established
- Further opportunities for Analysis!

Reflections

- Data Integrity – Test / Control and Test Again
- A tangible business need is critical for a project to be successful
- Leadership support crucial when other data sources used
- Ensure that data usage is compliant to GDPR / Organizational policy
- Assemble the post-hoc Program team well in advance
- Monitor and Control at regular intervals for ‘live research’

Thank you
