IISE Global Performance Excellence Webinar Series:

Operational Analytics 501:

Detailed Design & Development

Creating Op Analytics Competencies and Capabilities

Tools, Methods, App's

IISE Coordinator

D. Scott Sink
IISE Performance Excellence and Op Analytics Volunteer Lead
Facilitator/Member, CISE

Our Speaker today and our Sponsor:

Jared Frederici, MBB
The Poirier Group

Jared Frederici Linkedin Page

THE POIRIER GROUP
Focused Performance Improvement

INSTITUTE OF INDUSTRIAL & SYSTEMS ENGINEERS
75th ANNIVERSARY 1948-2023

03 Aug 2023

Council on INDUSTRIAL & SYSTEMS ENGINEERING

Agenda

11:00-11:10	Scott to ‘tee-up’ the session, go back to go forward just a bit
11:10-11:45	How to develop your OA knowledge and skills—tools, methods, apps, training, etc. (Jared)
11:45-11:55	Scott and Jared Dialogue
11:55	Scott close out and overview our upcoming AI mini-series

Housekeeping

INSTITUTE OF INDUSTRIAL & SYSTEMS ENGINEERS

Solving complex & critical problems of the world.

1. Thank you for joining us!
2. We'll share how to get access to the recording, presentation, YouTube versions and blogs at the end of the webinar. The presentation is available now, use this link to get.. (we'll post as a chat)
3. We will field questions as appropriate and time permits. Please **use the 'chat' function** to share your comments and questions.
4. Follow up questions are welcomed and contact information is provided at the end of the presentation.
5. For those who value certificates of participation, IISE will be mailing those out the week after the webinar. Be patient and check your clutter and spam folders if you don't receive one.

PARTNERING for GROWTH

Thanks to our Sponsor and Partner for investing time, money, energy programming and directing this overall Program for IISE!

THE POIRIER GROUP

INSTITUTE OF INDUSTRIAL & SYSTEMS ENGINEERS

PARTNERING for GROWTH

Our 2023 Mini-Series' :

Strategies for Riding the Waves of Disruption

Supply Chain Management 4.0/5.0

Operational Analytics

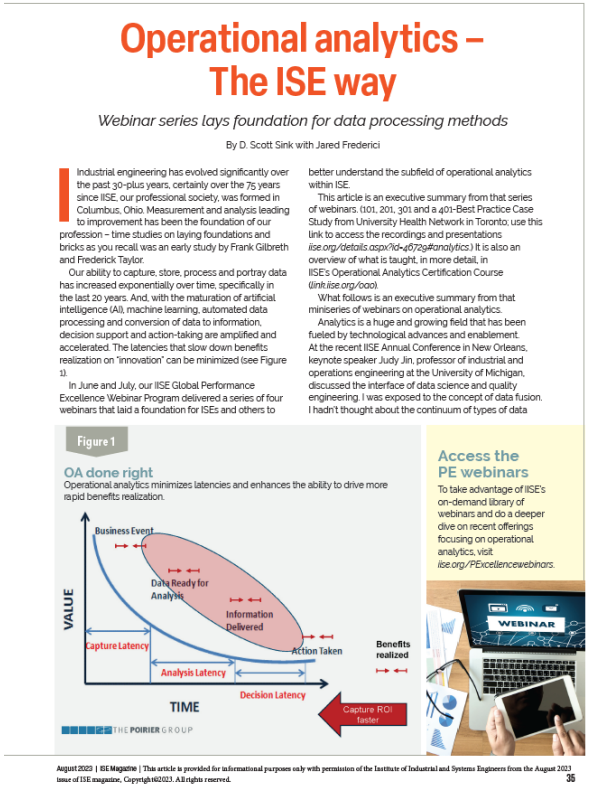
AI

THE POIRIER GROUP

Membership has its Privileges....

Dec 2022

April 2023



Operational analytics – The ISE way

Webinar series lays foundation for data processing methods

By D. Scott Sink with Jared Frederici

Industrial engineering has evolved significantly over the past 30-plus years, certainly over the 75 years since IISE, our professional society, was formed in Columbus, Ohio. Measurement and analysis leading to improvement has been the foundation of our profession – time studies on laying foundations and bricks as you recall, was an early study by Frank Gilbreth and Frederick Taylor.

Our ability to capture, store, process and portray data has increased exponentially over time, specifically in the last 20 years. And, with the maturation of artificial intelligence (AI), machine learning, automated data processing and conversion of data to information, decision support and action-taking are amplified and accelerated. The latencies that slow down benefits realization on "innovation" can be minimized (see Figure 1).

In June and July, our IISE Global Performance Excellence Webinar Program delivered a series of four webinars that laid a foundation for ISEs and others to better understand the subfield of operational analytics within ISE.

This article is an executive summary from that series of webinars. (101, 201, 301 and a 401-Best Practice Case Study from University Health Network in Toronto; use this link to access the recordings and presentations *iise.org/details.aspx?id=46729#analytics*.) It is also an overview of what is taught, in more detail, in ISE's Operational Analytics Certification Course (*link.iise.org/oaa*).

What follows is an executive summary from that miniseries of webinars on operational analytics.

Analytics is a huge and growing field that has been fueled by technological advances and enablement. At the recent IISE Annual Conference in New Orleans, keynote speaker Judy Jin, professor of industrial and operations engineering at the University of Michigan, discussed the interface of data science and quality engineering. I was exposed to the concept of data fusion. I hadn't thought about the continuum of types of data

Figure 1

OA done right

Operational analytics minimizes latencies and enhances the ability to drive more rapid benefits realization.

Access the PE webinars

To take advantage of ISE's on-demand library of webinars and do a deeper dive on recent offerings focusing on operational analytics, visit *iise.org/PExcellencewebinars*.

August 2023 | ISE Magazine | This article is provided for informational purposes only with permission of the Institute of Industrial and Systems Engineers from the August 2023 issue of ISE magazine, Copyright ©2023. All rights reserved.

Aug 2023

IISE Global Performance Excellence on-demand Webinar Library

100+ Timely Webinars on a full spectrum of Performance Excellence topics with an Integrated Systems Engineering Perspective and Point of View.

Available on-demand for IISE members.

Clustered into packages of webinars to provide tailored **Certificate opportunities** for our Members.

1--Operational Excellence
2--Integrated LeanSigma
3--Operational Analytics
4--Change Leadership & Management

Strengthen your Resume and Linkedin Page!!

Visit The Poirier Group's Website to access shorter versions of these Webinars (snippets)

https://www.thepoiriergroup.com/perspectives/

Or go to the TPG YouTube Channel for the short and longer version.

General — 12 minute video

Operational Analytics 301: Data Management Role & Analyst/Decision Action Support Role

Seminar / Webinar — July 20, 2023

General — 12 minute video

Operational Analytics 401: Case Study – University Health Network

Seminar / Webinar — July 18, 2023

General — 14 minute video

Operational Analytics 201: Concept Design Stage for Building Successful Measurement Systems

Seminar / Webinar — July 5, 2023

General — 14 minute video

Operational Analytics 101: Foundational Principles & Frameworks

Seminar / Webinar — June 19, 2023

https://www.youtube.com/channel/UCixxhLPZrwdK-DdKYqYZm1A

Videos ▶ Play all

Operational Analytics 301: Data Management &...

29 views • 9 days ago

Operational Analytics 301: Data Management &...

4 views • 9 days ago

Operational Analytics 401: Case Study - University...

23 views • 11 days ago

Operational Analytics 401: Case Study - University...

8 views • 11 days ago

Operational Analytics 201: Concept Design Stage for...

25 views • 3 weeks ago

Operational Analytics 201: Concept Design Stage for...

26 views • 3 weeks ago

How does one develop their Op Analytics Knowledge and Skill and competencies and capabilities

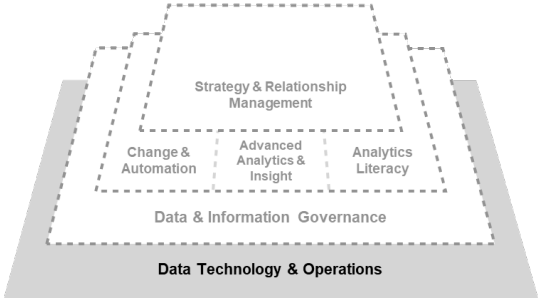
- The focus of todays OA 501 Webinar is on developing your ‘Analyst’ Role knowledge and skills:
  - RECAP: What does an OA Specialist have to be able to ‘do’, create? (Scott)
  - What are the ‘tools’ of the OA trade, what ‘apps’ does one need to be conversant and skilled with? (Jared)
  - The relationship between BPM/I 4.0&5.0 and Op Analytics (we’ll point them to your BPM webinars) (Jared)
  - Jared’s suggested professional development plan to kick your OA game up a couple of notches.. (Jared)
  - What does an OA ‘Certification’ look like relative to an ILSS belt certification? (Scott)

OA Specialist Ideal Capabilities & Competencies (illustrations)

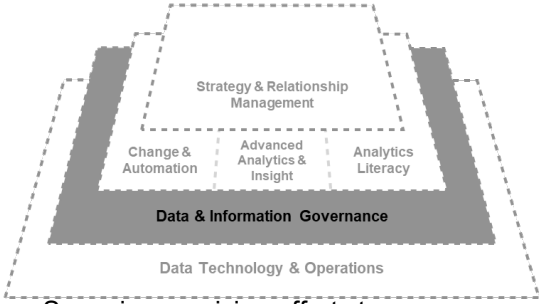
- Do Organizational/Value Stream baseline analysis.
  - How does it work
  - How does it need to perform
  - How does it perform
  - What/where are the gaps
  - What's causing the gaps
  - What do we do about the gaps
- Build data models, perform the Data Management Role
  - Define the Data element requirements
  - Source the data
  - Assemble and organize the data for analytics
  - Transfer from 'excel' to your analytics app (e.g. Minitab, PowerBI)
- Conceive of, Concept Design for the Information to Decisions to Actions to Benefits Realization causal chain and work backwards as you design and develop (Perform the Analyst Role)
- Ultimately be a Change Master, create systems that provoke timely decisions and actions that lead to faster better solutions that lead to faster benefits realization.

In our OA 401 session, we were exposed to UHN's Design Model

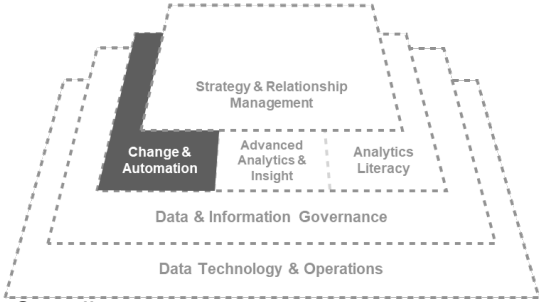
OMIX-H Components



Managing the flow of data and information required to develop analytics solutions

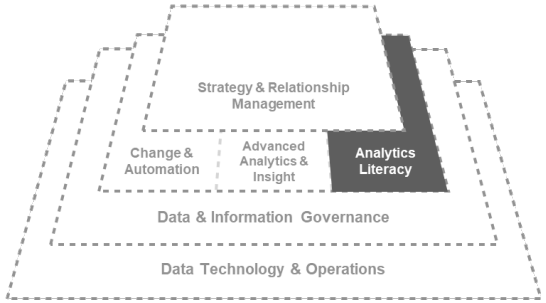


Serve in organizing efforts to manage, protect and enable value from enterprise data assets



Coordinate the implementation of advanced analytics solutions to ensure human and AI systems can work, interact and communicate with each other

Enable explorations insight generation and problem solving using data



Advance the organizations capabilities in understanding data, its collection, management and application

Stimulate, surface and shape the organization's needs across all domains of the organization

UHN

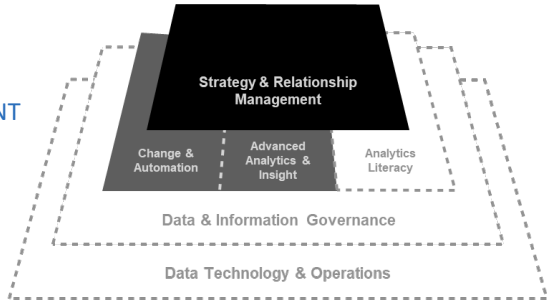
Caesar, et al. 2020. Connecting Data to Value: An Operating Model for Healthcare Advanced Analytics - Healthcare Quarterly

They stressed the interactions between components in the system relative to desired business outcomes

OMIX-H Interactions

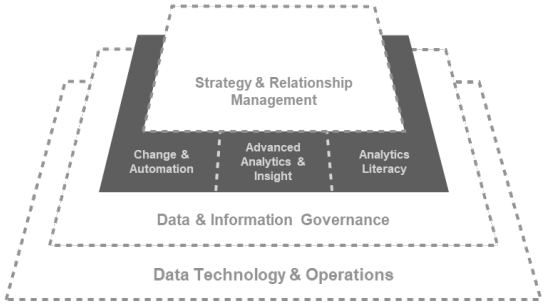
PRIORITIZATION & INVESTMENT

Prioritization of advanced analytics or AI projects



PEOPLE/CULTURE & DATA LITERACY

Ensure that organizational culture and people capabilities advance with the introduction of need ways of doing work

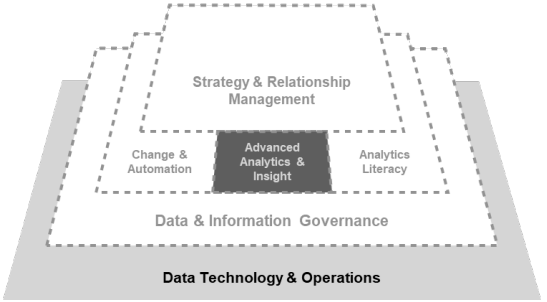


RISK TOLERANCE & STRATEGY

Ensure a balance between risk appetite and strategic pursuits

TECHNOLOGY & BUSINESS OPPORTUNITIES

Understand current and future needs to data technology and help align investment



Caesar, et al. 2020. Connecting Data to Value: An Operating Model for Healthcare Advanced Analytics - Healthcare Quarterly

And they shared the core roles that they have in their Unit

Decision Support Analyst

Our resident experts in informatics helping UHN understand its data and performance

Role:

- Performance data quality, reporting and analytics for clinical and management teams

Skills:

- Epic Cogito reporting, business intelligence, communication, and statistical analysis
- Medical terminology and informatics proficiency
- Database tools/programs (e.g. Crystal Reports, Power BI, SAS and Python)
- Large healthcare data sets

Value proposition:

- Provide accurate information and thoughtful insights on hospital performance to support operational and strategic evidence-based decision-making
- Recommend innovative ways to improve reporting process efficiency and data quality

Example Contributions:

- Stroke Accreditation
- Blood Group Confirmation to ensure patient safety and optimal delivery of blood resources

Analytics Consultant

Using data to solve problems and generate insight

Role:

- Utilize analytics and data to understand and address healthcare challenges

Skills:

- Simulation, predictive analytics, operations research, project management, and change management

Value proposition:

- Leverage UHN data assets to develop innovative analytics solutions that improve the delivery of care and operations

Example Contributions:

- Toronto General Hospital Simulation Model [inform medium and long-term capacity planning]
- Primary Care Provider Data Visualization [understand patient/provider care in the community]
- Emergency Department Predictive Model [forecast patient arrivals to inform staffing decisions]
- Eating Disorders Program Model [understand available capacity and reduce patient wait times]

Data Storyteller

Helping UHN connect to its data, understand it, and take action

Role:

- Convert business problems into decision intelligence solutions using data-driven visual stories to drive decision-making

Skills:

- Data visualization, development methodologies, information architecture, data analysis, user interface design, agile product ownership, and change management

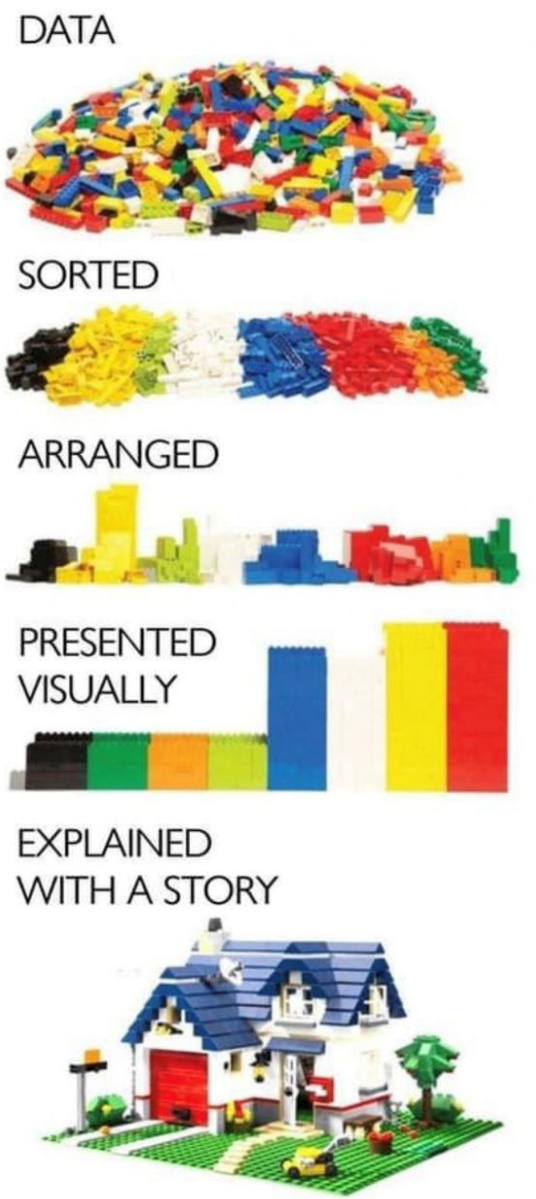
Value proposition:

- Communicating complex data through storytelling to support patients and staff in making critical decisions

Example Contributions:

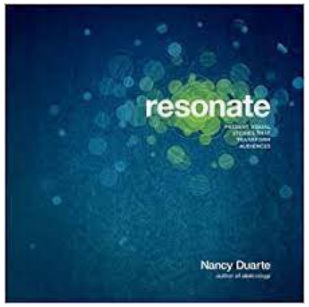
- UHN Corporate Scorecard [inform Executive Leadership and Board on performance against North Star Indicators]
- Patient facing Emergency Department (ED) wait times tool [inform patients and staff of expected wait to see a provider]
- Patient Experience dashboard [understand and improve how patients' experience care at UHN]
- COVID-19 vaccine registry dashboard and portal [identify and prioritize eligible groups for vaccination]

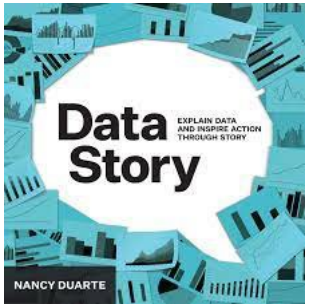
This is a neat graphic that helps understand the Analytics Triangle. Many nuances, cultural, cognitive style, complexities to making this all work effectively in organizations.



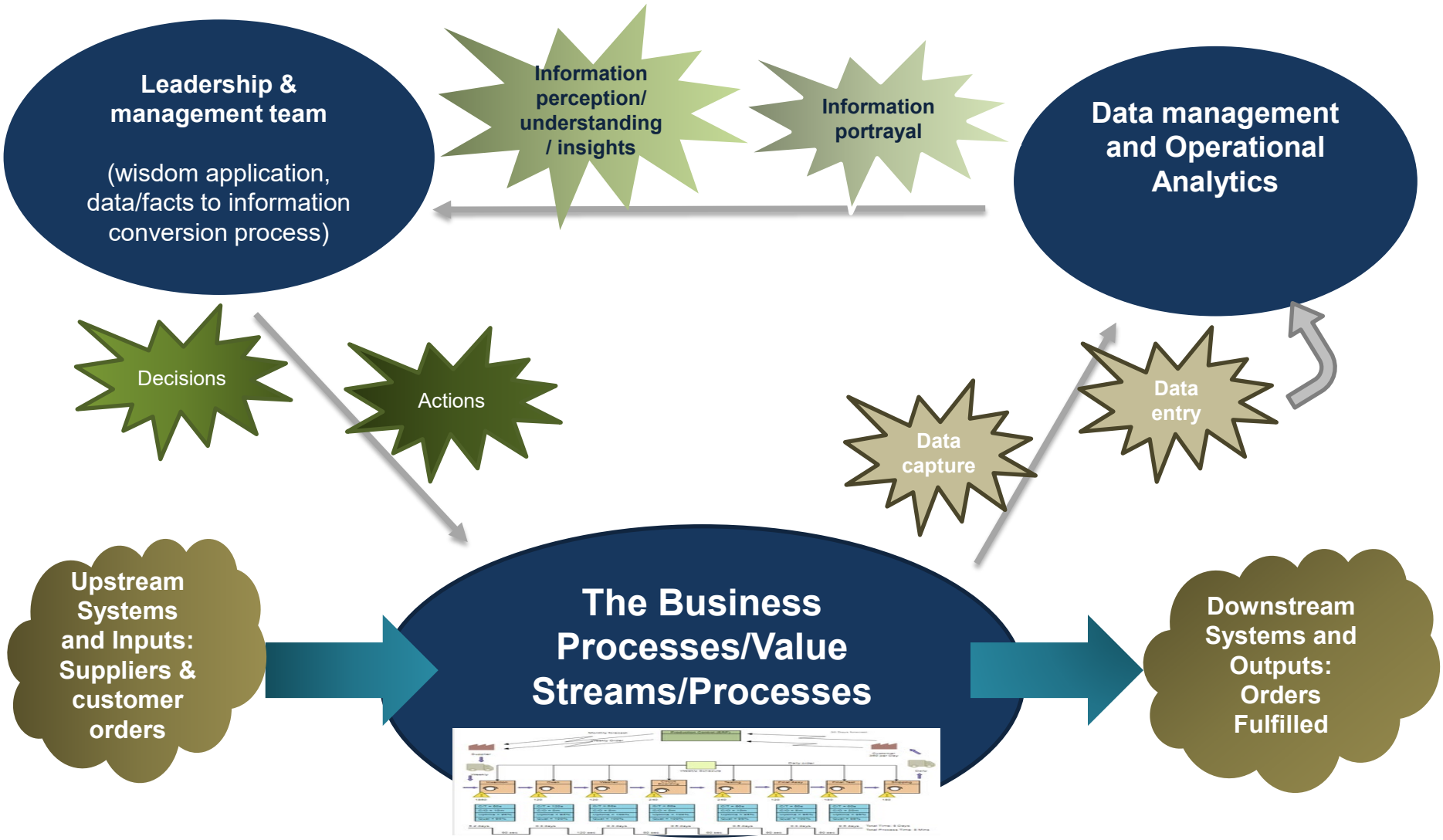
The Data Management Role

The Bus Intelligence, Analyst, Decision Support Role

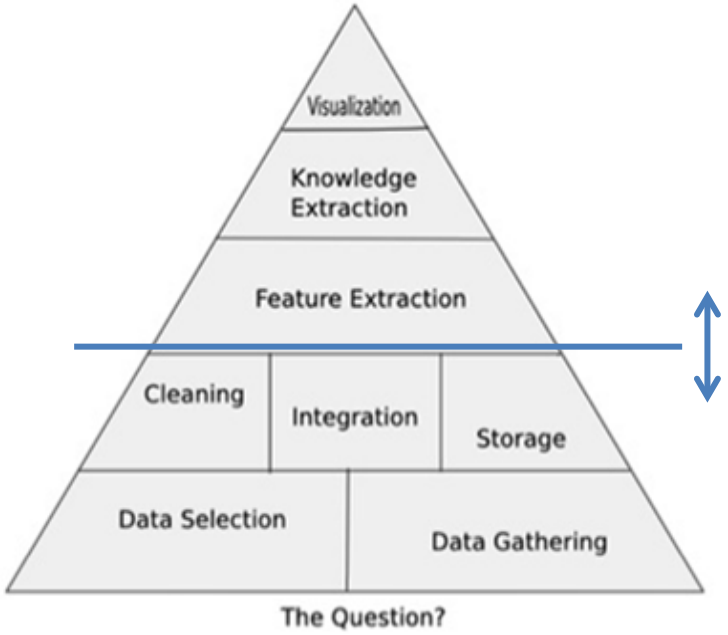




Organizational Systems, Extended Enterprises down to the smallest process is this happening..

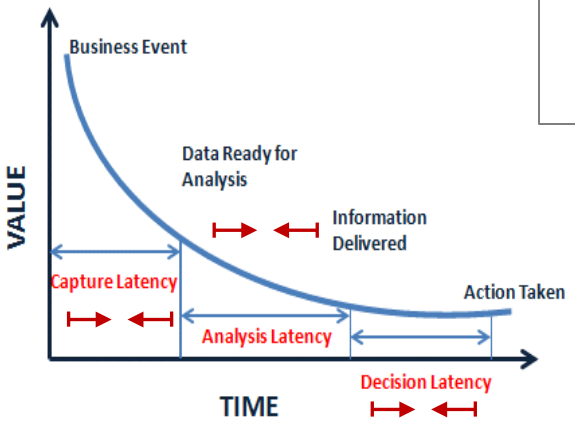


How to Build Better 'Dials' on your 'Dashboards' and 'Scorecards



Key Points to Consider:

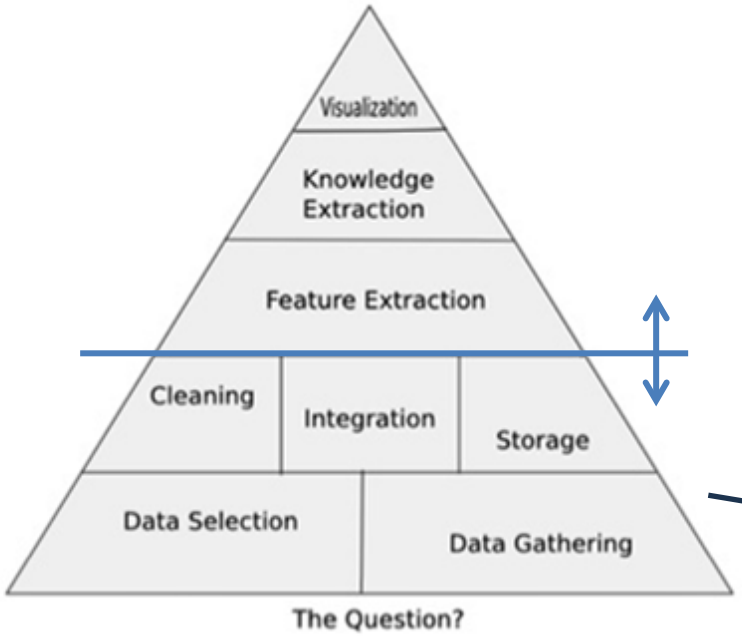
- Good analytics come from good context understanding, use case clarity, *good problem/opportunity statements*, clear understanding of DONE, they specify 'the questions'
- Investment in the data foundation has a positive ROI, as analysts and users move faster when they trust the data – results in faster results
- Good data visualizations can tell the right story quickly, because people are predisposed to believe what they see in a chart …
- Good Operational Analytics *provokes more timely decisions and actions* – indeed, in most organizational systems, simple and persuasive/influential beats complex/ambiguous every time
- Good Operational Analytics *provokes more timely decisions and actions* – indeed, in most organizational systems, simple and persuasive/influential beats complex/ambiguous every time



TPG can help your organization speed things up and achieve Better Benefits Faster. Contact us.

Converting Data to Information to Insights to Decisions-Actions:

The Study-Adjust Process



The Foundational Data Management Role:

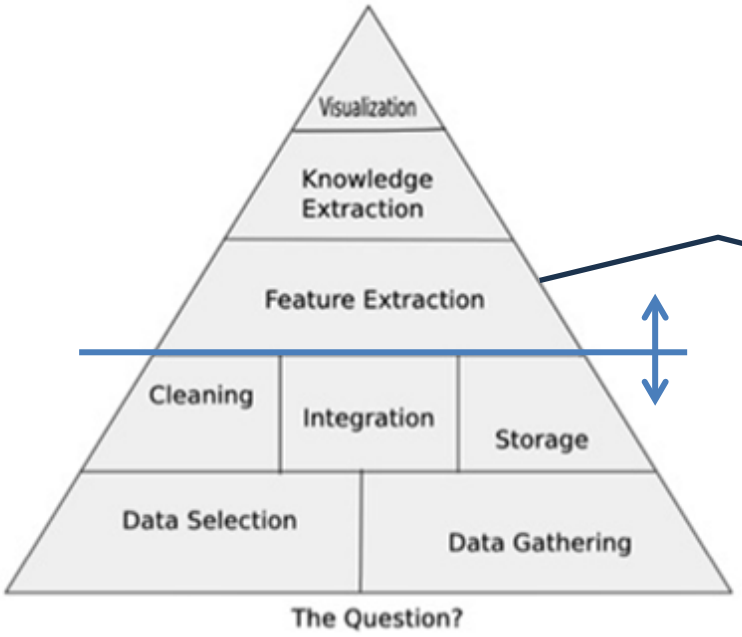
- Begins with the formulation of the problem statement, they hunches/hypotheses, use cases, user requirements, management system modeling and analysis
- It ends with getting the data integrated and organized in a fashion that makes analytics easy

Common Issues/Failure Modes:

- Don't start with the questions
- Don't define DONE
- Don't understand how it works
- Don't understand 'customer' requirements
- Don't design/build in right sequence, action junky tendencies prevail

Converting Data to Information to Insights to Decisions-Actions:

The Study-Adjust Process



Feature Extraction:

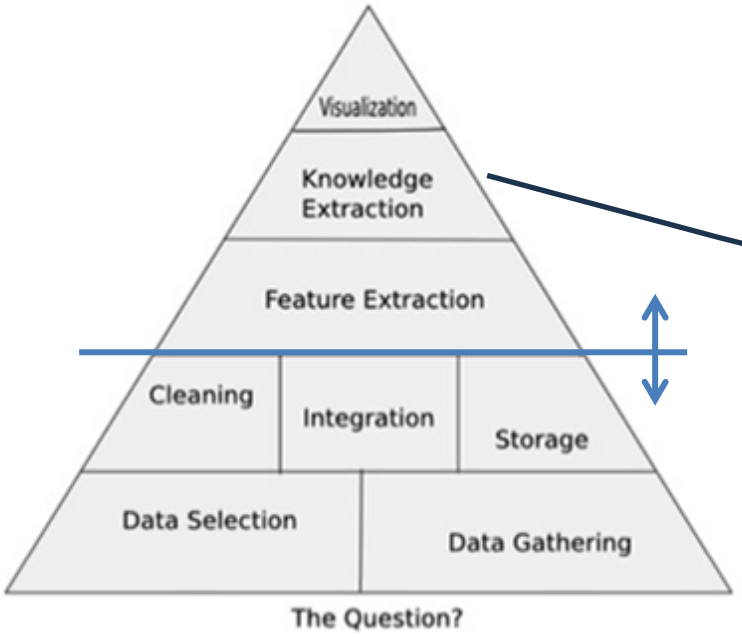
- …is the selection of data elements of interest, key performance indicators, measures of interest and is based on 'The Questions', The Use Cases and User Requirements relevant to the improvement work and the 'system' focus.
- A 'report' in Power BI is an example of feature extraction.
- It is essentially data base portrayal with the ability to 'slice and dice', sort, filter, organize, etc.

Common Issues/Failure Modes:

- Report proliferation, Data Rich and Information Poor.
- Get Stuck in/with Feature Extraction.

Converting Data to Information to Insights to Decisions-Actions:

The Study-Adjust Process

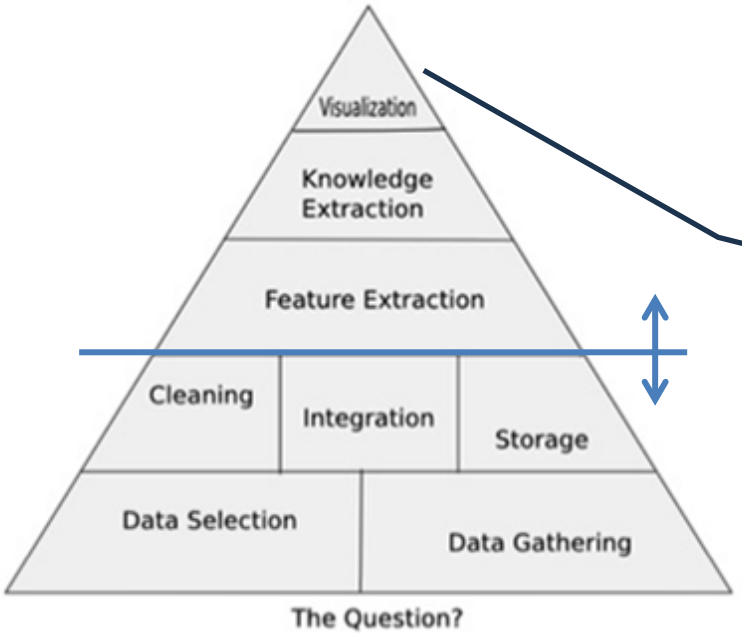


Knowledge Extraction:

- …is the conversion of data portrayal to information portrayal. The basic distinction is that information is directly 'usable', one has an answer to a question and/or can act on the basis of what they 'see', now know.
- A simple question I always ask is whether the 'portrayal' is just a 'so what' to users. Nice to know but it doesn't provoke doing (or not doing) something.

Converting Data to Information to Insights to Decisions-Actions:

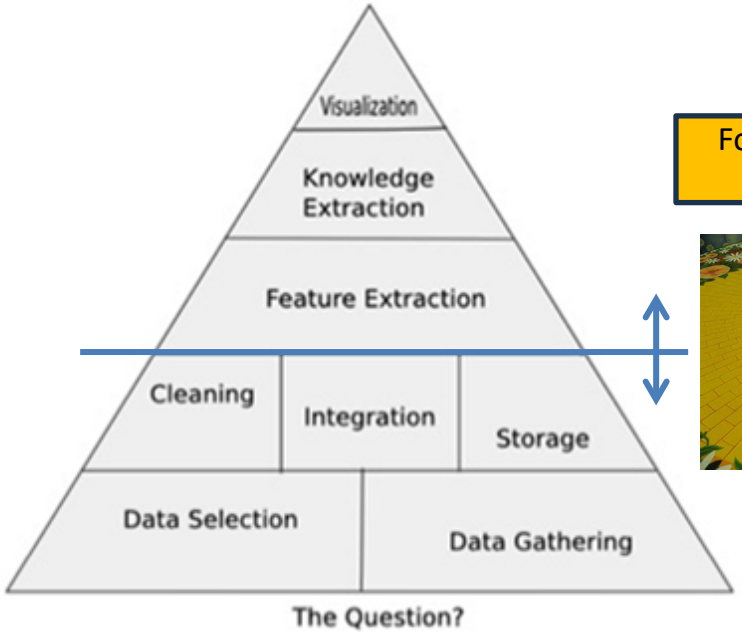
The Study-Adjust Process



Visualization Science & Art:

- …is all about 'how you portray' the information so that the 'knowledge' produces results…
- It's the art of storytelling, persuasion—it's all about creating 'aha' moments with visualizations.
- It's where the Questions are put juxtaposition with the Answers and the 'decision makers' GET IT, know what to do next (or what not to do).
- It is often about Statistical Thinking, providing longitudinal data, portraying it in a way that makes it easy to see patterns, trends, breakdowns, etc.

Just like DMAIC, OA has a 'roadmap'



Follow the 'yellow-brick' road

- Most ISE/ILSS Process Improvement Projects require that the ISE/Belt do both roles, certification requires that
- Data is almost never stored in a common place and are not trusted nor available

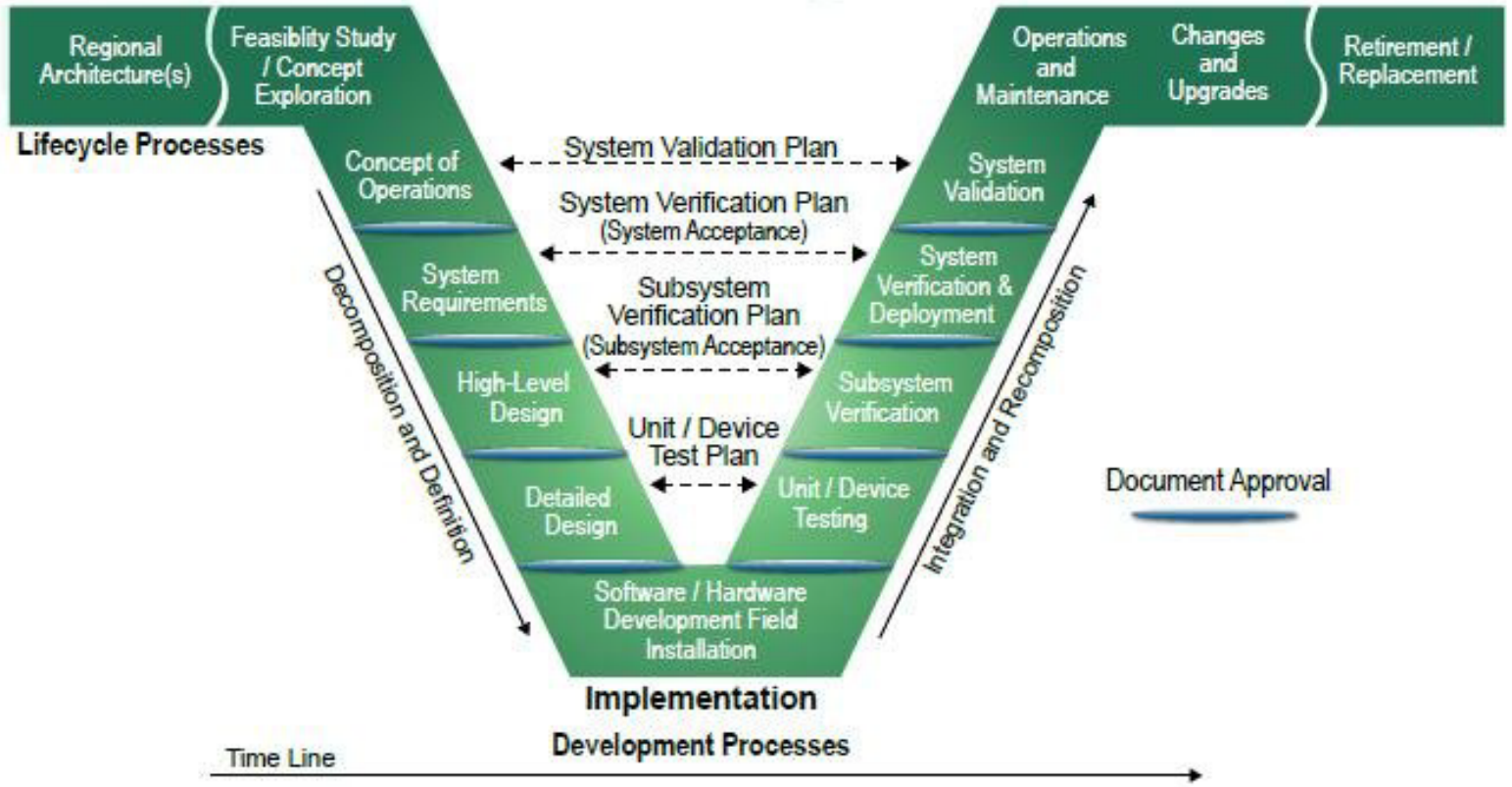
- the current state process in many large organizations splits data and analytics
- Data are stored in a common place, and are trusted and available

The Basic Roadmap for the OA Triangle

- **"Above the line" analyst role**
  1. What are the fundamental Questions that have to be answered?
  2. What data elements do those questions require?
  3. Organize the data and facts and then export to your analytics app.
  4. Extract features from data through integration and manipulation of data that move us closer to answers. (torture the data)
  5. Apply business acumen to data & analyses – create new knowledge
  6. Apply data visualization techniques to aid in telling the right story – as in life, so in business: the best story wins …
- **Foundational data role**
  1. What do we need to know in order to achieve the performance objectives—what are the questions we have to answer?
  2. Architect/Create the Measurement and Analytics Plan (Data Model included)
  3. Select and gather data from many sources, preferably through automated extract, transfer, & load (ET&L) process
  4. Create (observation, interviews, etc.) any data elements that don't exist (ISE Measurement)
  5. Assure data are cleaned & ready for analysts or you to use – data quality monitors
  6. Assure data are integrated & can be joined with other data – think LEGOs
  7. Assure data storage is high reliability & user-friendly – SSAS cubes, databases
  8. Integration and organization of foundational data elements as well as derivative data and other key metrics of interest

Design for… approach to Management Systems Engineering

Define	**C**oncept Design	**D**etailed Design & Development	**O**ptimize	**V**erify
OA 101	OA 201	OA 301 & 501	OA 401	



OA 501—The Knowledge and Skills to do this!!

Design for… approach to Management Systems Engineering

Define

101

- Strategic Context
- Key Stakeholder Analysis
- Management System Model
- Management System Analysis
- Value Stream Mapping and Analytics
- MSM Interface Requirements Definition
- Control Point Metrics and Spec Limit determination

Concept Design

201

- BPI capability and capacity
- Enterprise level Value Stream Mapping and Modeling (Enterprise Value Map)
- BPI Portfolio Strategy and Development
- Tiered Scorecard and Dashboard and Chartbook Concept Development
- Visible Measurement System
- Tiered Huddle System (as example)

Detailed Design & Development

301

- BPI capability and capacity
- Enterprise level Value Stream Mapping and Modeling (Enterprise Value Map)
- BPI Portfolio Strategy and Development
- Tiered Scorecard and Dashboard and Chartbook Concept Development
- Visible Measurement System
- Tiered Huddle System (as example)

Optimize

501

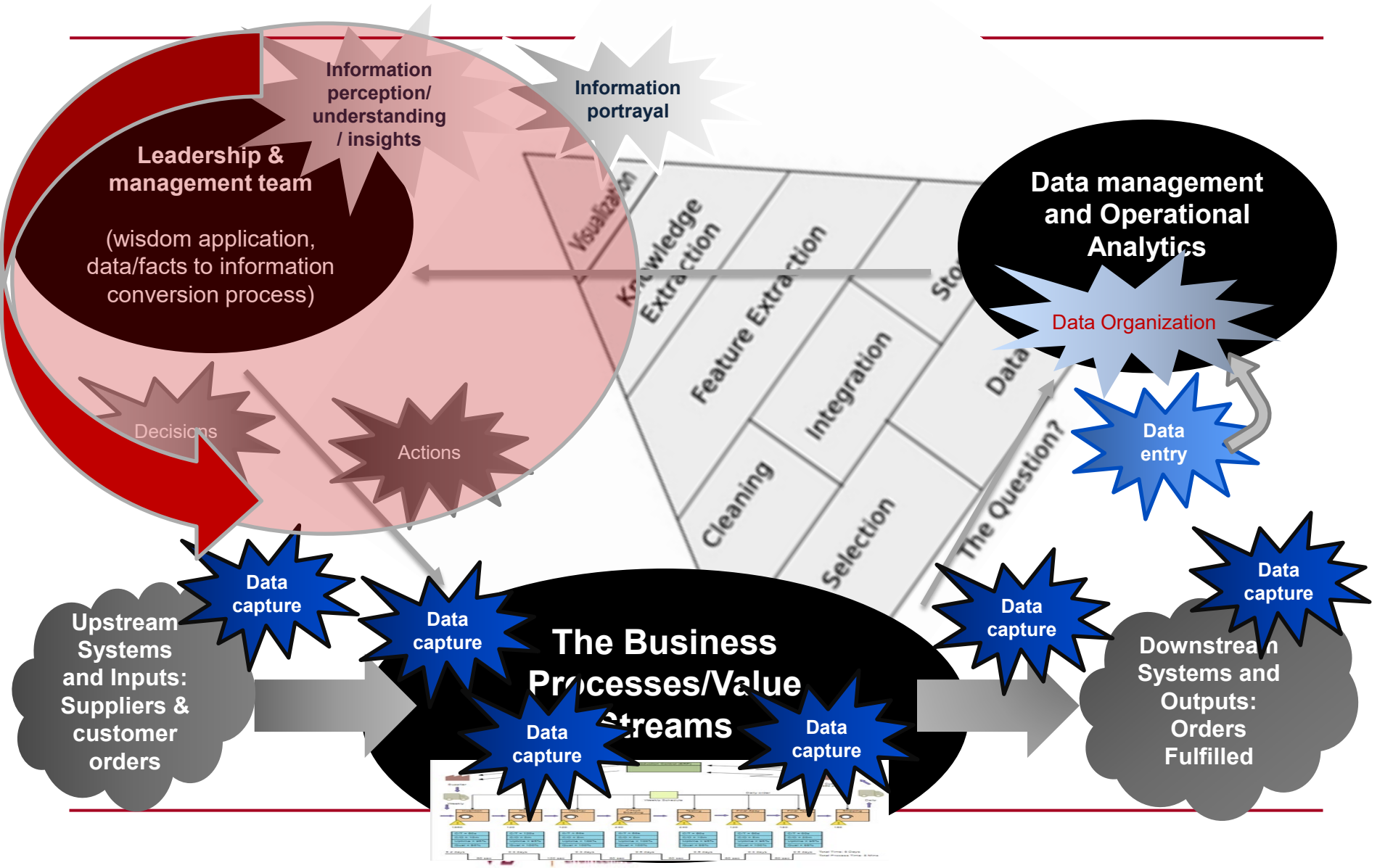
- Creating Visualizations that cause ‘aha’ moments
- Decision-Action Support with data/facts
- Study-Adjust enablement
- Data Modelling
- Data Story Telling—Pyramid Principle
- PML improvement
- Power BI, Power Apps
- ‘Minitab’ or equivalent proficiency

Verify

401

- Measuring what matters
- Data and Fact Driven Organization
- Enterprise Value growing at best in class rates
- B continually driving out ‘C’ and ‘D’
- **Focused** innovation and improvement
- **Alignment** and **coordination** top to bottom, back to front
- **Discipline** with ‘A’ and ‘B’
- Accountability, Trust, Culture
- Information (Profound Knowledge) and Insights and Bias for Action and Results

Rounding the Corner on the Model is a Critical to Success Skillset for the Analyst



How does one develop their Op Analytics Knowledge and Skill competencies and capabilities

- The focus of todays OA 501 Webinar is on the ‘Analyst’ Role:
  - What does an OA Specialist have to be able to ‘do’, create? (Scott)
  - What are the ‘tools’ of the OA trade, what ‘apps’ does one need to be conversant and skilled with? (Jared)
  - The relationship between BPM/I 4.0&5.0 and Op Analytics (we’ll point them to your BPM webinars) (Jared)
  - Jared’s suggested professional development plan to kick your OA game up a couple of notches.. (Jared)
  - What does an OA ‘Certification’ look like relative to an ILSS belt certification? (Scott)

Story Line

- Business Process Management is undergoing a rapid evolution that is part of the Industry 4.0/5.0 transformation.
- We (TPG) have defined the migration strategy and plan that organizations can take to ‘mature’ their BPM capabilities and capacities and get a competitive edge.
- Tools, app’s, power app’s, in general ‘methods/mechanisms’ abound, picking the right ‘tools’ is important and challenging for most.
- Navigating up the Process Maturity levels can be difficult, often external guidance is useful.
- Operational Analytics is a key cog, component in the BPM Process Maturity Improvement activity with correlated maturity levels for OA capabilities and competencies.

Business Process Management 4.0 and 5.0 Framework

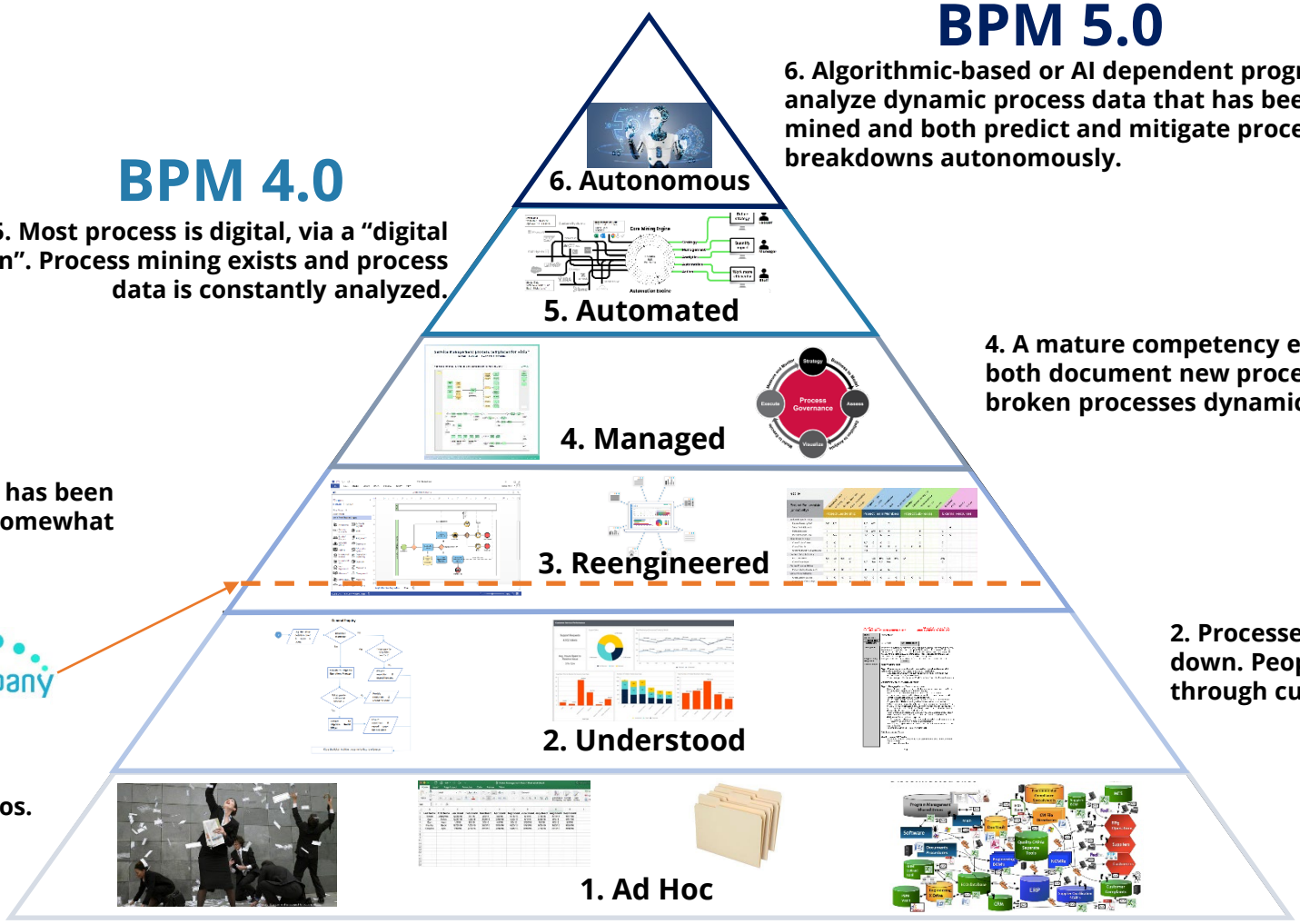
Using a variant of the classic BPMM model, we can assess the maturity of an organization's process maturity of BPM. TPG's client set has an average maturity index of **2.2** / 6 across it's past **~400** projects.

BPM 5.0

6. Algorithmic-based or AI dependent programs analyze dynamic process data that has been mined and both predict and mitigate process breakdowns autonomously.

BPM 4.0

5. Most process is digital, via a "digital twin". Process mining exists and process data is constantly analyzed.



4. A mature competency exists to both document new processes and fix broken processes dynamically.

3. Future-state has been designed and somewhat implemented.

2. Processes are written down. People thought through current state.

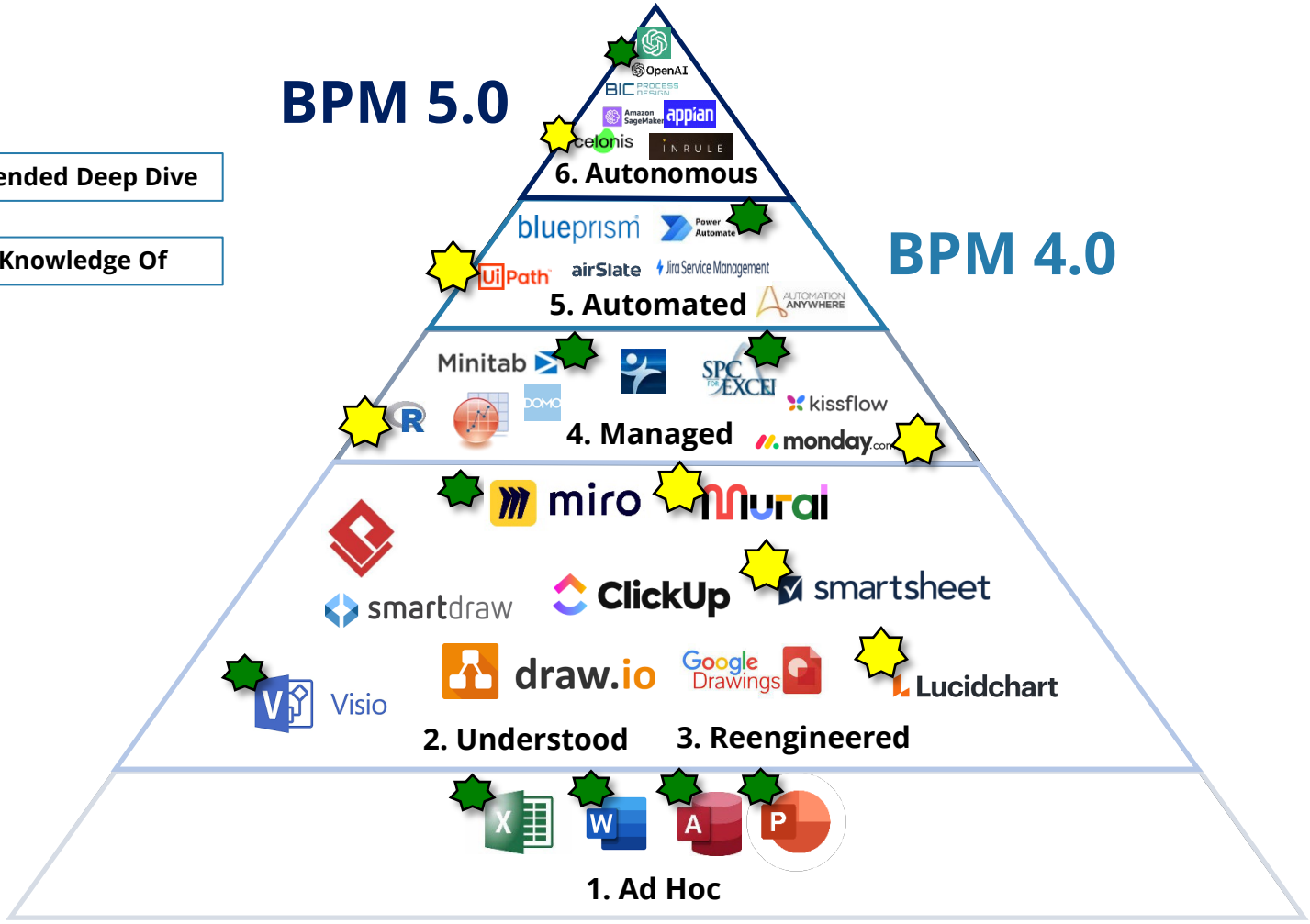
1. Controlled chaos. Process is art.

Select Tools / BPM Technology Roadmap

High correlation between successful IE's in moving your organization up the maturity curve and knowing **how and when to deploy corresponding technologies.**

Recommended Deep Dive

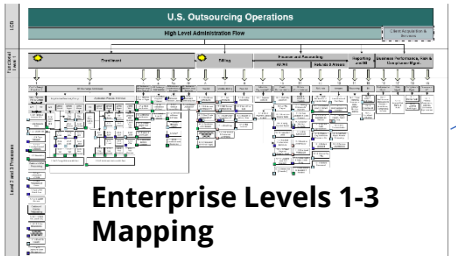
Some Knowledge Of



Navigating Common Maturity Level Increases (1-3)

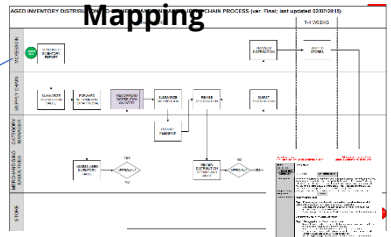
Many IE's, especially those deployed into small organizations, startups or organizations with lower maturity, may find themselves working on the basics, to setup the foundation for higher levels.

Frameworks to Employ

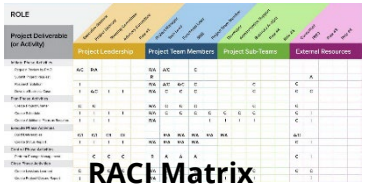


Enterprise Levels 1-3 Mapping

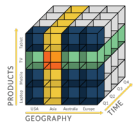
Swimlane Level 4 Mapping



SOP's



RACI Matrix



A few Core Data Cubes

Tools to Support

miro

Visio

Strategies

- Get an understanding of the enterprise business processes
- Leverage digital whiteboards to obtain process characteristics
- Choose, in priority order, business processes to get mapped (Visio is most common) and map by swim lane
- For the most critical processes, get clear SOPs in place and trained on
- Basic RACI matrix to see the interactions between and within processes
- Basic database management to connect key data tables (Data cubes, OLAP) in prep for efficient queries

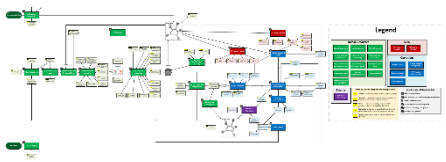
1. Ad Hoc

Navigating Common Maturity Level Increases (3-5)

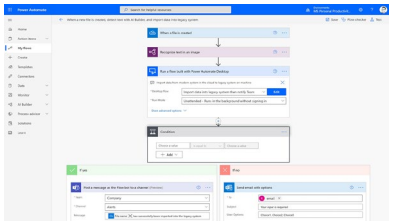
This phase begins to stretch the typical IE background and does require access to some more advanced tools and analytics to properly employ. However, this phase can also deliver much higher ROI's via automation.

Frameworks to Employ

Digital Twin

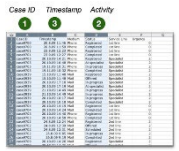


Automation Workflow



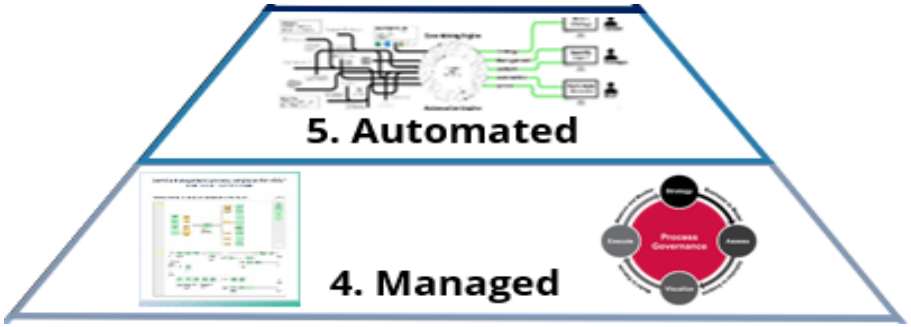
Process Layers to Mined Data

Process Mining



Tools to Support

Power Automate · UiPath · airSlate · blueprism · AUTOMATION ANYWHERE



Strategies

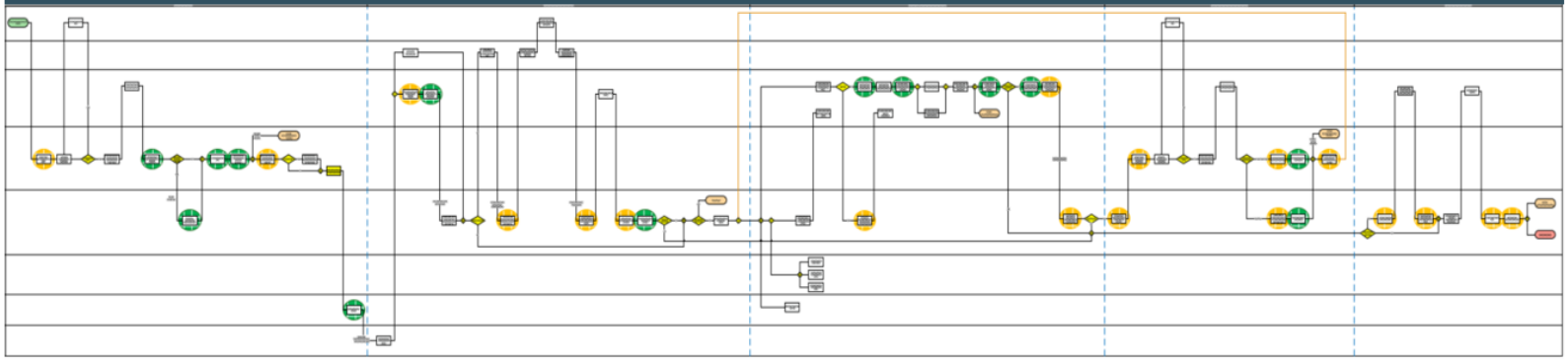
- Create the "digital twin" of in-scope business processes, those ripe for automation via technology platforms matched to your organizations tech stack / ERP
- Begin using tools to leverage RPA to automate some of the digital workflows you have. Some great candidates are typically found in the service back office around invoice management
- Work with more dynamic process data, mining both manually and semi-automatically and setup business rules for cases where decision support comes automatically without much human intervention
- Ensure integration of governance structure upon review of automated or semi-automated processes

Private & Confidential

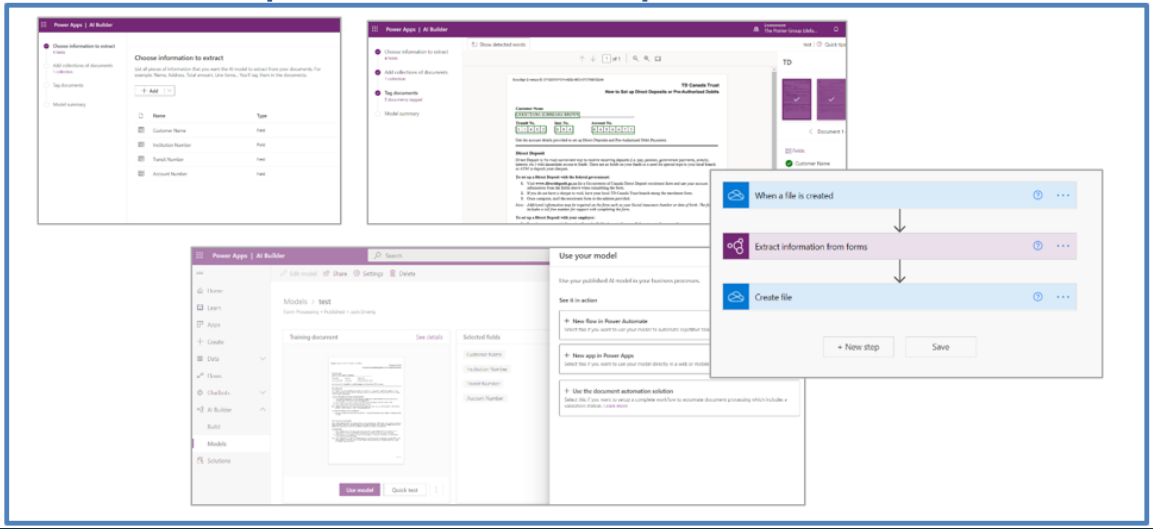
Maturity Level 5 in Action

Visuals / case studies of what this transition looks like:

Of the 67 steps within process X, TPG has identified **~13 process steps** as candidates for **full** automation and **~18 process steps** as candidates for **partial** automation; Currently, the cumulation of these steps require **2.9 FTE**



Workflow Example for Automated File Upload - Power Automate



Legend

- Processes identified as potential candidates for full automation (i.e. manual tasks, manual workflows)
- Processes identified as potential candidates for partial automation

Power Automate · UiPath · airSlate · Automation Anywhere · blueprism

Rapidly Identify Processes to Automate. Leverage Tools like PowerAutomate to Join, Modify, Delete, Streamline.

What Does 6 Look Like? Home Grown Version

Automated Process Mapping Using AI

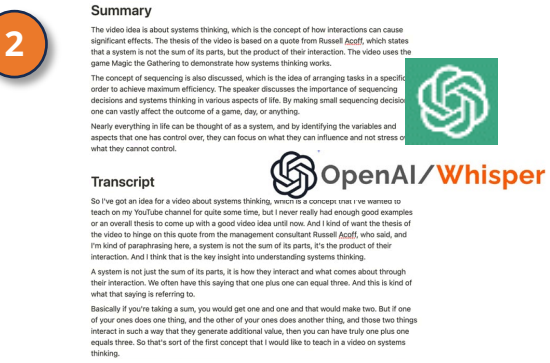
1

REC

miro

Process workshop conducted in Teams, using Miro and **recorded** (with Transcript)

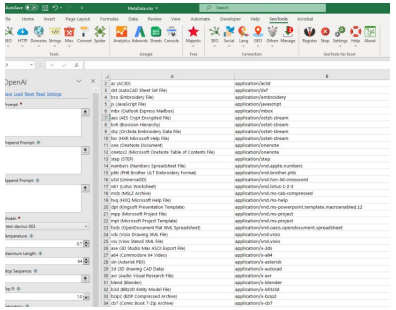
2



OpenAI/Whisper

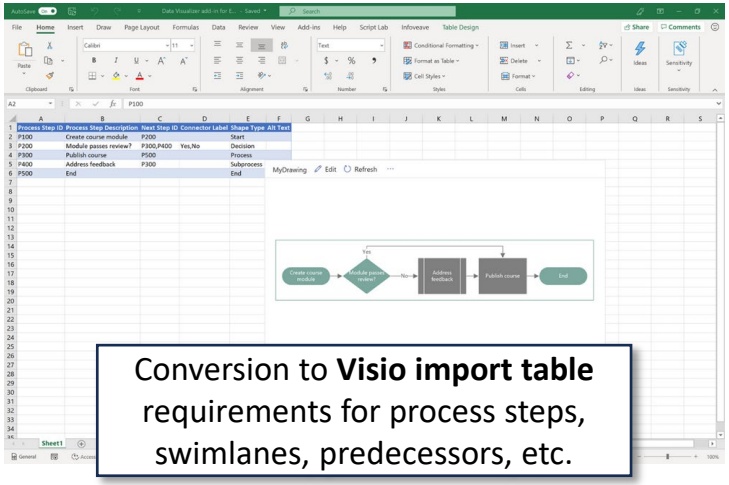
Open AI's speech-to-text conversion (**Whisper**) into a summary and direct transcript (**GPT 3.5**)

3



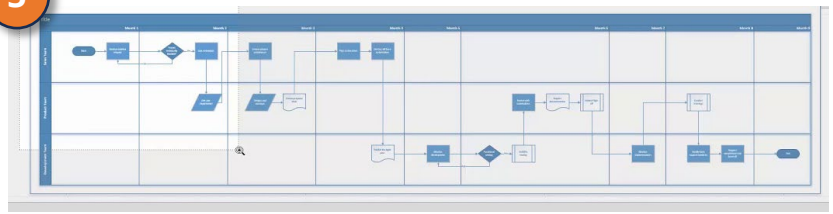
GPT3+ Excel Add in – Conversion to tabular data process characteristics

4



Conversion to **Visio import table** requirements for process steps, swimlanes, predecessors, etc.

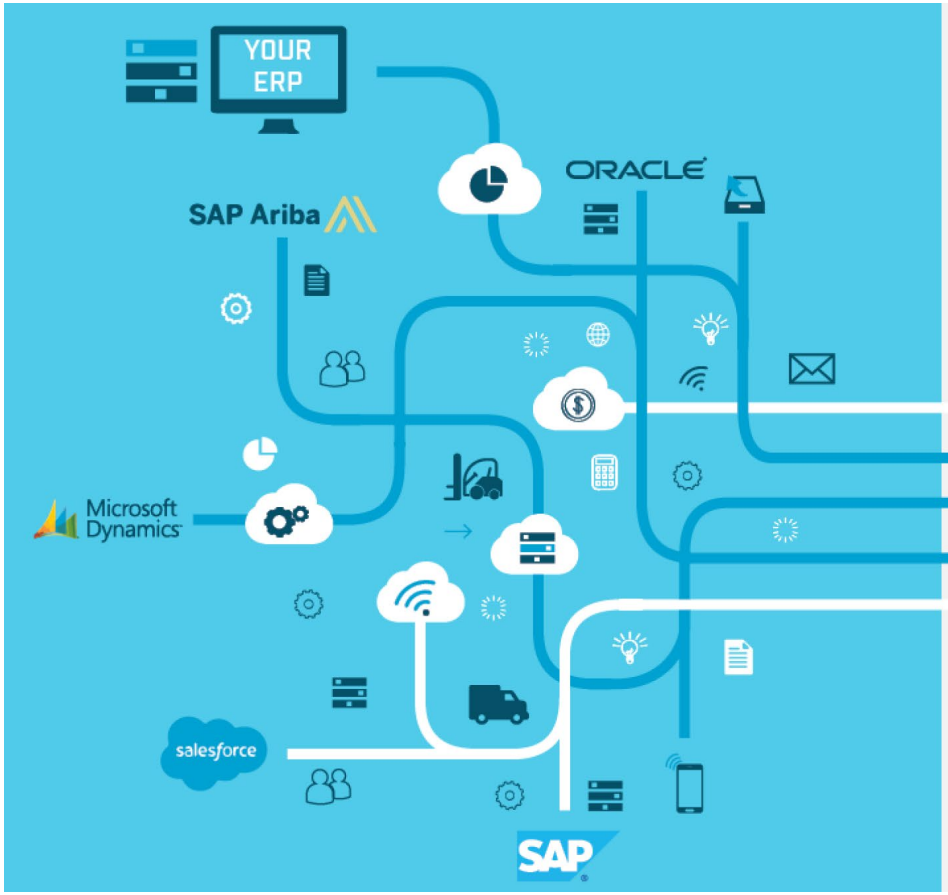
5



Swimlane process diagram **automatically created** based on process workshop

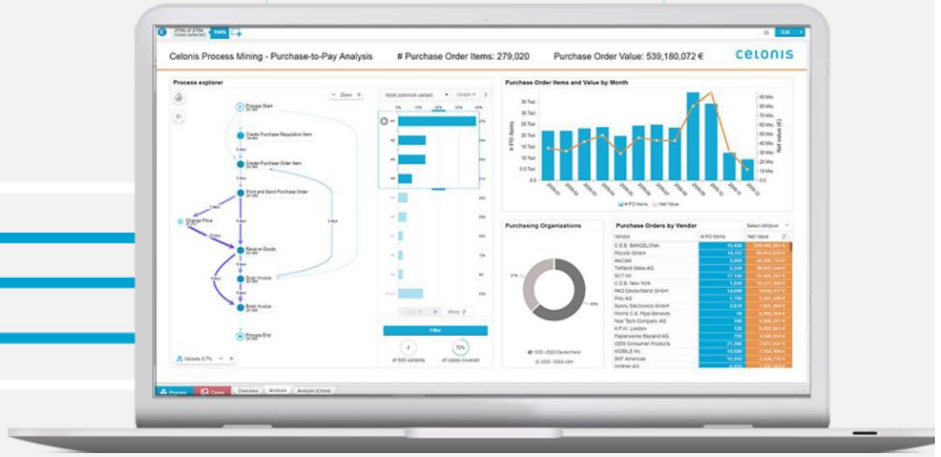
What Does 6 Look Like? Enterprise Version

Fully connected AI-based process mining and analysis



VISUALIZATION OF THE ACTUAL PROCESSES

AI-POWERED ROOT CAUSE ANALYSIS & IMPROVEMENT



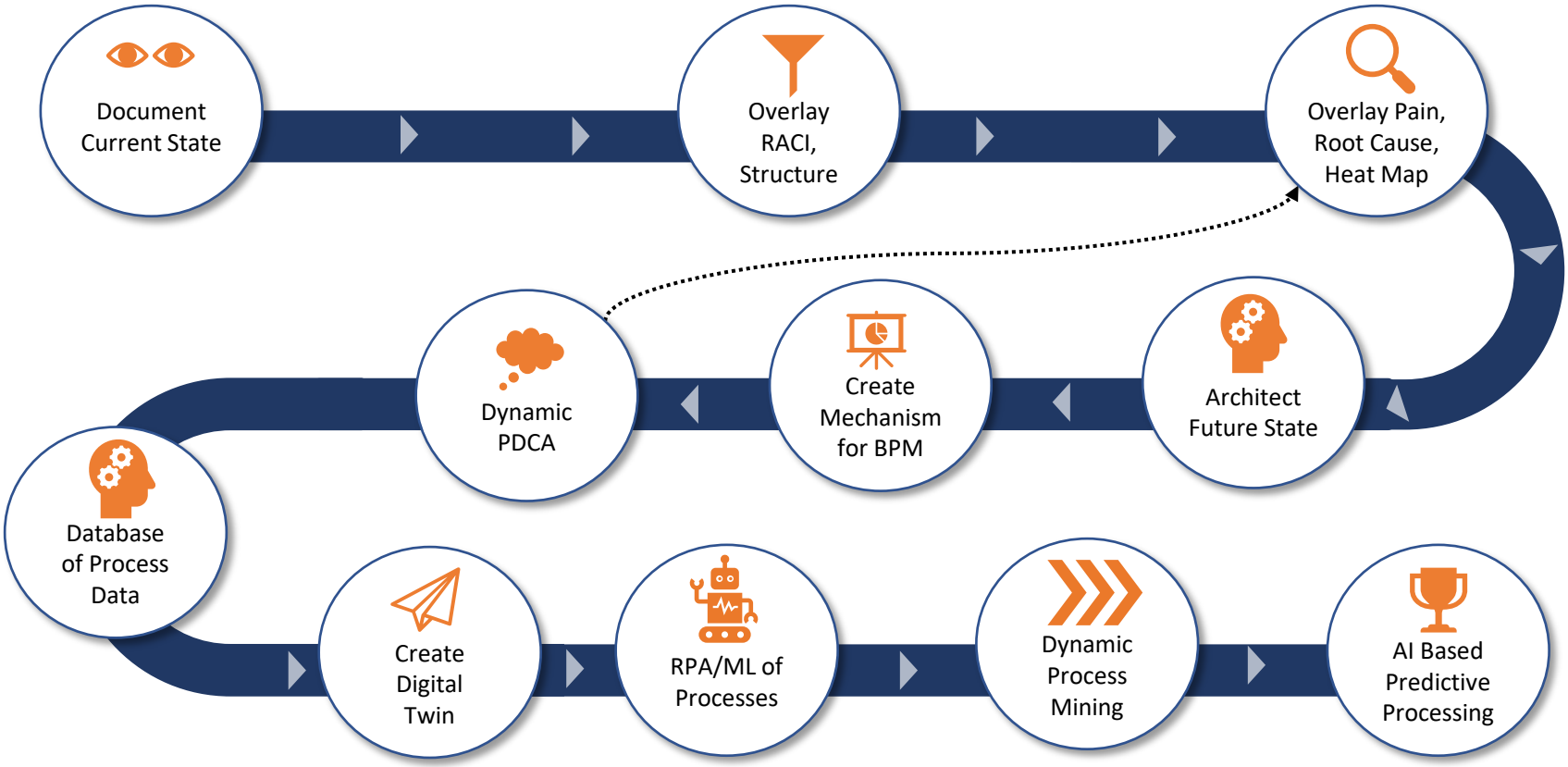
EVENT LOG

2016-12-01	CREATE PURCHASE ORDER	#1234
2016-06-23	START PRODUCTION	#5678
2016-07-14	RECEIVE PAYMENT	#1234
2016-07-14	SEND EMAIL	#9012

Tier 1 AI-Based Process Mining Connects to Your Process & Transactional Data and Automatically Maps, Creates, Predicts, Intervenes, Reports Back

Major Developmental Milestones

Key milestones in the BPM 4.0/5.0 journey as IE's



What About Operational Analytics in the Context of BPM?

Just like BPM, Operational Analytics (OA) is a competency within an organization that can be measured. **Most IE's** we experience are equipped to operate a **little over a 4** but **rarely deploy 5 and 6 level tools**.

OA 5.0

6. Large portions of BI and data science practices are autonomous. Predictive and automatic interventions occur based on rules. Humans spend 90% + on decision support and implementation

OA 4.0

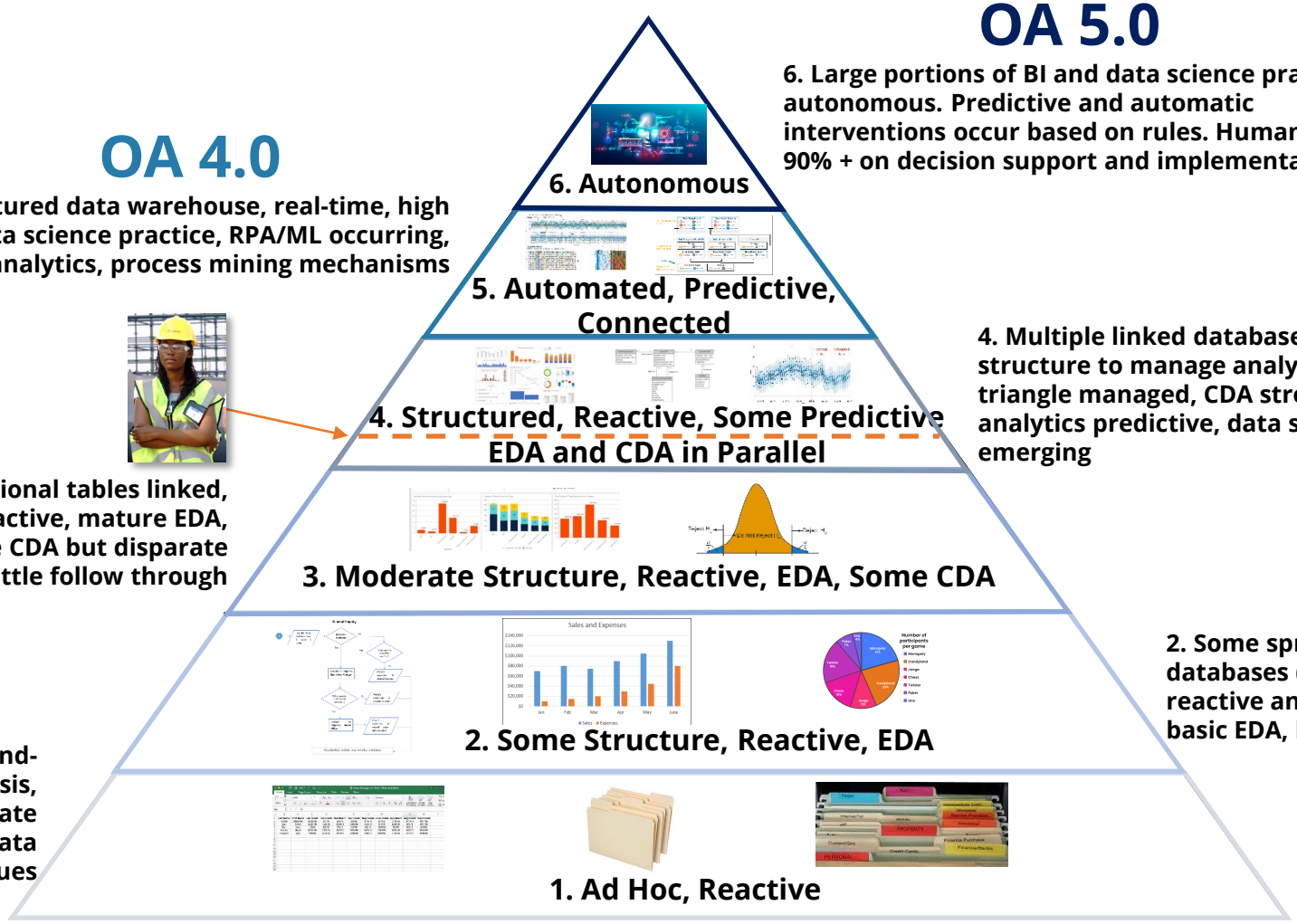
5. Mature structured data warehouse, real-time, high integrity, data science practice, RPA/ML occurring, predictive analytics, process mining mechanisms

3. A few relational tables linked, ERP, still reactive, mature EDA, RCA, some CDA but disparate with little follow through

1. Paper files, hand-written analysis, multiple disparate systems, data integrity issues

4. Multiple linked databases, ERP or equiv, structure to manage analytics, BI, general triangle managed, CDA strong, some analytics predictive, data scientist role emerging

2. Some spreadsheets, a few databases (unlinked), reactive analytics, some basic EDA, little to no RCA

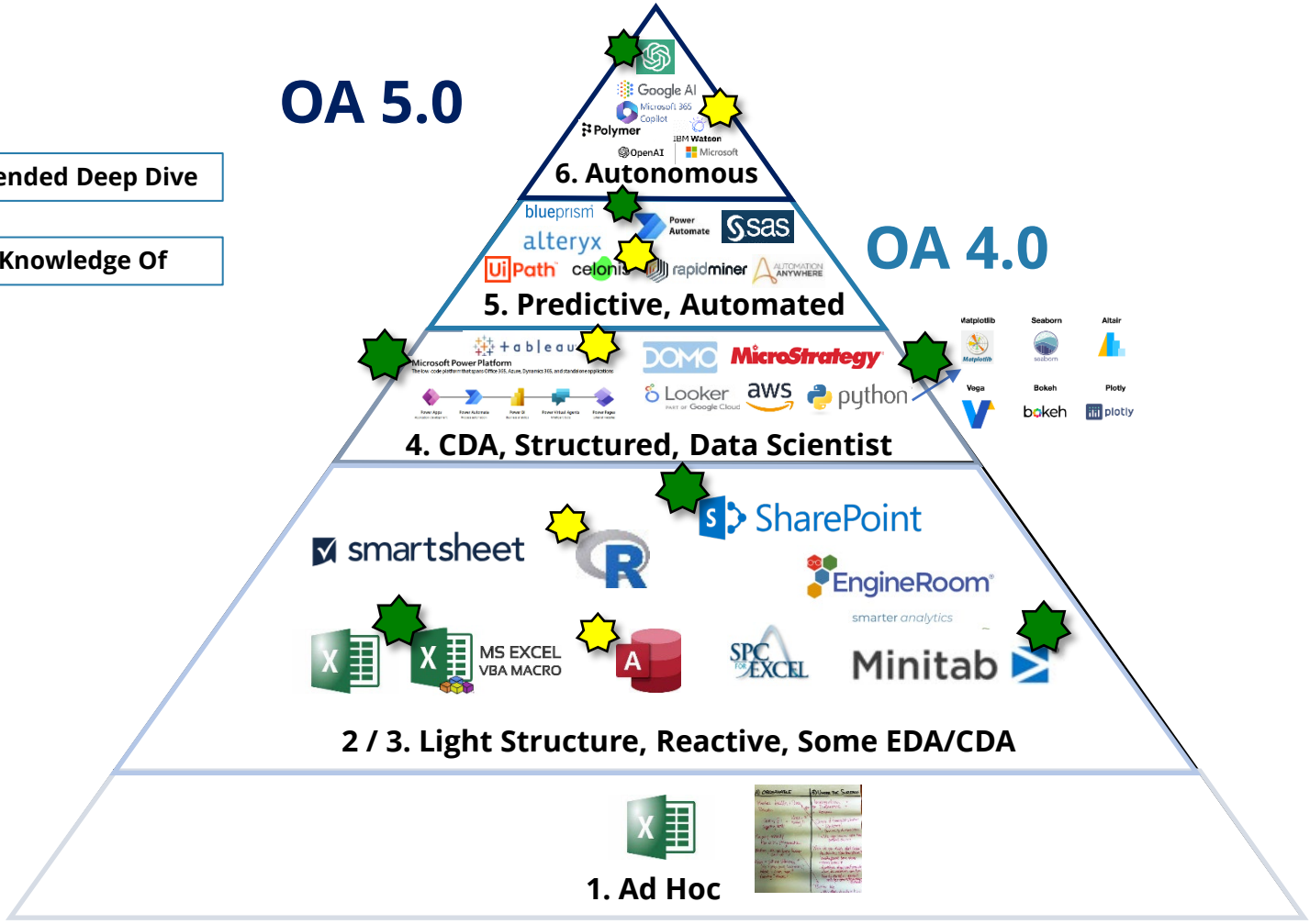


Select Tools / OA Technology Roadmap

High correlation between successful IE's in moving your organization up the maturity curve and knowing **how and when to deploy corresponding technologies.**

Recommended Deep Dive

Some Knowledge Of



Another Way of Looking at it…

These technologies also **overlay onto the Intel triangle** of the various roles IE play within OA. Lots of overlap but they will equip you to **seamlessly move in and out of these rapidly**.

What Does the 1-2/3 Transition Look Like?

Bumping up Your Excel Skills

Beginner

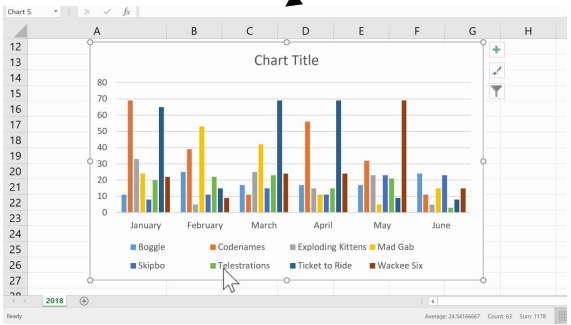
- =A1+B2
- Data Entry
- Simple Charts
- Tables
- SUM/AVERAGE

Intermediate

- Lookup Functions
- Nested IF statements
- Advanced Charts
- Pivot Tables
- SUMFIS

Advanced

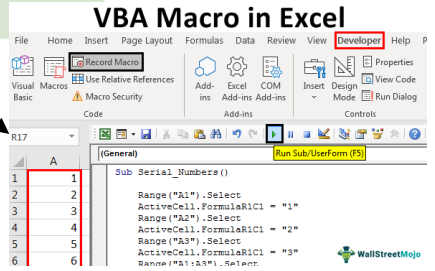
- Array Functions
- VBA/Macros
- Scenarios
- Power Pivot
- Doesn't use the mouse

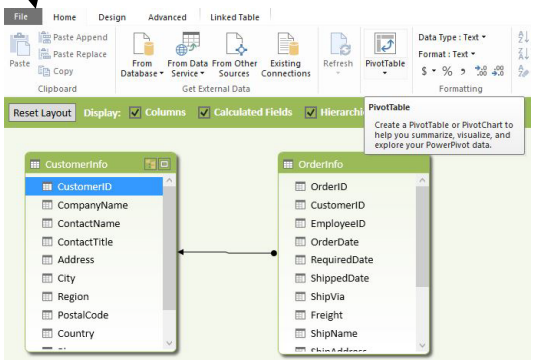


D2

=IF(AND(B2>150,C2>150),10%, IF(AND(B2>=101,C2>=101),7%, IF(AND(B2>=51,C2>=51),5%, IF(AND(B2>=1,C2>=1),3%,""))))

	A	B	C	D	E	F	G	H
1	Seller	Jan sales	Feb sales	Commission			Sales	Commission
2	Mike	$150	$145	7%			$1 - $50	3%
3	Sally	$95	$120	5%			$51 - $100	5%
4	Amy		$80				$101 - $150	7%
5	Neal	$45					Over $150	10%
6	Peter		$90					
7	Olivia	$45	$135	3%				
8	Aiden	$130						

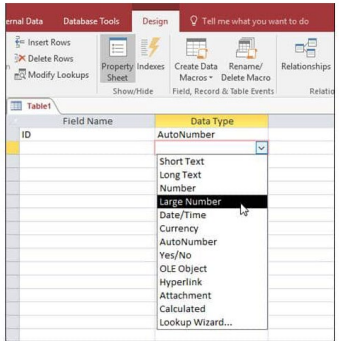




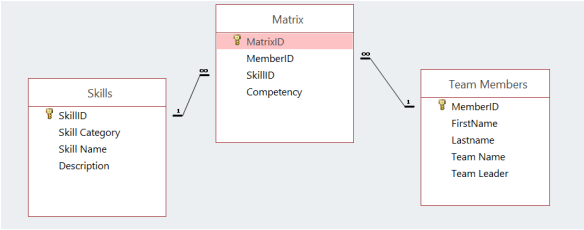
What Does the 2-4 Transition Look Like?

Getting Good at Access

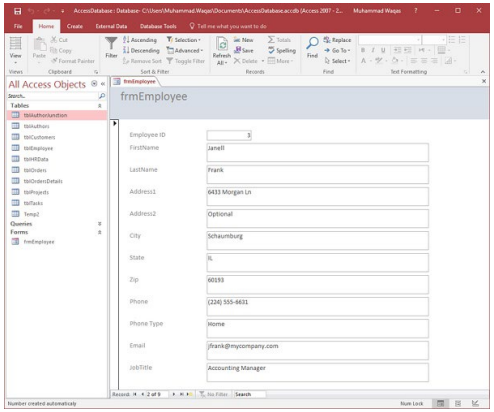
1. Figure out imports, database management, field settings and data types



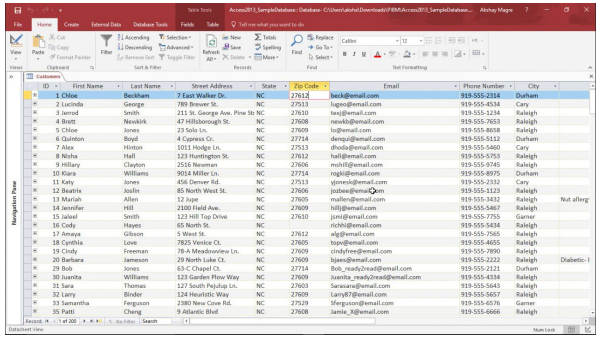
2. Understand tables, relationships (inner, outer, cross, union, etc.)



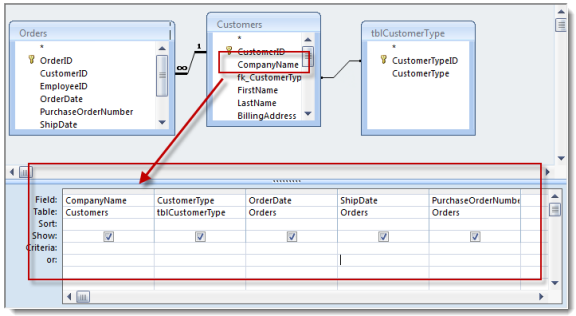
3. Build your first form, link table data, use action buttons



4. Populate new tables (or existing) with form data

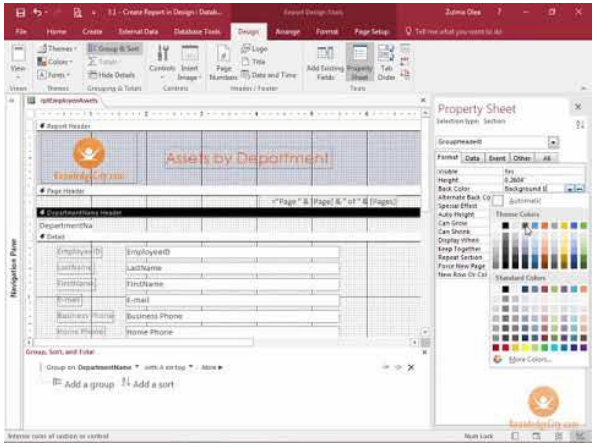


5. Run your first query on tabular data connected through joins*



5a. Bonus, use SQL to execute query!

6. Create your first report

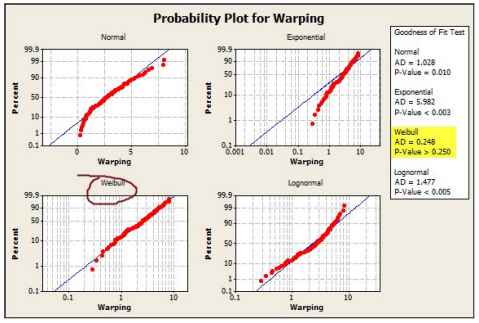


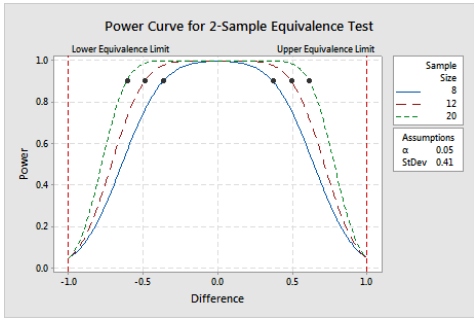
Private & Confidential

What Does the 1-3/4 Transition Look Like?

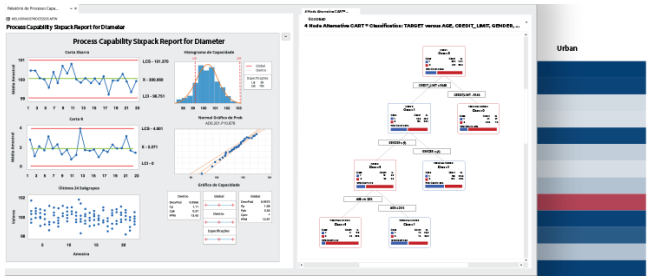
Exploratory Data Analysis (EDA)

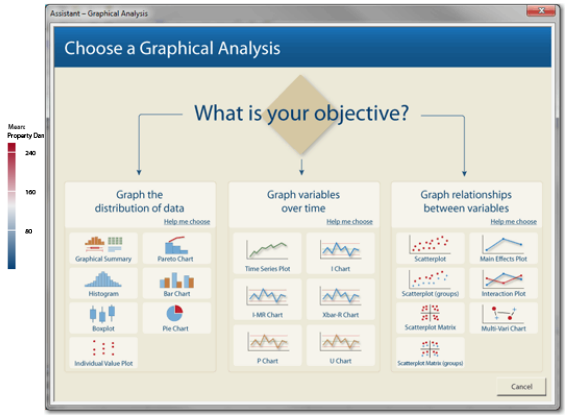
1. Consistently see weakness around ability to detect and work with non-normal distributions (or even find out…) and statistical power of sample



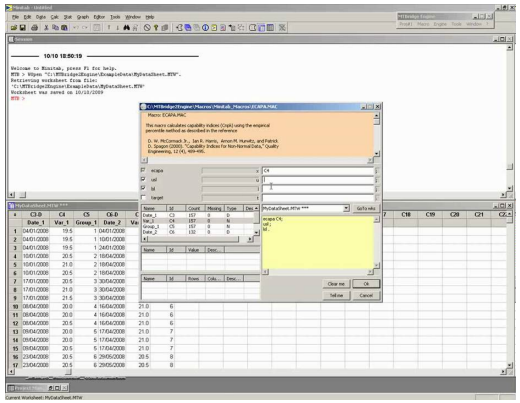


2. In v17 and higher, leveraging the assistant function – limiting ourselves to just time-series plots and not getting creative





3. Not realizing “macros” also exist in Minitab via scripts. What if you could populate 30+ charts in a few seconds to explore a data set?



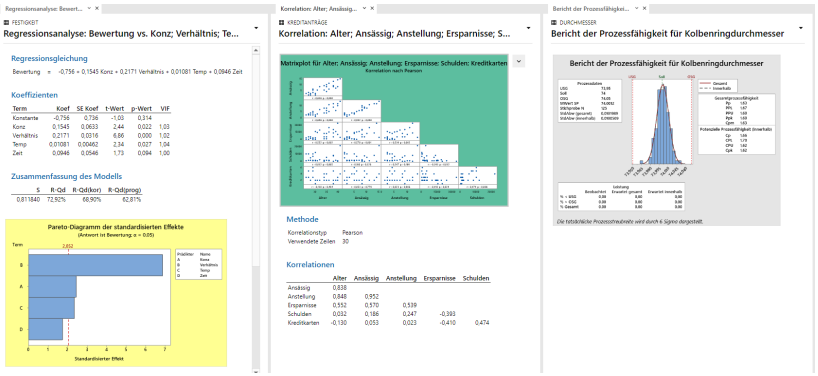
```
WOpen "C:\Documents and Settings\user\My documents\Cpk.xls";
FType;
  Excel;
VNames;
  None.

MCapa C1-C10;
  Size 1;
  LSpec C12;
  USpec C13;
  Pooled;
  AMR;
  UnBiased;
  OBiased;
  GHistogram;
  GNormal;
  Tolerance 6;
  Within;
  Overall;
  CStat;
  CPK   'Cpk1'.

IChart C1 - C10

Boxplot C1 - C10;
  Overlay;
  IQRBox;
  Outlier.
```

What Does the 2-5/6 Transition Look Like?

Confirmatory Data Analysis (CDA)

1. “Table Stakes” is to be able to rapidly but accurately do CDA based on knowing the statistical distribution(s) of our data set. Minitab’s “Six Pack” and others can combine features.

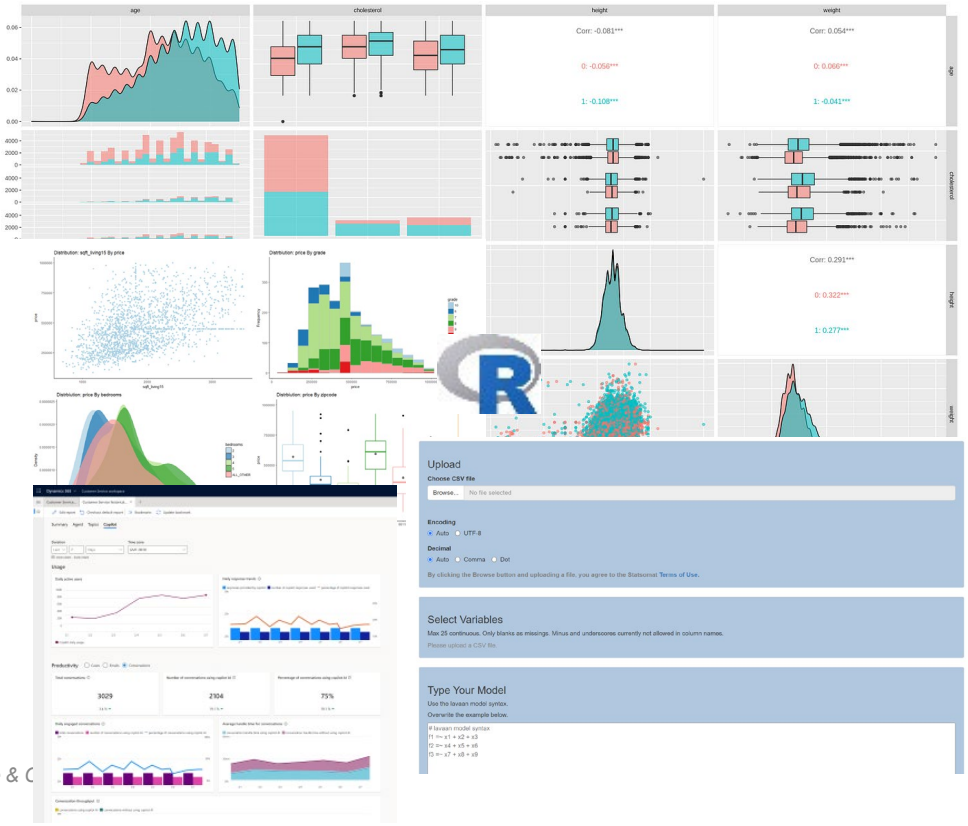
2. Know how and when to employ hypothesis testing, ANOVA, regression, multiple regression, correlation, etc.



VS.

1. Automated EDA and CDA leveraging a variety of bolt on applications in R, “AutoEDA”, GGAlly, Statsomat / CFA.

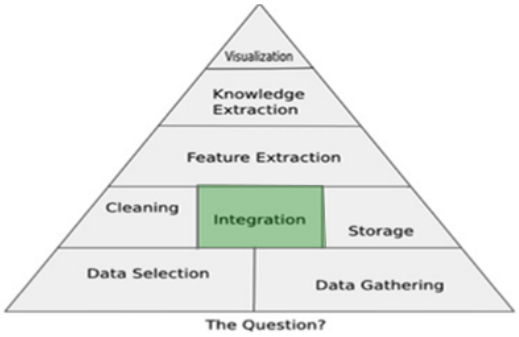
2. Copilot demo/beta creating automated analysis / CDA / hypotheses based on multiple input data sources.



Private &

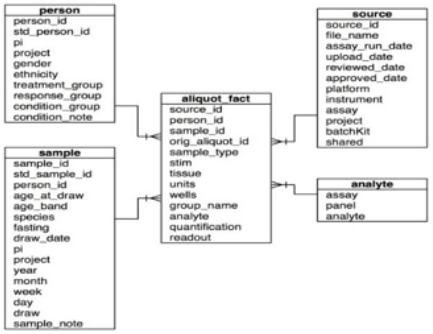
What Does the 2-4 Transition Look Like?

Data Cubes

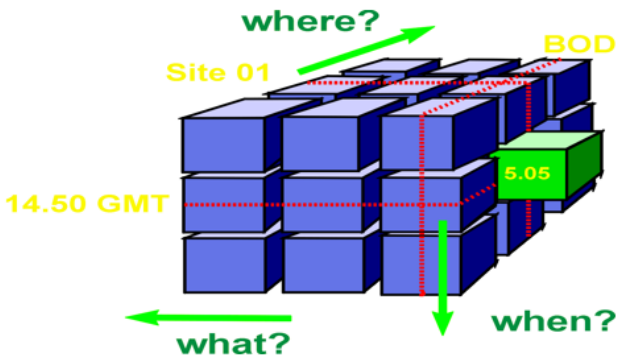


- **Once you've isolated the sources, and have brought them into a "data warehouse" type of application, create a data model**
- **Leverage "cubes" and "hypercubes" in your data model for efficient processing**

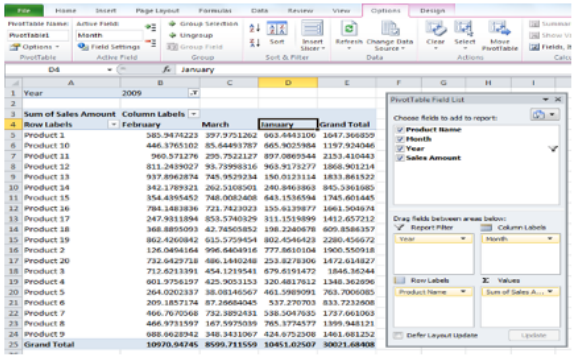
Data Model



Data Cube



Organized Data in Pivot View



In addition to leveraging a third dimension of data, organizations with relationships into an array of data shown by PowerPivot or PivotTables, there are default cube functions built into Excel 2010 and higher. Examine SQL OLAP cube builder. Note OLAP and NoSQL platforms are growing.

CUBEKPIMEMBER()

CUBEMEMBER()

CUBEMEMBERPROPERTY()

CUBERANKEDMEMBER()

CUBESET()

CUBESETCOUNT()

CUBEVALUE()

What Does the 2-5 Transition Look Like?

Top Python Libraries

Pandas
Data analysis and manipulation

NumPy
Mathematical functions

Matplotlib
Data visualisations

SeaBorn
Data visualisations

Tensorflow
Machine Learning

Keras
Deep Learning

SciPy
Scientific computing

PyTorch
Machine Learning

Scrapy
Web crawling

SQLModel
Interact with SQL databases

Power of Python

1. Import the libraries.

```
# Import the necessary libraries

import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
%matplotlib inline
sns.set(color_codes=True)
```

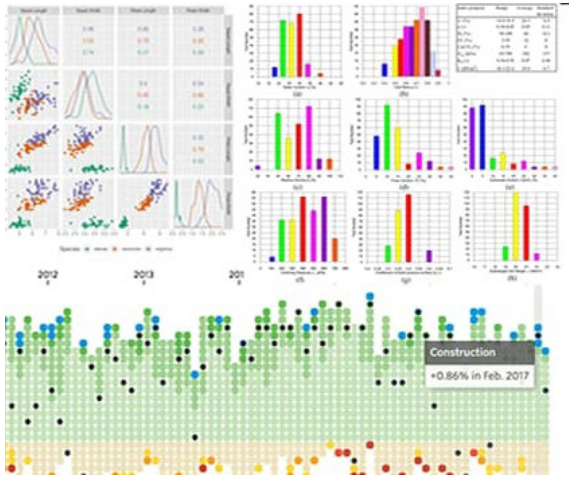
2. Load the dataset using pandas read_csv() function.

```
# Load the car.csv dataset
car = pd.read_csv('C:/Users/avijeet.biswal/Desktop/car.csv')
```

3. Display the head of the dataset using the head() function.

```
# Display the head of the dataset
car.head()
```

	Make	Model	Year	Engine Fuel Type	Engine HP	Engine Cylinders	Transmission Type	Driven_Wheels	Number of Doors	Market Category	Vehicle Size
0	BMW	1 Series M	2011	premium unleaded (required)	335.0	6.0	MANUAL	rear wheel drive	2.0	Factory Tuner,Luxury,High-Performance	Compact
1	BMW	1 Series	2011	premium unleaded (required)	300.0	6.0	MANUAL	rear wheel drive	2.0	Luxury,Performance	Compact
2	BMW	1 Series	2011	premium unleaded (required)	300.0	6.0	MANUAL	rear wheel drive	2.0	Luxury,High-Performance	Compact
3	BMW	1 Series	2011	premium unleaded (required)	230.0	6.0	MANUAL	rear wheel drive	2.0	Luxury,Performance	Compact
4	BMW	1 Series	2011	premium unleaded (required)	230.0	6.0	MANUAL	rear wheel drive	2.0	Luxury	Compact

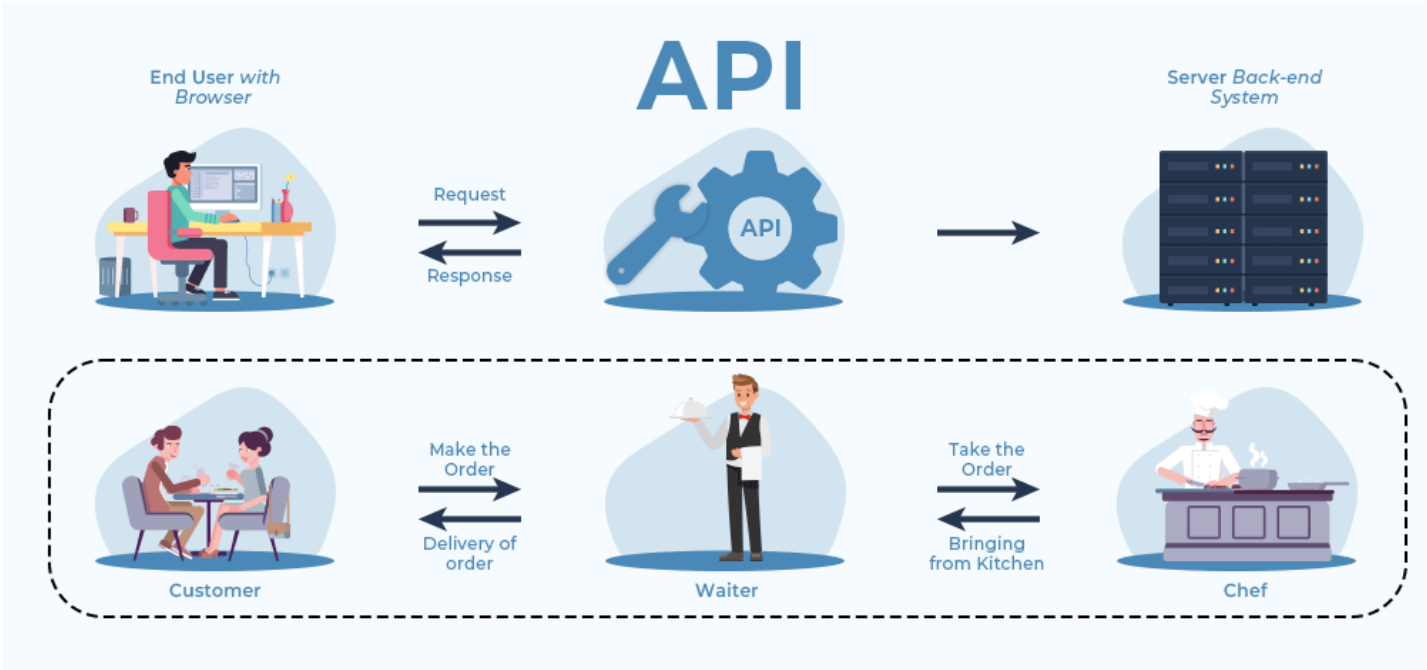


Create easily data arrays, display them, plot them, visualize and correlate using loops if needed.

Flexible, opensource, tons of analytics libraries now and much better visualization platforms available.

What Does the 2-4 Transition Look Like?

API's and Integration Hubs



A basic understanding of an API (Application Programing Interface) to make data "calls" using requests and responses to obtain web server data is important and the coding/language can be simple for some needs.

```
Endpoint      https://apiurl.com/review/new
HTTP Method   POST
HTTP Headers  content-type: application/json
              accept: application/json
              authorization: Basic abase64string
Body          {
                "review" : {
                  "title" : "Great article!",
                  "description" : "So easy to follow.",
                  "rating" : 5
                }
              }
```

Private & Confidential

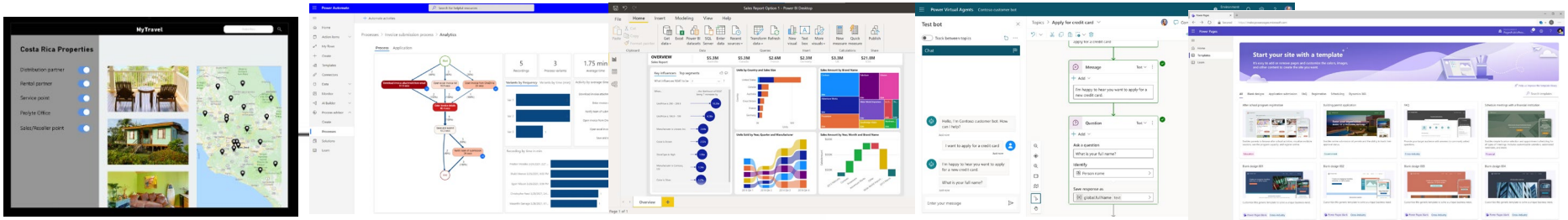
What Does the 3-5 Transition Look Like?

Microsoft's Power Platform

The ability to know a "little bit about a lot" about the Power Platform will go far, especially if your organization is already on various Microsoft platforms.

Microsoft Power Platform

The low-code platform that spans Office 365, Azure, Dynamics 365, and standalone applications



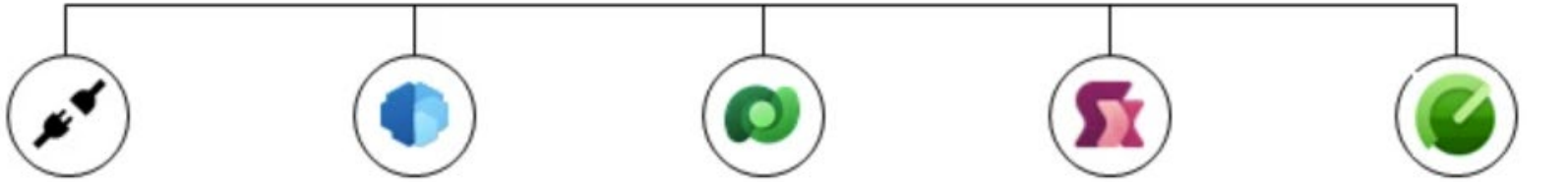
Power Apps
Application development

Power Automate
Process automation

Power BI
Business analytics

Power Virtual Agents
Intelligent bots

Power Pages
External websites



Data connectors

AI Builder

Microsoft Dataverse

Power Fx

Managed Environments

Example of Pulling in 2, 3, 4 and 6

Automated Benchmarking Analysis

Corporate ERP Modules, Financial GL & Core Financial Reports, Management Reports, Internal Documents, Transaction Master Files, Sensors/Controllers/Plant Systems, Call Centers, Website Logs, CRM, etc.

Rapid Organizational Leverage Analysis

Chat GPT

IBIS World

API

S&P CAPITAL IQ
McGRAW HILL FINANCIAL

↑ 3.8%	↑ 6.2%	↓ 10.2%	↓ 8.8%	↓ 14.3%	↑ 4.2%	–	↑ 24.2%	
Pricing	Volume	COGS	SG&A	Inventory	Receivables	Payables	Projects	
Grow Revenue / Price Recovery		Reduce Costs		Reduce Working Capital			Improve Fixed Capital	

Private & Confidential

What Does 6 Look Like?

Automation of Organizational Diagnostic

1

REC

miro

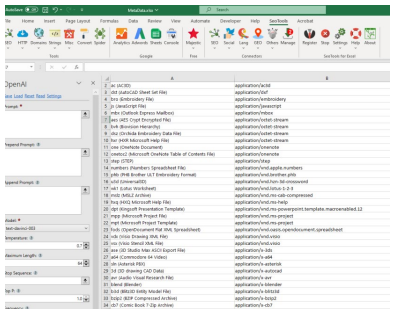
Process workshop, interviews conducted in Teams, using Miro and **recorded** (with Transcript)

2

OpenAI/Whisper

Open AI's speech-to-text conversion (**Whisper**) into a summary and direct transcript (**GPT 3.5**)

3



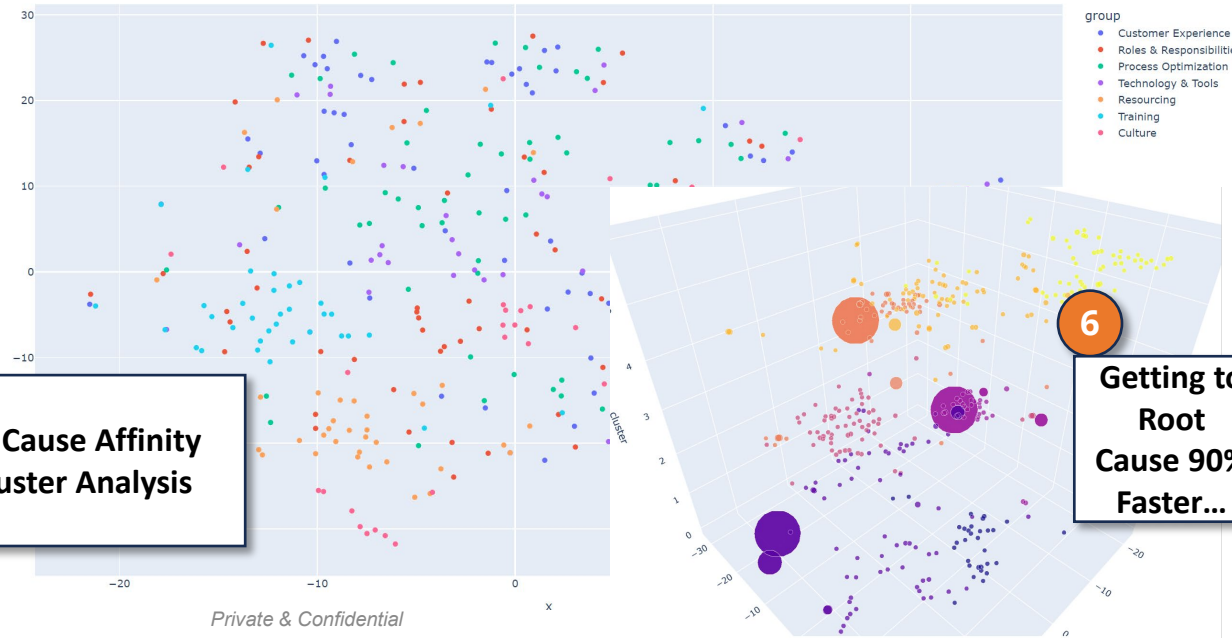
GPT3+ Excel Add in – Conversion to tabular data, codified to 100 decimal points

4

GPT Add In for Structured Data Sources (File Uploader)

5

Automated Root Cause Affinity Grouping and Cluster Analysis



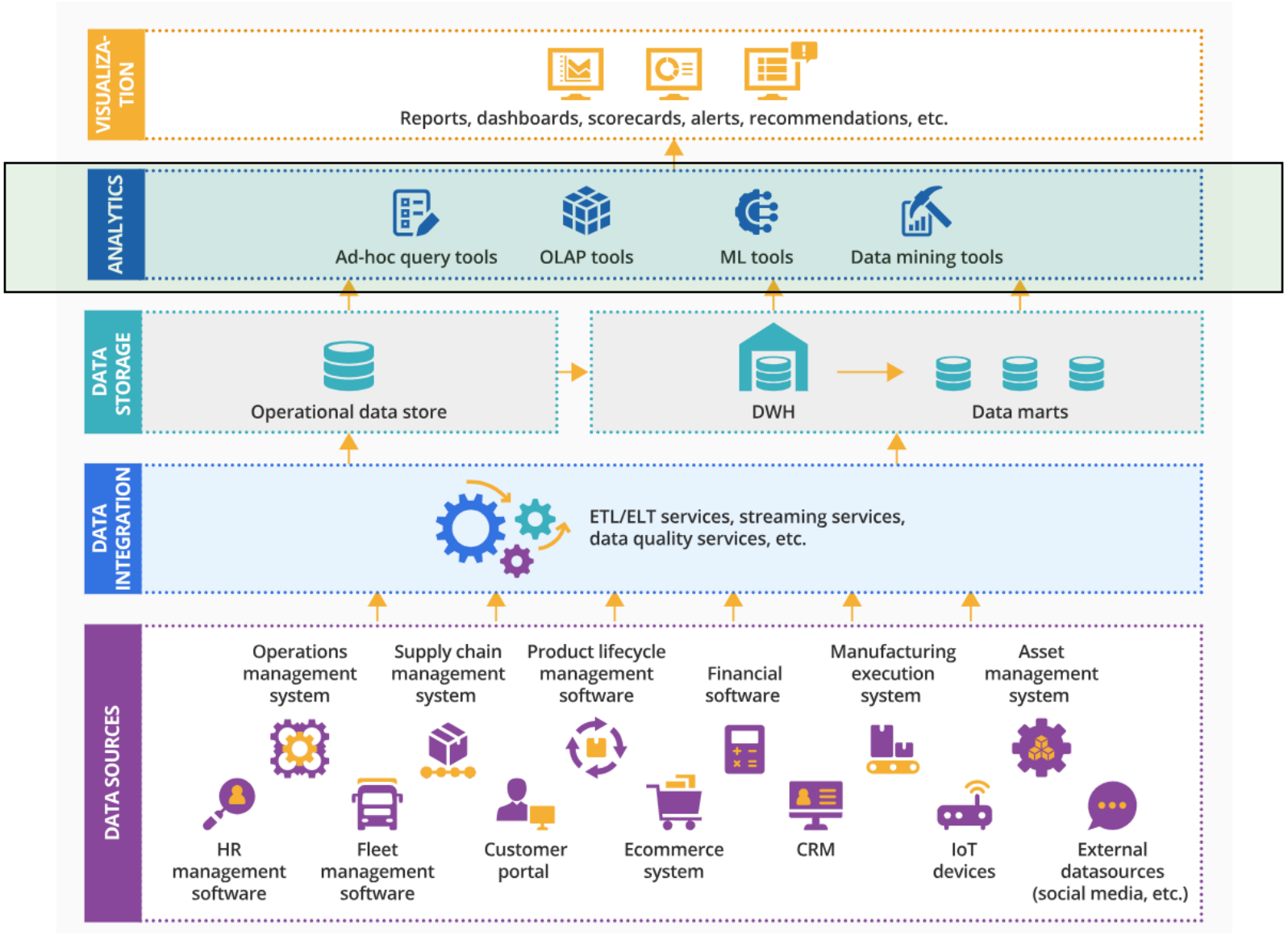
6

Getting to Root Cause 90% Faster…

Private & Confidential

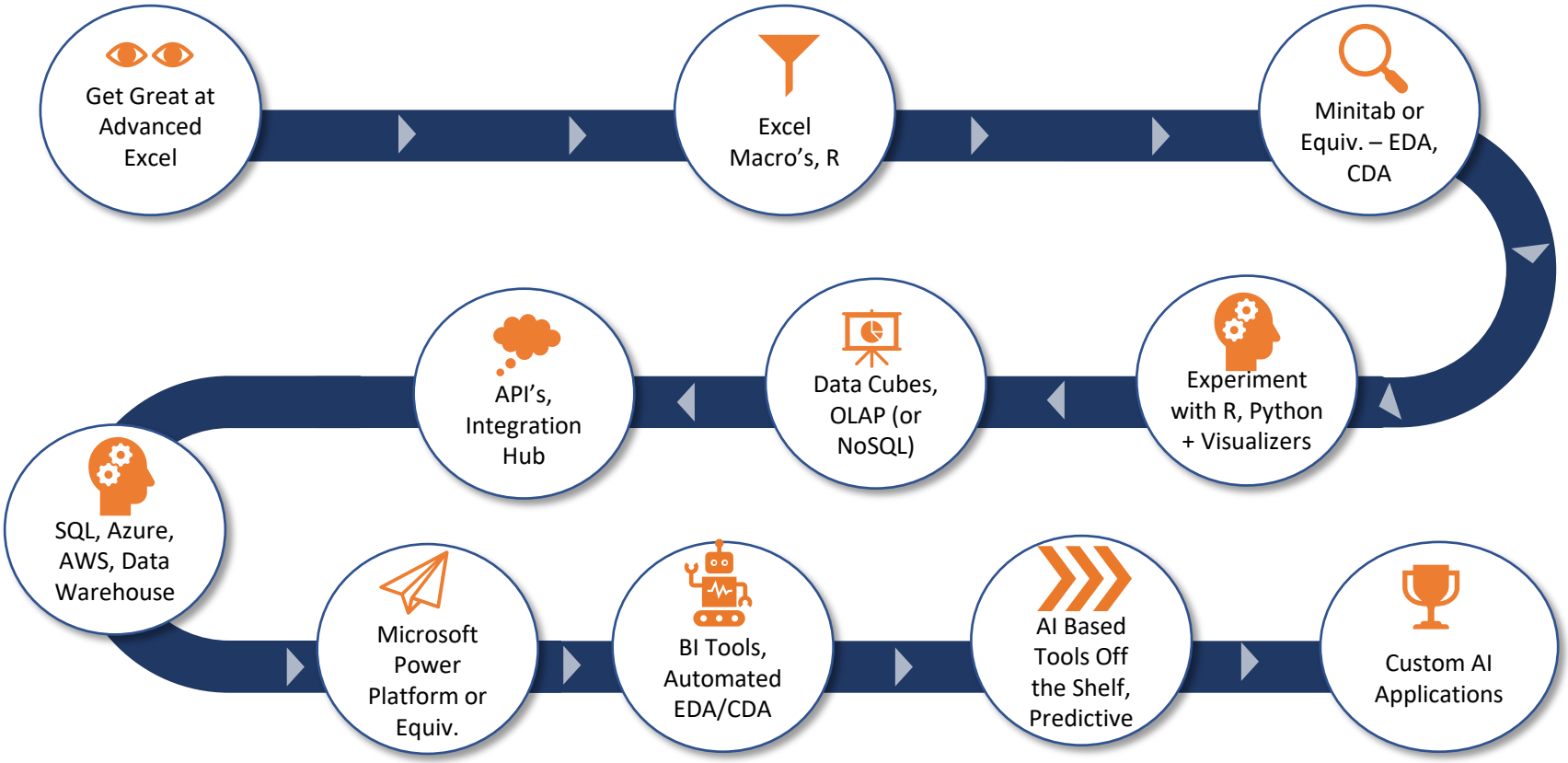
Putting it all Together

Mature Structure From Source Data to Visualization with OA



Major Developmental Milestones

Key milestones in the OA 4.0/5.0 journey as IE's



How does one develop their Op Analytics Knowledge and Skill competencies and capabilities

- The focus of todays OA 501 Webinar is on the ‘Analyst’ Role:
  - What does an OA Specialist have to be able to ‘do’, create? (Scott)
  - What are the ‘tools’ of the OA trade, what ‘apps’ does one need to be conversant and skilled with? (Jared)
  - The relationship between BPM/I 4.0&5.0 and Op Analytics (we’ll point them to your BPM webinars) (Jared)
  - Jared’s suggested professional development plan to kick your OA game up a couple of notches.. (Jared)
  - What does an OA ‘Certification’ look like relative to an ILSS belt certification? (Scott)

Op Analytics Development Options

INSTITUTE OF INDUSTRIAL & SYSTEMS ENGINEERS

MIT MANAGEMENT EXECUTIVE EDUCATION

IISE Training Center

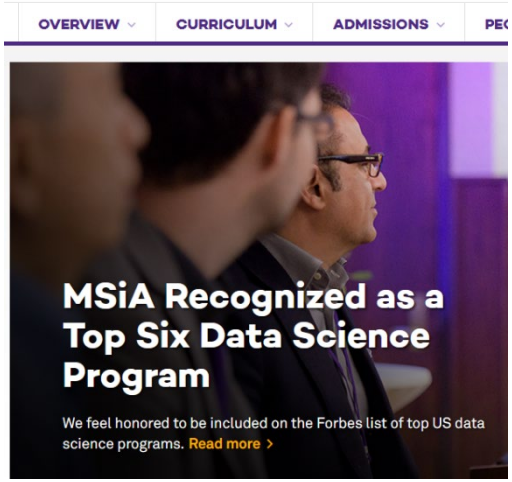
Operational Analytics Certificate & Certification
120 hours ++ (equiv to 1 semester, 4ch course) 12 CEU's

$400 students + $250 for certification

$575/725 member/non-member + $550 for the certification

Northwestern McCORMICK SCHOOL OF ENGINEERING

Master of Science in Analytics



Time/ Cost

4 days to 6 mos. $600-$5,000

On-Line, Virtual

Hybrid/ Blended Model

1-2 yrs, $50-100k

On campus or Hybrid MS Programs

https://careerfoundry.com/en/blog/data-analytics/best-data-analytics-certification-programs/

Op Analytics represents huge opportunity for ISE's

In Partnership with:

The Poirier Group
Moresteam University

Delivered Uniquely:

IISE Training for Op Ex/Analytics 'Store'

- **10+ Video Modules for easy, self-paced consumption/learning**
- **'Chat' Support with Coaches**
- **Periodic Huddles for virtual coaching**
- **Certificate requires engagement with the course 'coach' on assignments**
- **Certification requires the Certificate plus a reduction to practice, proof of skill project**

Module 1: OA Thought Leader Perspectives
Module 2: Operational Analytics Perspectives, Points of View and Foundational Principles and Methods and Models
Module 3: Operational Analytics: The Foundational Data Management Role
Module 4: Operational Analytics: The Analyst, Decision/Action Support Role
Module 5: Data Sciences and The New Industrial and Systems Engineering
Module 6: Operational Analytics: The Evaluation Role
Module 7: Operational Analytics—Visual Measurement/Management Systems (Parts I, II, III)
Module 8: Operational Analytics: Putting it All Together: Case Studies
Module 9: The Role of Data and Information (Engineered Management Systems) in Periods of Major Disruption, Reducing the Latencies
Module 10: Creating Cultures that Support Full Potential Performance/Operational Excellence

INSTITUTE OF INDUSTRIAL & SYSTEMS ENGINEERS

10 fundamental modules make up the certificate program.

On-demand Learning Management System.

Chat Coaching and periodic 'huddle' coaching included.

Approximately 120 hours of studying designed to be completed in 6 months or less.

1. Op Analytics Certificate and Certification Program Overview
   Module
2. Op Analytics: Perspectives and Overview
   Module
3. Op Analytics: Data Management Role
   Module
4. Op Analytics: Analyst Role
   Module
5. Data Scientist Role
   Module
6. Op Analytics: Process Improvement (Moresteam)
   Module
7. Op Analytics: Visual Measurement (Management) Systems
   Module
8. Op Analytics: Management Systems Engineering Role
   Module
9. Op Analytics: Case Studies
   Module
10. Op Analytics: Data Sets and Skill Development Practice/Exercises
    Module

And, Just Ahead…..

Aug-Oct Offerings for you..

An AI Mini-Series is launching next week

10 August AI 101-- https://link.iise.org/AI-part1

- ***An ISE perspective on AI***

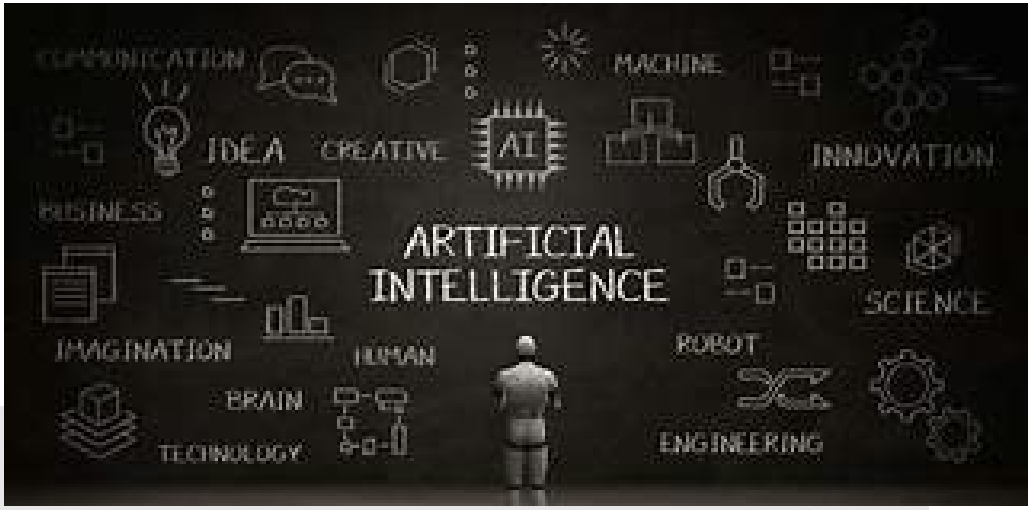
AI 201, 301, 401 Under Development for Aug-Sept.

10 August OA 601

- ***A deeper dive on today's webinar content***

- ***September--Our Annual Final Four Capstone Senior Design Presentations***
  - ***Dalhousie, Virginia Tech, Toronto Metro University, Georgia Tech***
- ***October 19—Best Practices in Service Systems Engineering***
  - ***GM, Purdue & County Community Corrections, Univ. of Illinois and Deepair Solutions***
- ***October 24—Jim Tompkins is back!! With his perspectives and points of view on the evolution of Globalization vs De-Globalization and how this will impact ISE in practice***
  - ***To Register: Register for Jim Tompkins on Globalization vs De-Globalization Evolution***

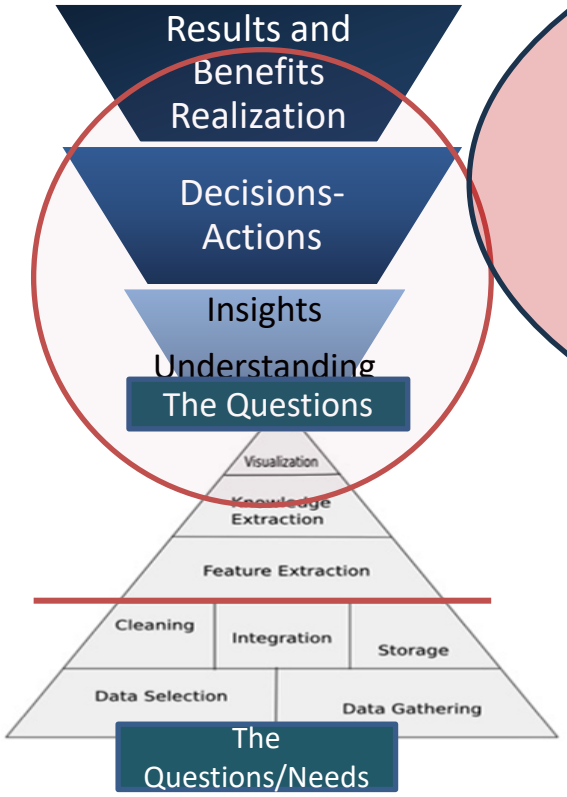
The Purpose of our upcoming AI Miniseries



Sense making in an everchanging World

ISE Perspectives and Points of view on AI

Objective: build out the capability to do the top half of the Op Analytics Process DO-TRAIN/COACH Approach)



The BPI/Analytics Team:

The Implementation Science and Benefits Realization Role doesn't exist yet (PMO)

The BPI/Analytics Support Team:

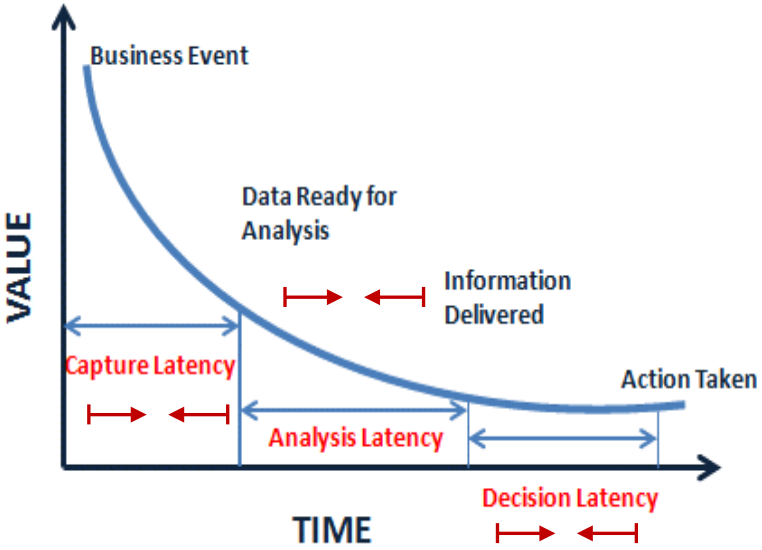
The Analyst Role: doesn't exist yet

User Interface to Power BI output: (Data Management Role)

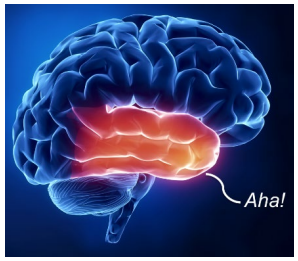
The Data Management Role: (Exists as Silo)
Data Sources, MMS, SQL tables, Query tools, and what's called Feature Extraction in the form of Reports/Tables/some charts

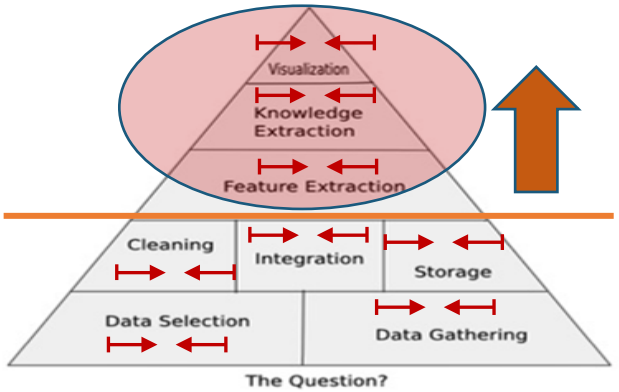
We need to get this going from top to bottom instead of bottom to top!!

Getting to Visualizations that create insights (aha moments) that provoke timely decisions and actions and improvements is the key



Timely Benefits Realization

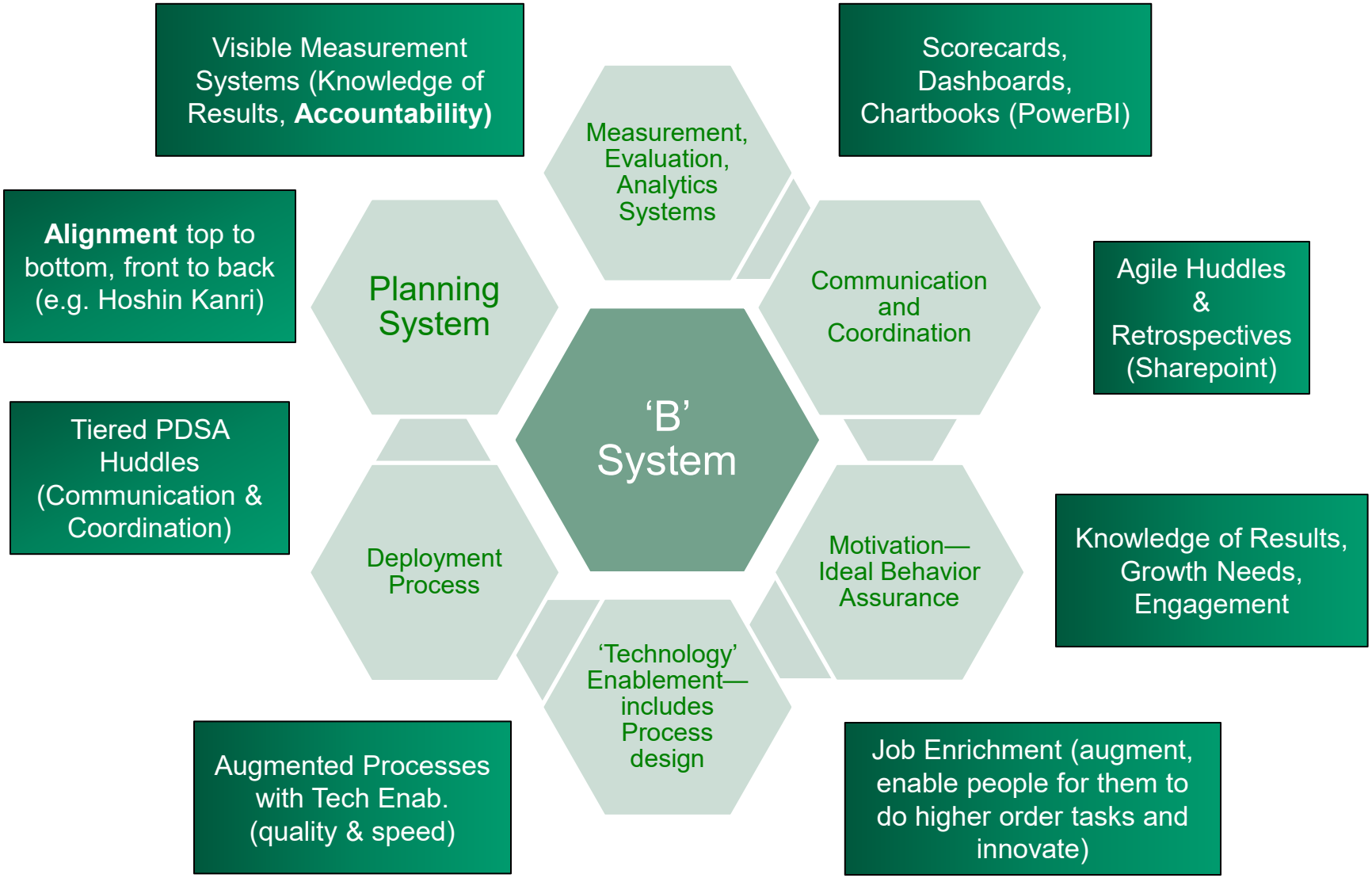




Must do, Accelerate ability to cycle bottom to top on the OA Triangle

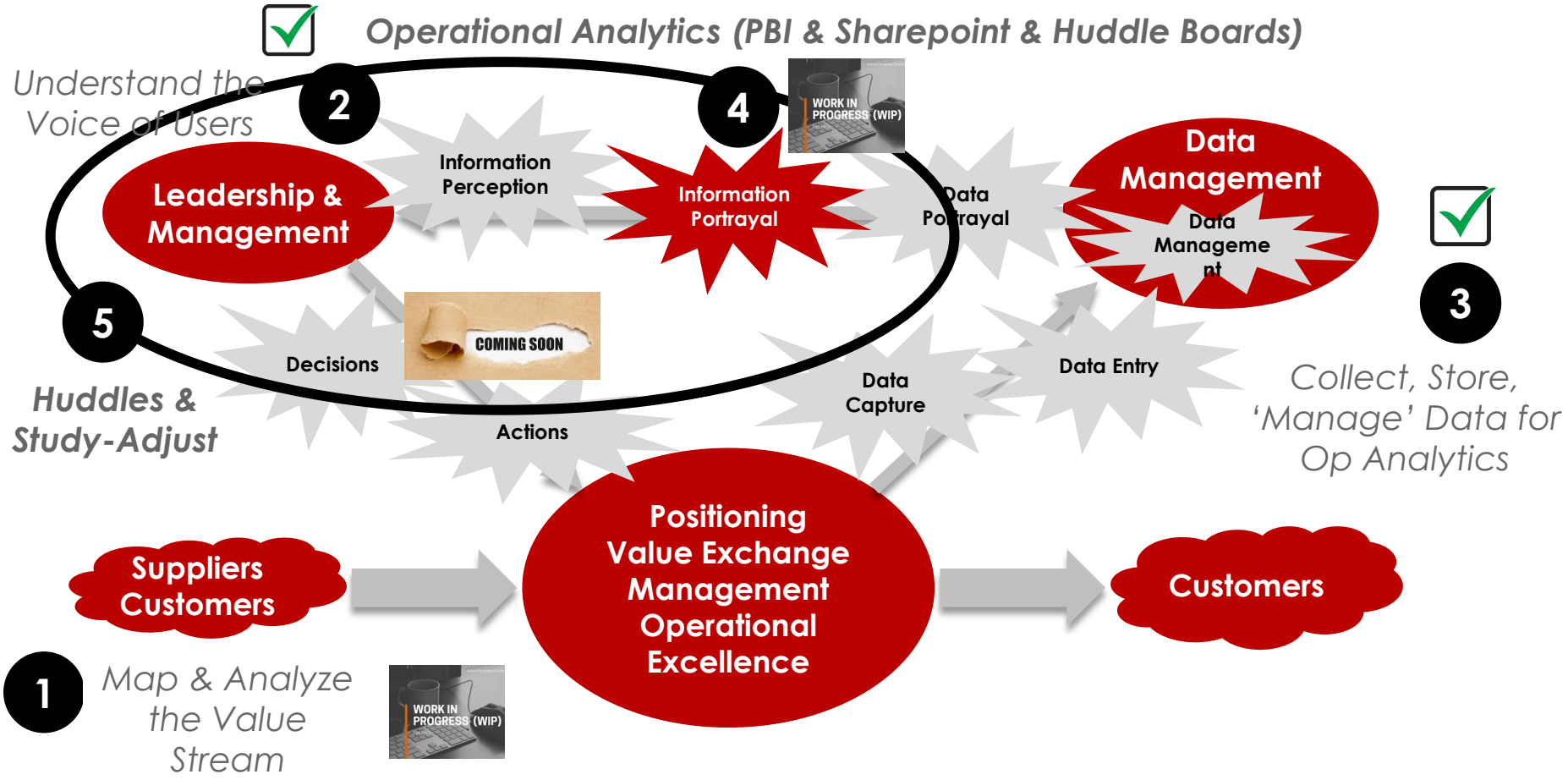
- Improved Alignment of OA work with Strategy—better portfolios due to leveraging better OA
- integrate data creatively, from multiple sources, rapidly using best tools available
- Visualizations must minimize the latency to get to the **"Ah-Ha" moment and then drive the causal chain to Benefits Realization**

What are the components of the ‘Management System’ (‘B’)

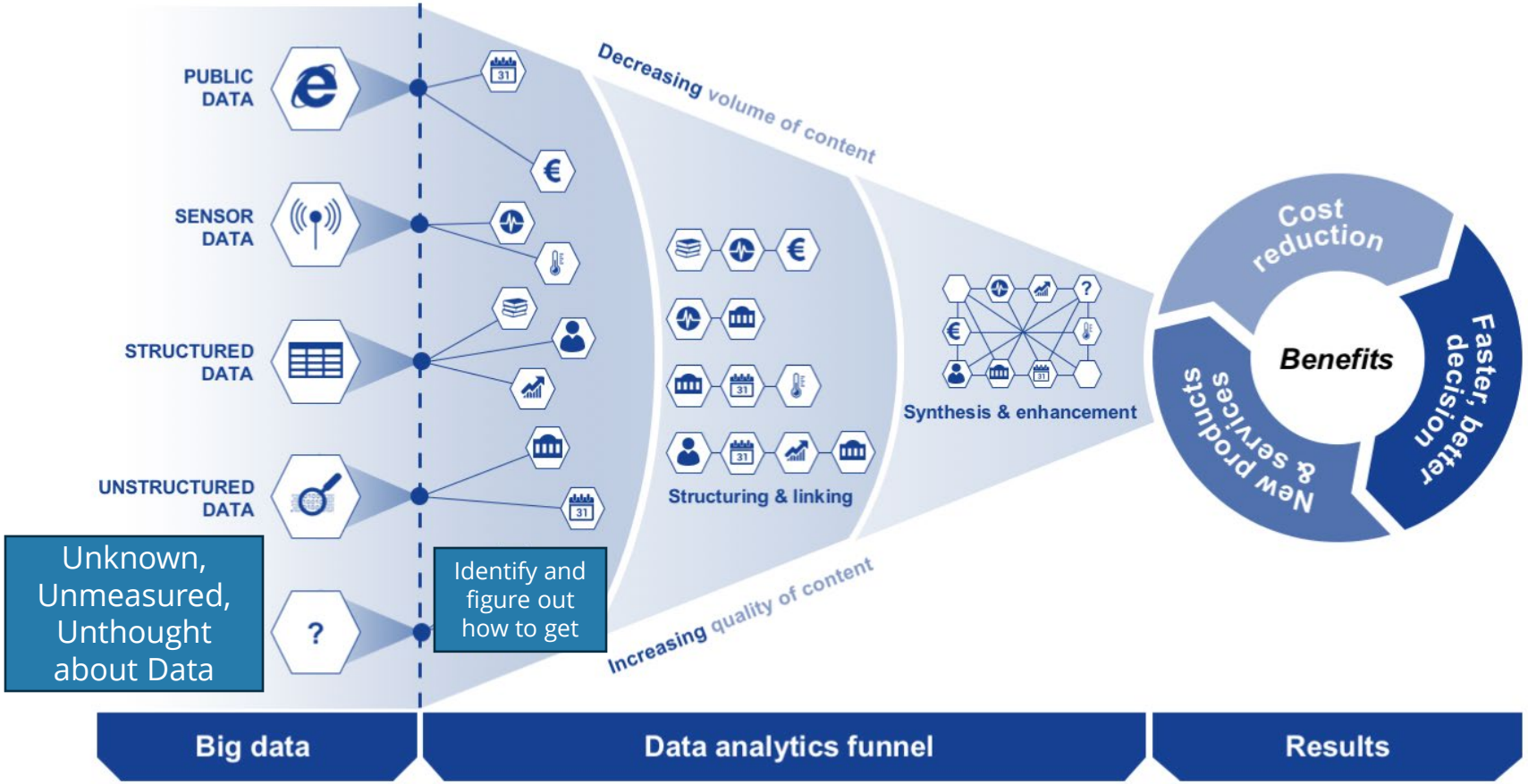


Steps in the "Build" of better PDSA systems

Peavey Performance Management/Measurement System



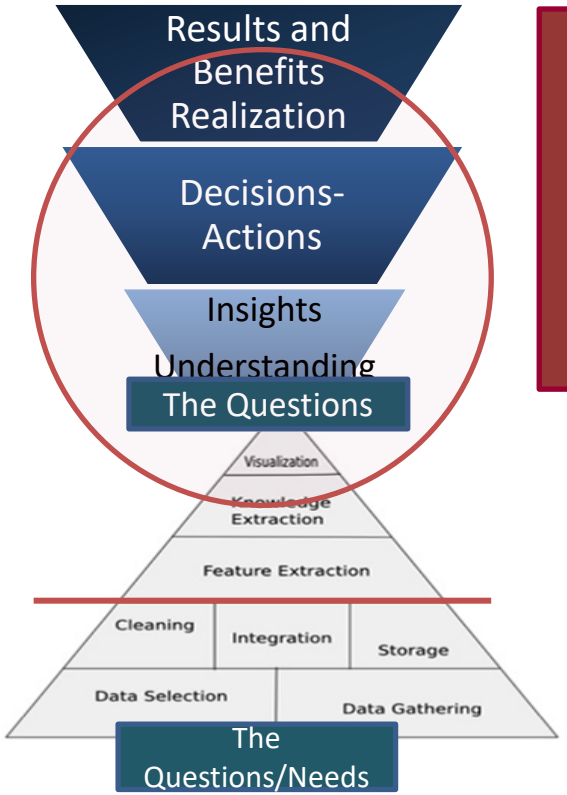
Moving from Big Data to Operational Analytics



Common Situation with Organizations on the journey with MS365 solutions

- Driving Results that are Sustainable
  - Much work ahead but will come quickly
- Study-Adjust:
  - Strong Alignment on the need for this
  - Need BPI tiger team to point the way
- Data Analytics:
  - Lots of work to do, directionally correct
- Data Management:
  - Solid foundation to build on

Objective 1: build out the capability to do the top half of the Op Analytics Process DO-TRAIN/COACH Approach)



The Development Team:

The Implementation Science and Benefits Realization Role doesn't exist yet (PMO)

The Development Support Team:

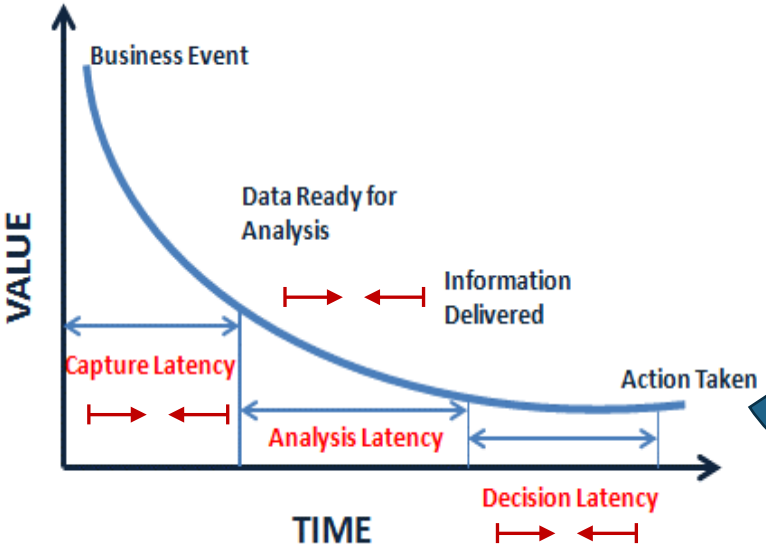
The Analyst Role: doesn't exist yet

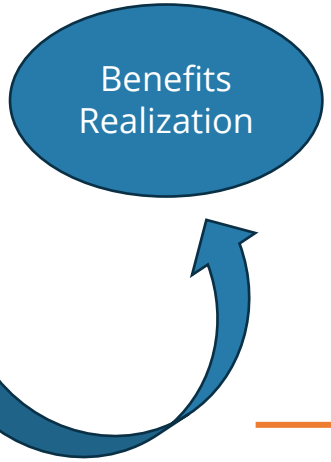
User Interface to Power BI output: (Underdeveloped in most org's)

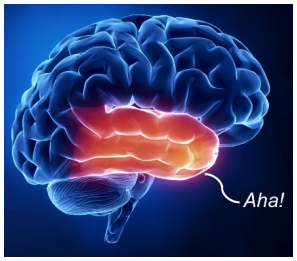
The Data Management Role: (Underdeveloped and mis aligned to BPI)
Data Sources, MMS, SQL tables, Query tools, and what's called Feature Extraction in the form of Reports/Tables/some charts

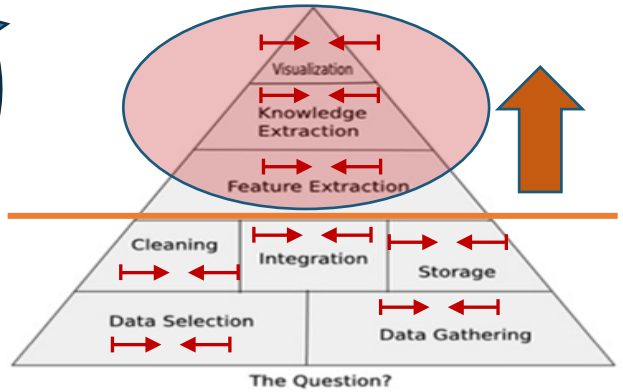
We need to get this going from top to bottom instead of bottom to top!!

Getting to Visualizations that create insights (aha moments) that provoke timely decisions and actions and improvements is the key









Must do, Accelerate ability to cycle bottom to top on the OA Triangle

- Improved Alignment of OA work with Strategy—better portfolios due to leveraging better OA
- integrate data creatively, from multiple sources, rapidly using best tools available
- Visualizations must minimize the latency to get to the **"Ah-Ha" moment and then drive the causal chain to Benefits Realization**