

Prescriptive Analytics

Outline



Prescriptive Analytics



Why / When?



Techniques and Tools



Case Study

4 Types of Data Analytics



DESCRIPTIVE
ANALYTICS



DIAGNOSTIC
ANALYTICS



PREDICTIVE
ANALYTICS



PRESCRIPTIVE
ANALYTICS

4 Types of Data Analytics

DESCRIPTIVE

CLEAN
SUMMARIZE
REPORT
VISUALIZE

DIAGNOSTIC

DATA DISCOVERY
HYPOTHESIS TESTING
DRILL DOWN
DATA MINING
CORRELATION

PREDICTIVE

REGRESSION
CLASSIFICATION
CLUSTERING
TIME-SERIES
NEURAL NETWORKS
DEEP LEARNING

PRESCRIPTIVE

LINEAR PROGRAMMING
GRAPH ANALYSIS
SIMULATION
COMPLEX PROCESSING
MACHINE LEARNING AND
NEURAL NETWORKS
HEURISTICS RESEARCH

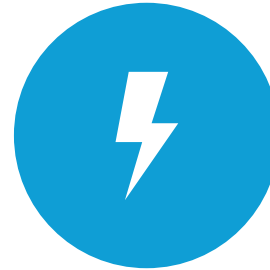
Research Questions



WHAT
HAPPENED?



WHY DID IT
HAPPEN?

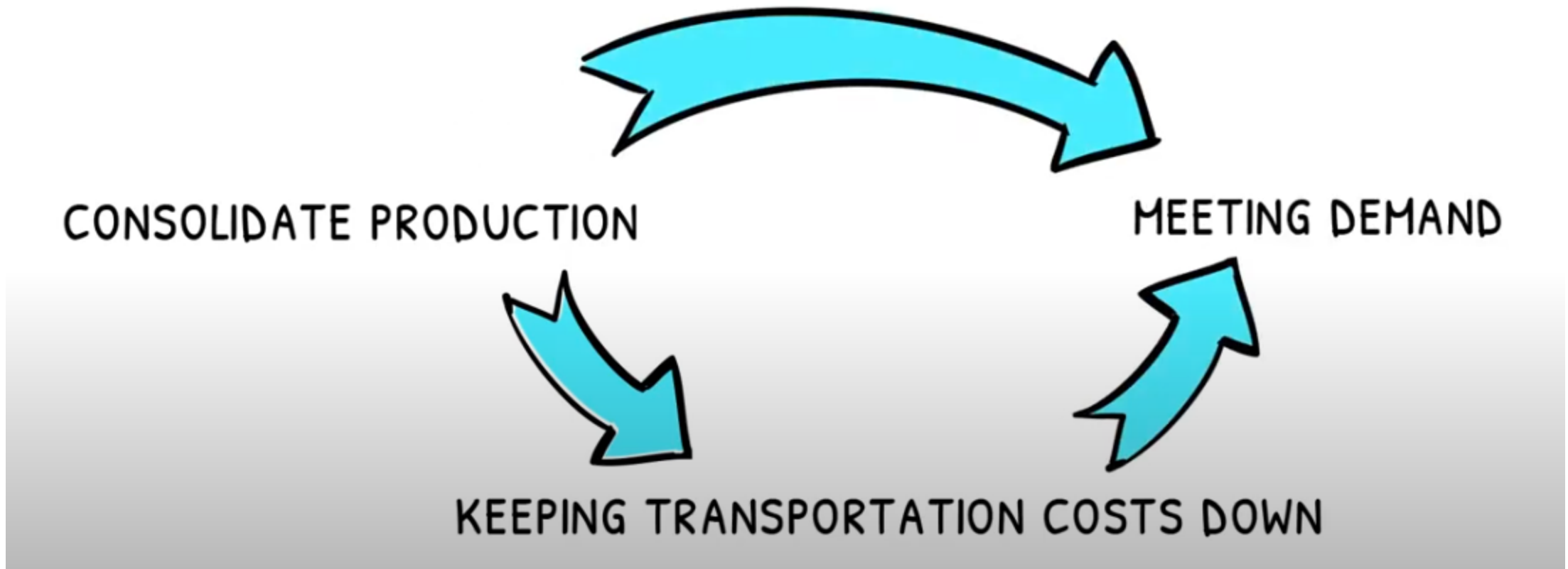


WHAT WILL
HAPPEN?



WHAT IS A
DECISION?

Why Prescriptive Analytics?



Why Prescriptive Analytics?



PROFIT IMPROVEMENT
OPPORTUNITIES



COST SAVINGS



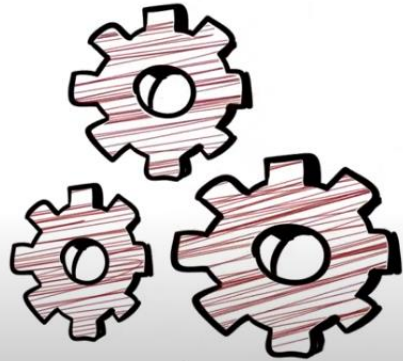
REDUCED RISK

Why Prescriptive Analytics?

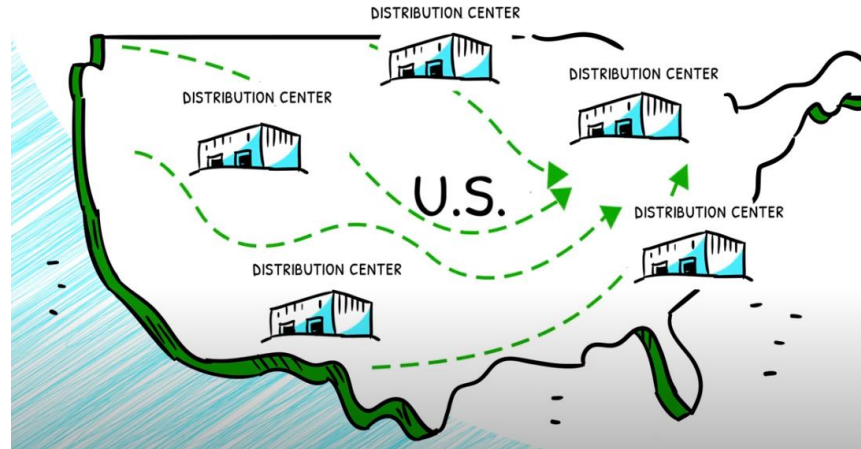
- Calculate past sales of a product to determine the number of replacements.
- Know the tendency of customers in certain products to launch marketing campaigns, according to users' needs.
- Predict equipment failures, which provides for maintenance at the right time.
- Know customers' purchasing habits and punctuality of payment to determine whether it is appropriate to grant credit.

When Prescriptive Analytics?

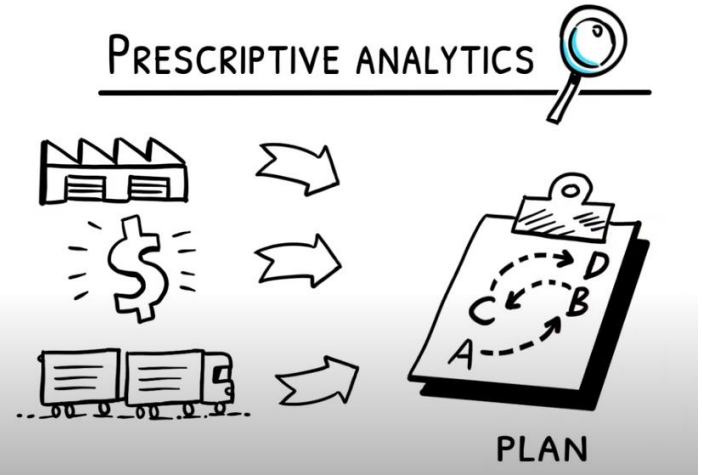
COMPLEX TRADE-OFFS



SEVERAL MOVING PARTS



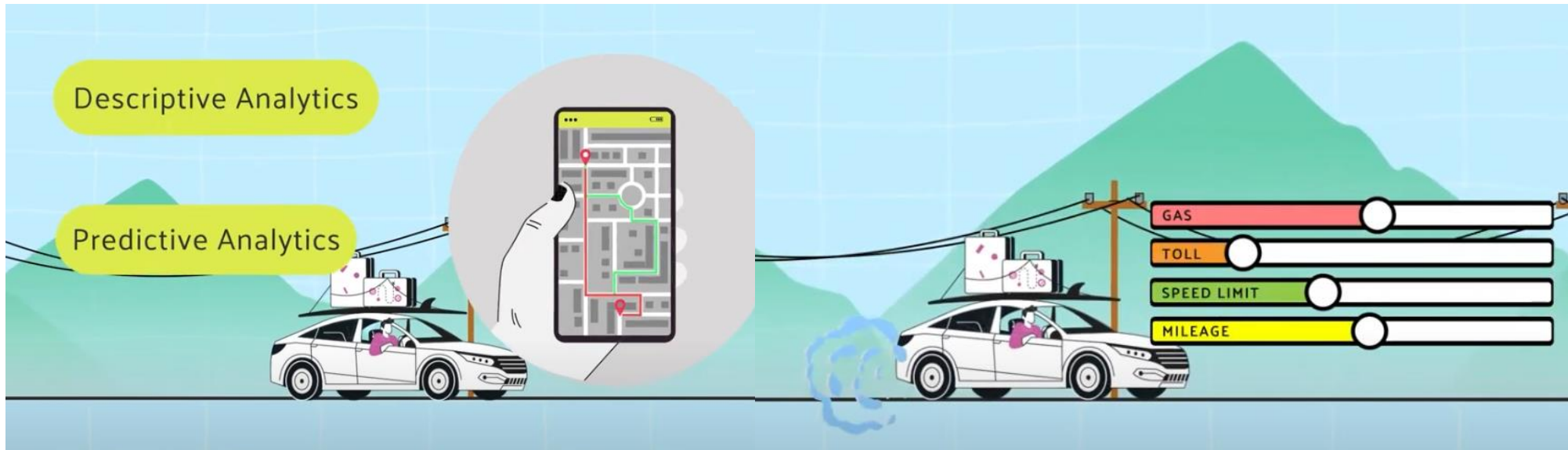
PREScriptive ANALYTICS



THE NETWORK OF PRODUCTION PLANTS
AVAILABLE RESOURCES
PRODUCT DEMAND
PROCESSING
TRANSPORTATION MODES LIKE AIR, RAIL, AND TRUCK
WORKFORCE EFFICIENCY
FINANCIAL CONSTRAINTS AND OBJECTIVES

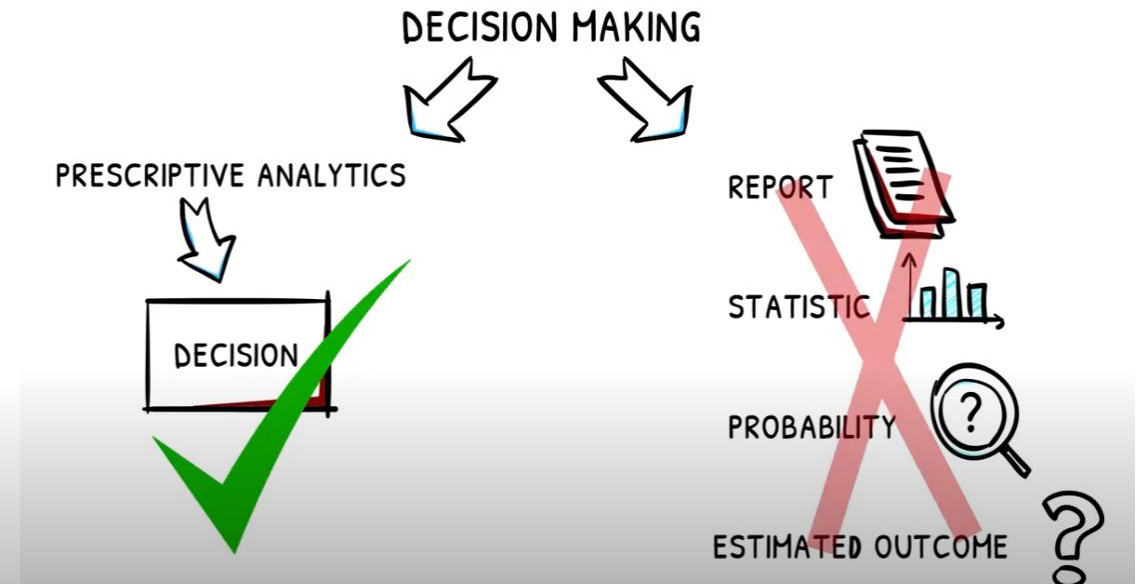
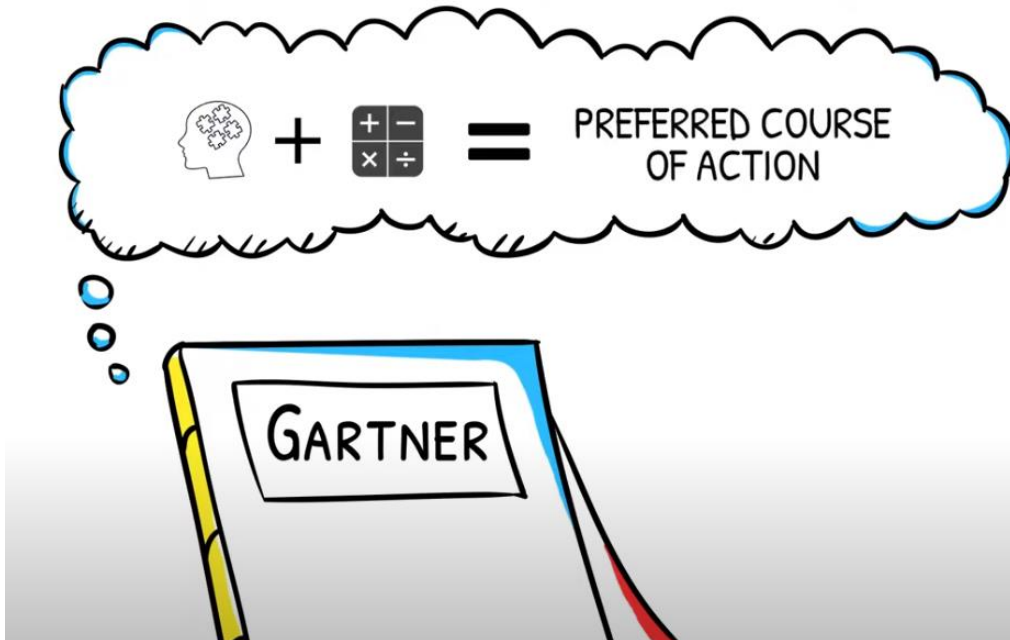
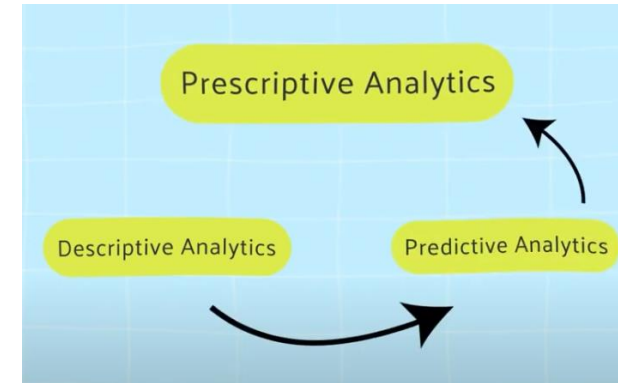
DO ALL SMALL **CHIP** BAGS HAVE TO BE
MADE AT EACH PLANT?
CAN WE CENTRALIZE SMALL **CHIP** BAG
PRODUCTION?
WILL TRANSPORTATION COSTS INCREASE?
CAN WE MEET DEMAND?

When Prescriptive Analytics?

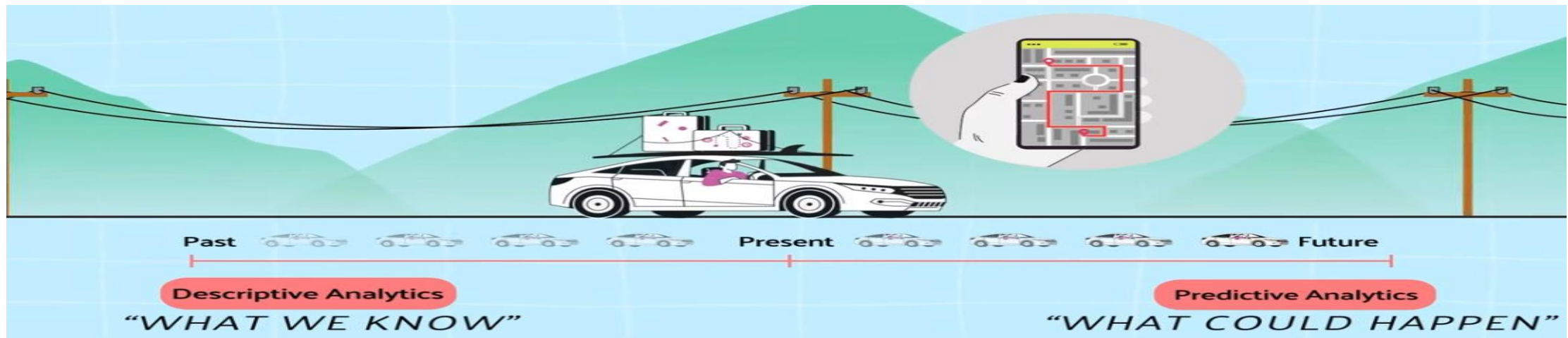
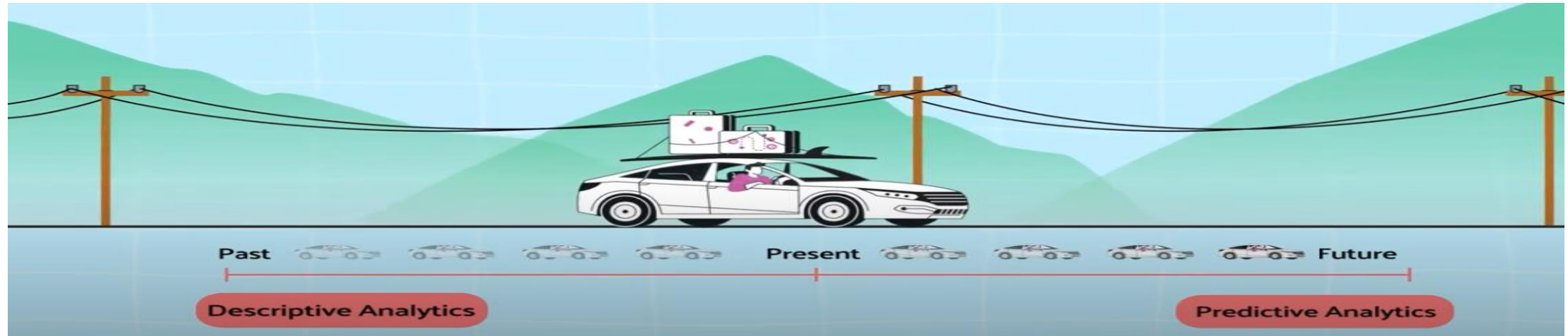


What is Prescriptive Analytics?

- How can it be applied?
- How can be adopted?



What is Prescriptive Analytics?

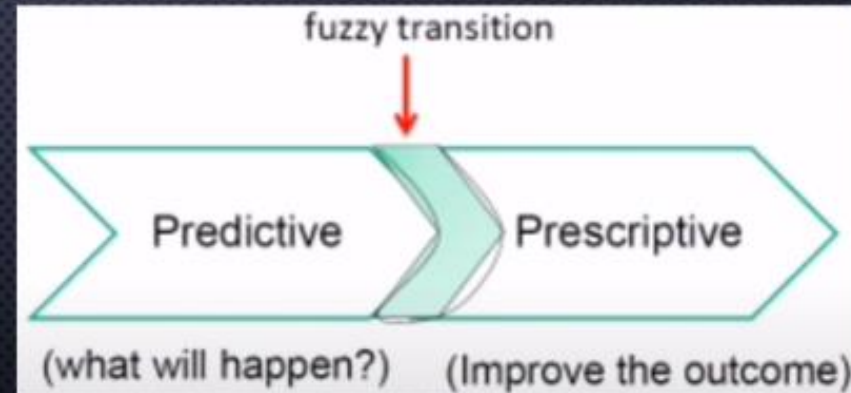


Predictive & Prescriptive Analytics?

Predictive	Prescriptive
<ul style="list-style-type: none">• An insightful forecast from predictive analysis can be analyzed using specific models designed for prescriptive analysis in order to produce automated recommendations or solutions.	<ul style="list-style-type: none">• Prescriptive analytics require complex algorithms in order to accomplish such machine-based decision-making.
<ul style="list-style-type: none">• With predictive analytics, it is understood that predictions may or may not happen.	<ul style="list-style-type: none">• For prescriptive analytics, however, there is an element of risk when using automated recommendations: human behavior can be unpredictable.

How does Prescriptive Analytics work?

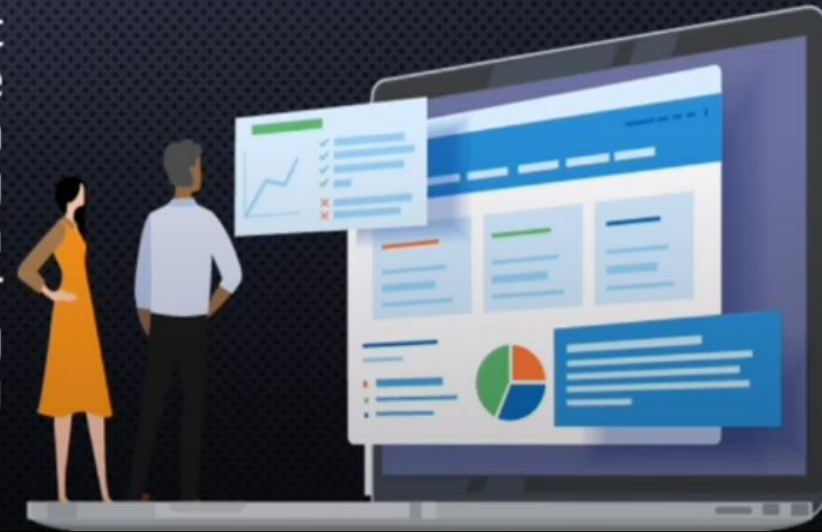
- Prescriptive analytics lies in finding the right way to arrive at the solution, given the data you have on hand.
- prescriptive analytics begins with acknowledging the fact that there is a problem that requires a solution.



How does Prescriptive Analytics work?

Here's an example:

- Training personnel can use predictive analytics to learn that a significant proportion of learners might not be able to complete a specific course without acquiring a particular skill. Prescriptive analytics can help you design an algorithm that can detect people lacking specific expertise in question. It can then proceed to send an automated message or recommendation to such persons urging them to acquire the skills before enrolling for the training course.



When is Prescriptive Analytics recommended?

1. Generation of revenue

Prescriptive analytics applications can provide detailed as well as timely information about the customers' preferences. It also allows business managers to identify new opportunities for cross-selling and accelerating the regular sales cycles at the same time.

2. Management of Gross Margins

Prescriptive analytics techniques when employed along with predictive analytics can provide gainful insights into the optimal product mix for the given and anticipated market conditions.

3. Reduction of expenses

When you apply prescriptive analytics techniques, it becomes easy to manage inventory levels. You have a definite plan of action to achieve a specific objective. Therefore, there is no need to store inventory for long durations.

When is Prescriptive Analytics recommended?

Prescriptive analysis has benefits such as:

- Optimization of processes, campaigns, and strategies.
- Minimizes maintenance needs and interconnects them for better conditions.
- Reduce costs without affecting performance.
- It increases the likelihood that companies will approach and plan for internal growth properly.
- Qualitative research method — know the characteristics that distinguish it.
- Production optimization.
- Efficient supply chain management.
- Improved customer service and experience.


Tools



- **RapidMiner** offers artificial intelligence and prescriptive analytics to companies through an open and extensive data analytics platform. This centralized platform features a powerful and robust graphical interface that enables users to create, maintain, and deliver predictive analytics. The tool also includes scripting support in multiple programming languages.

Pros	Cons
Can connect boxes on a canvas to conduct data analysis	Can be buggy at times
Plethora of data analytics and visualization tools	Limitations with some versions
No coding skills required	
Free version available	

Tools



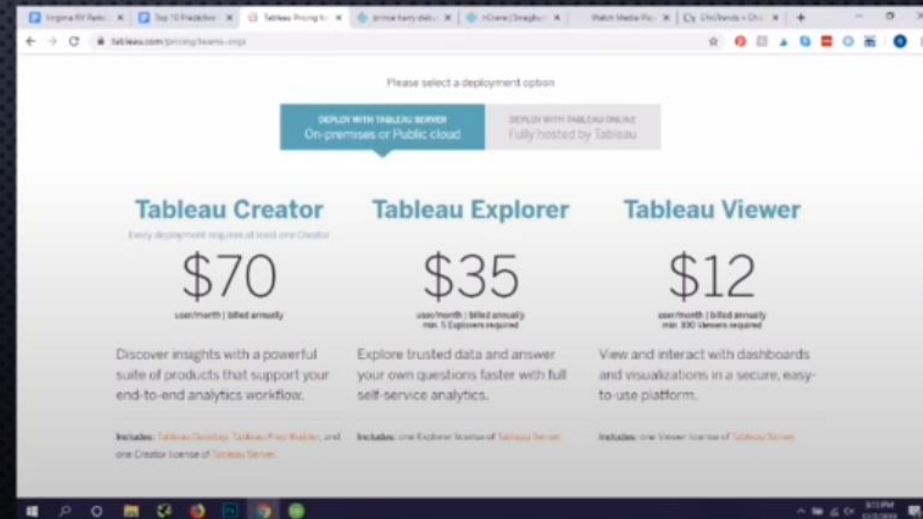
Open for Innovation[®] KNIME

- **Knime** is an open source BI tool for data integration, reporting, and analytics. It features a visual interface that includes nodes for a range of activities, from extracting data to presenting it. The platform is primarily focused on statistical models.
- Knime is an open source platform.
- Knime offers a variety of integrations for their platform.

Pros	Cons
More than 100 modules	Nodes are not as customizable as Python/R libraries, though for that Python/R node can be used
Visual user interface that doesn't require programming knowledge	Can run rather slow, particularly when more extensions and nodes are installed
Connect nodes through a drag-and-drop interface	There can be a steep learning curve for users who haven't used a similar tool

Tools

- Tableau is a business intelligence tool that helps organizations turn their data into impactful, actionable insights.
- Tableau's drag-and-drop feature helps users create interactive dashboards with advanced visual analytics.
- Tableau offers two different sets of prices for its software. One set of prices for installing the software on-premise and another for the software hosted by Tableau.
- Tableau offers the ability to connect to an extensive list of data sources.



Techniques in Prescriptive Analytics

PRESCRIPTIVE

LINEAR PROGRAMMING

GRAPH ANALYSIS

SIMULATION

COMPLEX PROCESSING

MACHINE LEARNING AND

NEURAL NETWORKS

HEURISTICS RESEARCH

Case 1

What is Supply Chain Analytics?

WHO AND HOW?

REQUIREMENTS

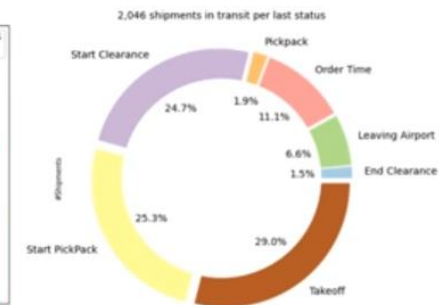
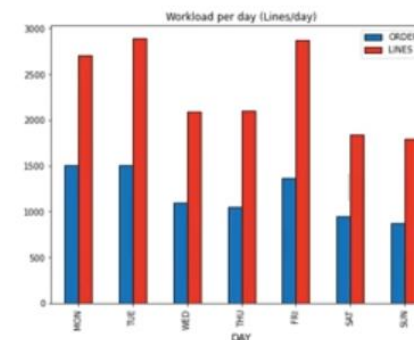
POSITIONS INVOLVED

Supply Chain Engineers, Data Analysts, Data Architects, Data Engineers, Data Scientists, Product Managers and Business Intelligence Experts

TOOLS

Cloud computing, Python processing libraries (Pandas, Spark), BI Visualisation tools (Tableau, PowerBI, Google Studio)

SUPPLY CHAIN ANALYTICS



Processing Time (min)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Job 1: Female Dress		Machine 2	Machine 3														
Job 2: Handbag			Machine 1				Machine 2			Machine 3							
Job 3: Belt		Machine 2	Machine 1				Machine 3										

Machine 1
Machine 2
Machine 3

Anti-theft Tag
Label(s) sewing
Kitting and Packing



Case 2



Case 2 (Cont.)



DEFINITION OF SUPPLY CHAIN

FLOW OF GOODS & INFORMATION



Case 2 (Cont.)



Case 2 (Cont.)

SUPPLY CHAIN ANALYTICS

ANSWER QUESTIONS

*Sales jumped by
+20%*

*National Holidays
Pushed the Sales*

*Sales will increase
by +10% next
week*



DESCRIPTIVE



*Which events
happened?*



DIAGNOSTIC



*Why did these
events happen?*



PREDICTIVE



*What can
happen?*



PRESCRIPTIVE



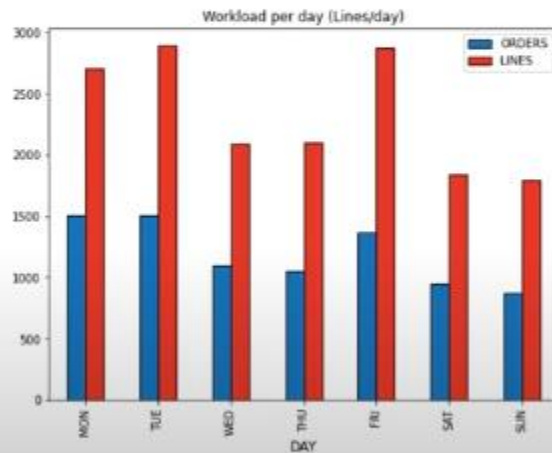
*What should we
do?*

Case 2 (Cont.)

DESCRIPTIVE ANALYTICS

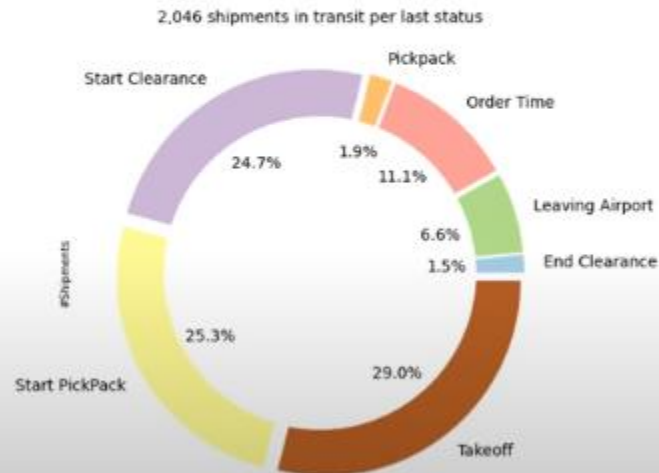
WHAT HAPPENED?

WAREHOUSE
WORKLOAD REPORT



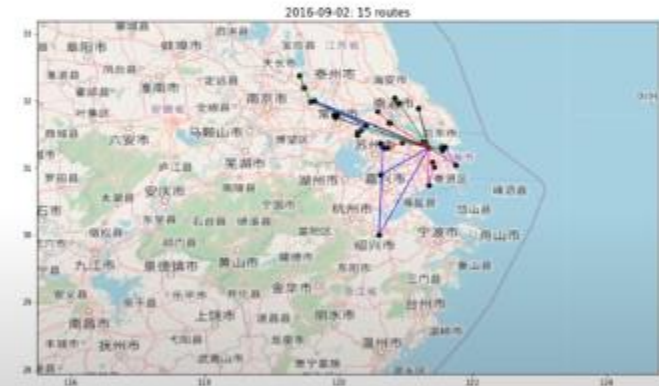
How many orders were prepared last week?

SUPPLY CHAIN CONTROL
TOWER



Where are my shipments currently in transit?

TRANSPORTATION ROUTE
ANALYSIS



What are the different routes used to deliver the stores last month?

Case 2 (Cont.)

DIAGNOSTIC ANALYTICS

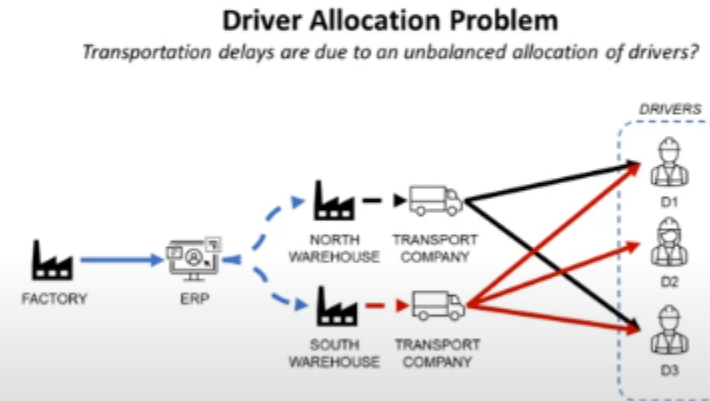
WHY DID THESE EVENTS HAPPEN?

END-TO-END DISTRIBUTION DELAYS ROOT CAUSE ANALYSIS



Why your shipment arrived late?

PROCESS FAILURE ROOT CAUSE ANALYSIS



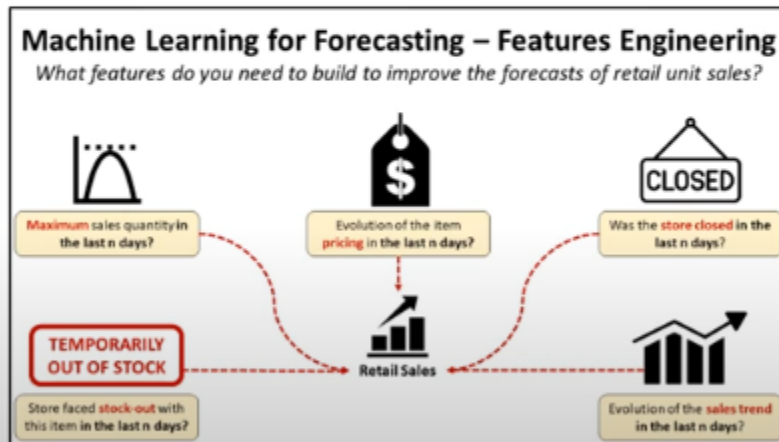
Transportation delays are due to an unbalanced allocation of drivers?

Case 2 (Cont.)

PREDICTIVE ANALYTICS

WHAT CAN HAPPEN?

RETAIL SALES FORECASTING USING TREE-BASED MACHINE LEARNING



What will be the sales next week?

3:34 / 6:46 • Predictive Analytics >

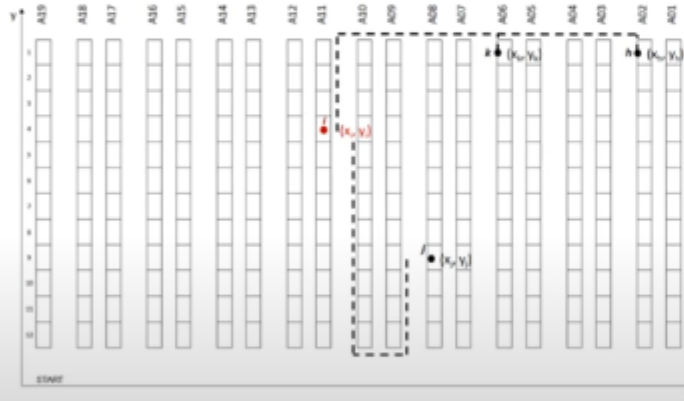


Case 2 (Cont.)

PRESCRIPTIVE ANALYTICS

WHAT SHOULD WE DO?

WAREHOUSE PICKING ROUTE OPTIMIZATION



What is the best picking route to minimize walking distance?

WAREHOUSE VALUE ADDED SERVICE SCHEDULING

Processing Time (min)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Job 1: Female Dress																	
Job 2: Handbag																	
Job 3: Belt																	

Machine 2	Machine 3																

Machine 1
Machine 2
Machine 3

Anti-theft Tag
Label(s) sewing
Kitting and Packing



What is the best sequence of job execution to minimize the cycle time?

Case 2 (Cont.)

WHO AND HOW?

REQUIREMENTS

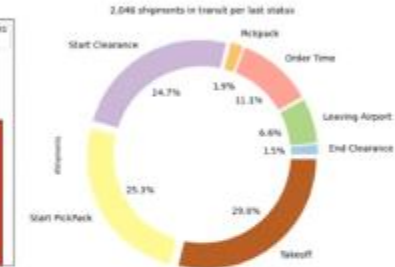
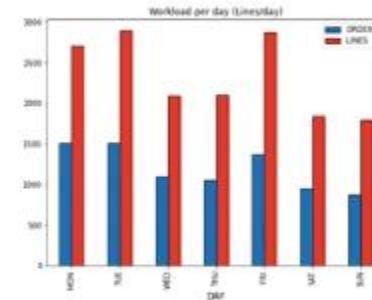
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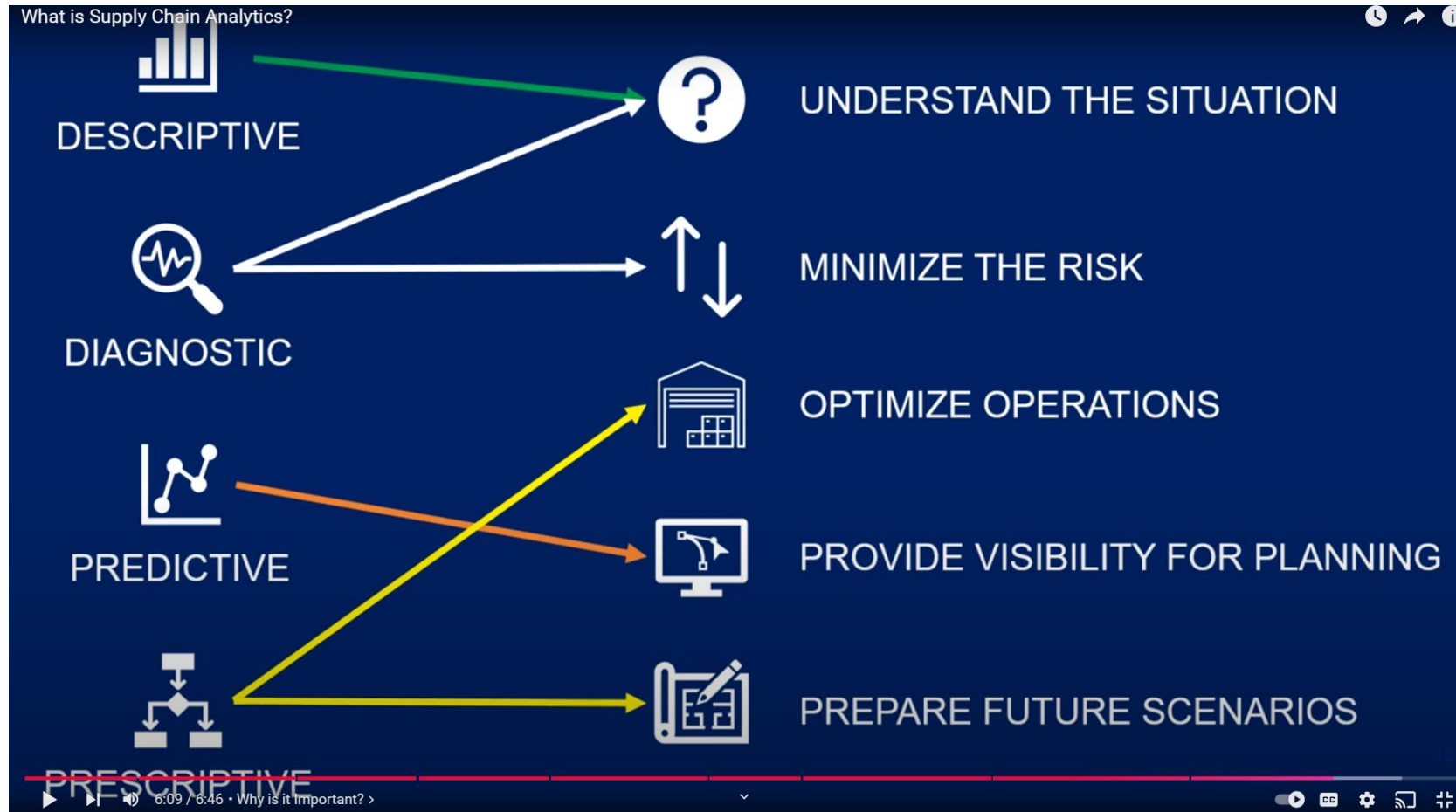


Processing Time (min)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Job 1: Female Dress			Machine 3														
Job 2: Handbag		Machine 1					Machine 2				Machine 3						
Job 3: Belt		Machine 2		Machine 1			Machine 3										

Machine 1: Anti-theft Tag
 Machine 2: Label(s) sewing
 Machine 3: Kitting and Packing



Case 3



References

- https://www.selecthub.com/business-intelligence/predictive-descriptive-prescriptive-analytics/#What_Are_Descriptive_Analytics
- <https://www.youtube.com/watch?v=Z9-0ei8HnYU&t=18s>
- https://www.youtube.com/watch?v=pzvT6Z_b6MA&t=76s
- <https://www.youtube.com/watch?v=bCynHKrxsbg>
- <https://www.youtube.com/watch?v=3d7C4pShykl&t=77s>