

Carnegie Mellon University
HeinzCollege

INFORMATION SYSTEMS • PUBLIC POLICY • MANAGEMENT



Nexteer x CMU – Leveraging AI/ChatGPT for Analytics

Capstone Project Fall 2023

Charles DeVries | Evelyn Sun | Kathy Wang | Muhammad Asad Shoaib | Sujai Sheel Chaudhary

Introduction + Background

Problem, Pain Points and Impact

Project Overview

Demo

Lessons Learnt

Way Forward

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Company



a leader in intuitive motion control

Core Products

- **Advanced electric and Hydraulic steering systems**
- **Driveline systems**
- **Autonomous driving technologies**



Technological Landscape in Automotive Sector

Nexteer is at the forefront, investing in AI to enhance operational efficiency, product quality, and customer satisfaction.



Team



- **Christopher Kowalsky:** Faculty Advisor
- **Muhammad Asad Shoaib:** Project Manager
- **Charlie DeVries:** Documentation Manager
- **Evelyn Sun:** Financial Manager
- **Sujai Sheell Chaudhary:** Quality and Risk Manager
- **Kathy Wang:** System Architect

- **Eric Chavez:** Global Systems Manager
- **Josh:** Final Consumer

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Way Forward

The Core Problem

"Analysis Paralysis" in procurement data on
PowerBI dashboards for preparing monthly reports





Prod_GSM

Global KPI Dashboard CMU

Dashboard

Trend

Sourcing On Time RP (LLM View)

Slicer Page

Sourcing On Time Drilldown

PPAP Drilldown

Perfect Launch - Meets Costbook RP

Gate Review Drilldown

0 PCs Drilldown

CPI list

Meets Costbook RP

Meets Costbook RP (LLM View)

10

Sourcing On Time RP

We updated the look of reports Take a tour, and we'll show you how to get around.

Global

US

AP

MX

EMEA-SA

Perfect Launch - Meet Costbook (Less Than 100% = Goal)

96.26%

Sourcing On Time

● LATE ● ON TIME

57.38%

42.62%

Perfect Launch - PPAP On Time

● LATE ● ON TIME

31.42%

68.58%

15.49K

95.00%

86.43%

Net Performance (Direct)

15.49K

95.00%

86.43%

Gate Review On Time Performance

80.71%

i

TFS

7.70%

i

PPB

26776

i

sCPB

15.0

i

Dashboard

Trend

Sourcing On Time RP (LLM View)

Slicer Page

Sourcing On Time Drilldown

PPAP Drilldown

Perfect Launch - Meets Costbook

Gate Review Drilldown

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CPI list

Meets Costbook RP

Meets Costbook RP (LLM View)

Sourcing On Time RP

PPAP RP

Gate Review RP

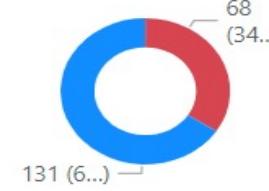
Perfect Launch - 0 PCs (90 Days) (Target 90%)



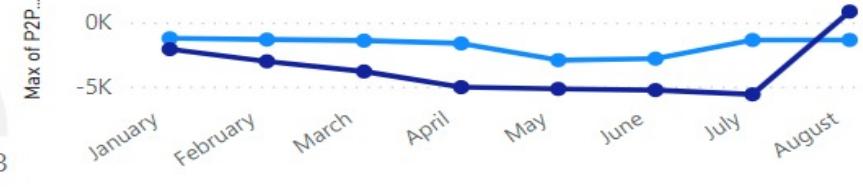
Meet BOM Cost Target on New Pursuits (Target 100%)



Perfect Launch - PPAP On Time (Target 90%)



Net Performance



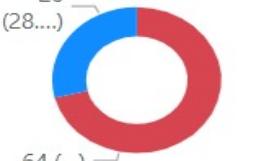
Perfect Launch - Meet Costbook (Target 100%)



PPB



Sourcing On Time (Target 100%)



sCPB



Gate Reviews On Time (Target 90%)



TFS





26 (28.89%)



Sourcing On Time (Target 100%)

80%

60%

40%

January

February

March

April

May

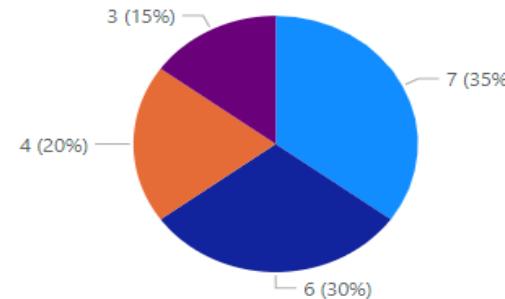
June

July

August



Count by Reason For Miss



ReasonForMiss

- Unexpected changes - ne...
- Supplier task delays - nom...
- Program Timing - Born Lat...
- GSM task delays - executi...

Count by Reason For Miss

Count of Title

5

0

Unexpected changes - negotiations, NBH, friction, etc.

Supplier task delays - nom letter sign-off

Program Timing - Born Late Records, Print Availability CCR, etc.

GSM task delays - execution, strategy and supplier development, etc.

ReasonForMiss

Sourcing On Time KPI	SourcingRegion	RecordNumber	PartNumber	ReasonForMiss	PartName	Program Number	ProgCon
LATE	US	14540	38315243		BELT, ASSIST DRIVE	5161a	6257 - GI
LATE	US	14540	38315243		BELT, ASSIST DRIVE	6257	6257 - GI
LATE	US	14540	38315243		BELT, ASSIST DRIVE	6502	6257 - GI
ON TIME	US	16163	38311186		STUB SHAFT	6732	6732 - St
ON TIME	US	17047	38323279		MOLYKOTE D-321 R Anti-Friction Coating	5997	5997 - GI
LATE	US	17077	28217746	GSM task delays - execution, strategy and supplier development, etc.	ROD, METERING	5998	5998 - G
LATE	US	18802	38316733	Unexpected changes - negotiations, NBH, friction, etc.	SHAFT, TUBULAR FEMALE (PLATED)	6494b	6494b - C
LATE	US	18803	38316726	Unexpected changes - negotiations, NBH, friction, etc.	SHAFT ASM, MALE TUBULAR (WELD)	6494b	6494b - C
LATE	US	18806	38256662		YOKE ASM, SHAFT & (PLATED)	5460	5460 - GI
LATE	US	18812	38312420		PLUG ADJUSTER	6257	6257 - GI

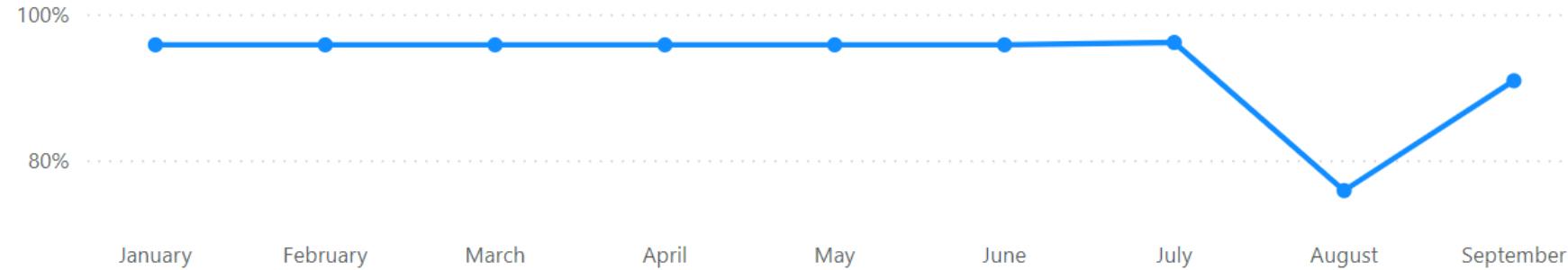
ReasonForMiss

Count of Title

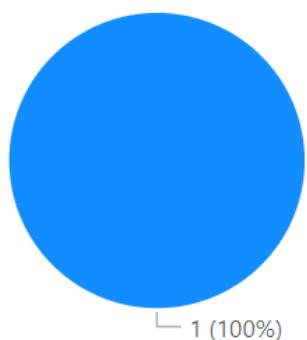
Unexpected changes - negotiations, NBH, friction, etc.	7
Supplier task delays - nom letter sign-off	6
Program Timing - Born Late Records, Print Availability CCR, etc.	4
GSM task delays - execution, strategy and supplier development, etc.	3
Total	20



Perfect Launch - 0 PCs (90 Days) (Target 90%)

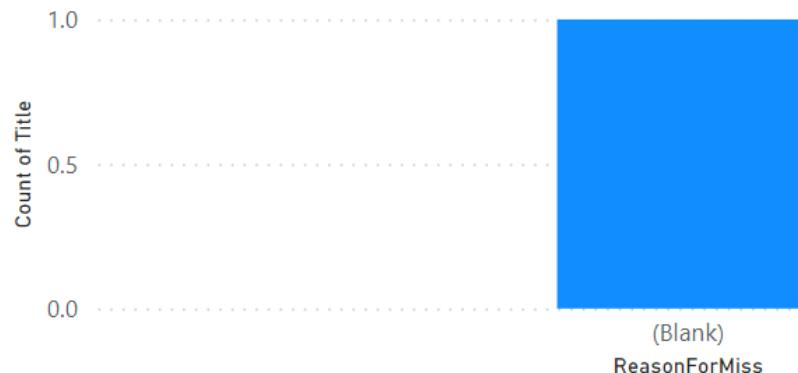


Count by Reason For Miss



ReasonForMiss
● (Blank)

Count by Reason For Miss



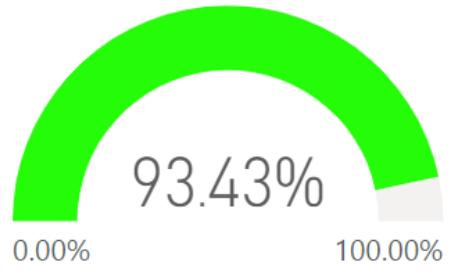
PCNumber Reporting Region Location.Country.Name Location.Name

Comments

31555	AP	CHINA	ANHUI ZHONGDING RUBBER-PLASTIC PRODUCTS CO., LTD. - 654561240	Testing
28280	AP	CHINA	ASIMCO NVH TECHNOLOGIES CO., LTD. (ANHUI) - 654635820	
31662	AP	CHINA	ASIMCO NVH TECHNOLOGIES CO., LTD. (ANHUI) - 654635820	
31823	AP	CHINA	ASIMCO NVH TECHNOLOGIES CO., LTD. (ANHUI) - 654635820	
35822	AP	CHINA	BAODING GREAT MACHINERY COMPANY LIMITED - 527037366	
30230	AP	CHINA	BAODING TIANYIN MACHINERY CO., LTD - 526903565	
29219	AP	CHINA	CENTRAL AUTOMOTIVE COMPONENTS ZHANGJIAGANG CO.,LTD - 421293526	
35521	AP	CHINA	CENTRAL AUTOMOTIVE COMPONENTS ZHANGJIAGANG CO.,LTD - 421293526	
32773	AP	CHINA	CHENGDU WANGJIN AUTOMOBILE COMPONENTS CO., LTD. - 544488097	
35603	AP	CHINA	CHENGDU WANGJIN AUTOMOBILE COMPONENTS CO., LTD. - 544488097	

Show/hide pane

Gate Reviews On Time (Target 90%)



Count by Reason For Miss

Count by Reason For Miss

GateReviewNum	RecordGate	ReasonForMiss	Gate Review Column Key	Location.Name	Gate Review On Time	GateRevDueDate	GateRe
Gate Review 5	APQP #6727 Gate Review 5		US	R&L SPRING CO - 059489179	HELD ON TIME	Thursday, January 05, 2023	Tuesda
Gate Review 4	APQP #7094 Gate Review 4		US	ENGINEERED CUSTOM LUBRICANTS (ECL) ECL - 047350044	HELD ON TIME	Friday, January 06, 2023	Wedne
Gate Review 2	APQP #7247 Gate Review 2		US	SMALLEY STEEL RING CO - 005126065	HELD ON TIME	Thursday, January 12, 2023	Thursd
Gate Review 3	APQP #7232 Gate Review 3		US	MURSIX CORPORATION TWOSON ESP - 610151755	HELD ON TIME	Thursday, January 12, 2023	Tuesda
Gate Review 5	APQP #6575 Gate Review 5		US	MID-CONTINENT SPRING CO - 006380257	HELD ON TIME	Thursday, January 12, 2023	Wedne
Gate Review 5	APQP #4280 Gate Review 5		US	DEVRIES INTERNATIONAL INC DE VRIES INTERNATIONAL - 148385800	HELD ON TIME	Friday, January 13, 2023	Wedne
Gate Review 5	APQP #4968 Gate Review 5		US	ELGIN DIE MOLD CO. - 043363035	HELD ON TIME	Friday, January 13, 2023	Tuesda
			US	ENGINEERED CUSTOM LUBRICANTS (ECL) ECL - 047350044	HELD ON TIME	Friday, January 13, 2023	Wedne
Gate Review 5	APQP #4317 Gate Review 5		US	PRISM PLASTICS LC - 007897049	HELD ON TIME	Friday, January 13, 2023	Wedne
Gate Review 5	APQP #4318 Gate Review 5		US	PRISM PLASTICS LC - 007897049	HELD ON TIME	Friday, January 13, 2023	Wedne
Gate Review 4	APQP #7020 Gate Review 4		US	ATF INC - 013488796	HELD ON TIME	Monday, January 16, 2023	Wedne
Gate Review 5	APQP #6853 Gate Review 5		US	SMALLEY STEEL RING CO - 005126065	HELD ON TIME	Monday, January 16, 2023	Tuesda



Reporting Region
 (Blank)
 AP

AQESQE.FullName
🔍 Search
 ALEJANDRO GA...

ReasonForMiss
 Drawing revi...
 Plant Appro...

PartNumber
🔍 Search
 00001798

RecordNumber
🔍 Search
 10024



1290

Count of Record...

RecordNumber	Reporting Region	AQESQE.FullName	ReasonForMiss	Location.Name	PartNumber	PartRevision	PPAP On Time	KPI	PPAP Approval	P
									Delta	
2995	US	JAMES MCCONNELL		PORITE JEFFERSON CORPORATION - 780514688	38239216	006C	ON TIME		-553	M
10678	US	MARTY SALISBURY		FEDERAL SCREW WORKS BIG RAPIDS DIV - 060184496	38276606	011B	ON TIME		-467	Tu
12652	US	MIKE ORLIK		KALB & ASSOCIATES INC APPLIED TECH INDUSTRIES - 825340693	38290797	001A	ON TIME		-322	Tu
4752	US	JAMES MCCONNELL		ROTAFORM LLC - 132169249	38286096	004	ON TIME		-320	M
16069	US	BRANDON GIERNAN		NEMAK USA INC. - 047260591	38026639	025C	ON TIME		-295	Tl
3697	US	CHRISTOPHER ZIELINSKI		MAGNODE CORPORATION - 004232823	38211598	011E	ON TIME		-295	Tu
7842	US	MEL TROWBRIDGE		TAWAS POWDER COATING INC - 607093556	38222918	007F	ON TIME		-290	Sa
12673	US	MIKE ORLIK		KALB & ASSOCIATES INC APPLIED TECH INDUSTRIES - 825340693	38290813	001A	ON TIME		-278	Tu
12651	US	MIKE ORLIK		KALB & ASSOCIATES INC APPLIED TECH INDUSTRIES - 825340693	38290818	001A	ON TIME		-278	Tu
14857	US	PAMELA HOLLINGER		RANE PRECISION DIE CASTING INC - 114371862	38251101	013F	ON TIME		-269	Su
4758	US	RUSSELL HOLOVE		RALCO INDUSTRIES INC - 053330874	38204336	016D	ON TIME		-256	M
11097	US	MEL TROWBRIDGE		POWDER COTE II, INC. - 035982537	38280077	005E	ON TIME		-253	Tu
17640	US	WAGIH WAZNI		KING STEEL CORPORATION - 005785429	38269749	005B	ON TIME		-249	Fr
16095	US	MEL TROWBRIDGE		POWDER COTE II, INC. - 035982537	38290974	006A	ON TIME		-224	Tu
19888	US	CHRISTOPHER ZIELINSKI		WHIRLAWAY CORP - 130438851	38269645	004D	ON TIME		-217	Tu
16453	US	MEL TROWBRIDGE		POWDER COTE II, INC. - 035982537	38290973	006A	ON TIME		-215	Tu
10120	US	MEL TROWBRIDGE		POWDER COTE II, INC. - 035982537	38291018	004A	ON TIME		-211	Fr
3782	US	JAMES MCCONNELL		M K CHAMBERS COMPANY - 005361365	38279973	008N	ON TIME		-203	M
4701	US	JAMES MCCONNELL		WHIRLAWAY CORP - 130438851	38283991	004G	ON TIME		-199	Fr
3897	US	JAMES MCCONNELL		CAPSTAN INDUSTRIES INC - 130947778	38275934	004A	ON TIME		-197	W
6841	US	JAMES MCCONNELL		WARREN SCREW PRODUCTS, INC. - 005323001	28245973	005B	ON TIME		-194	W
14801	US	WAGIH WAZNI		GERDAU MACSTEEL INC MACSTEEL MONROE - 087054078	28191490	006D	ON TIME		-194	M

A total of 16 dashboards for 5 regions

Impacts

overwhelming

to analyze

Operational efficiency

is reduced

>10 hours

per person per month per region

Introduction + Background

Problem, Pain Points and Impact

Project Overview

Demo

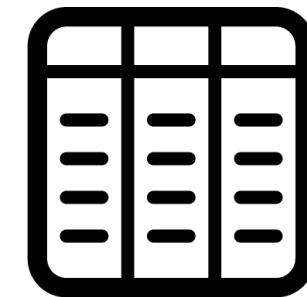
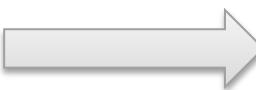
Lessons Learnt

Way Forward

Project Overview

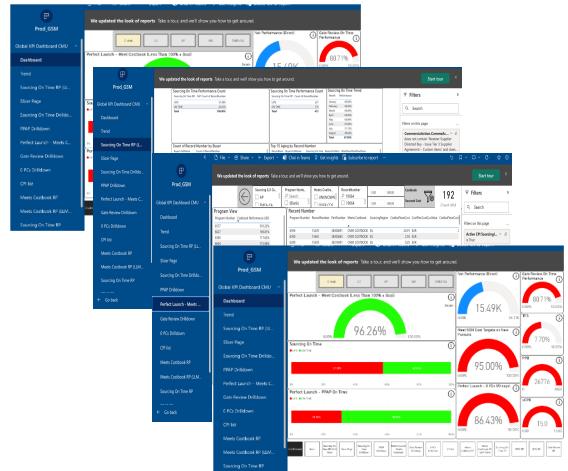
Business Objectives and Vision

- The objective is to **prevent analysis paralysis**, and address the challenges related to **understanding metrics and identifying issues or overdue tasks** efficiently
- Have a tool that can **parse through numerous KPIs** to provide insights

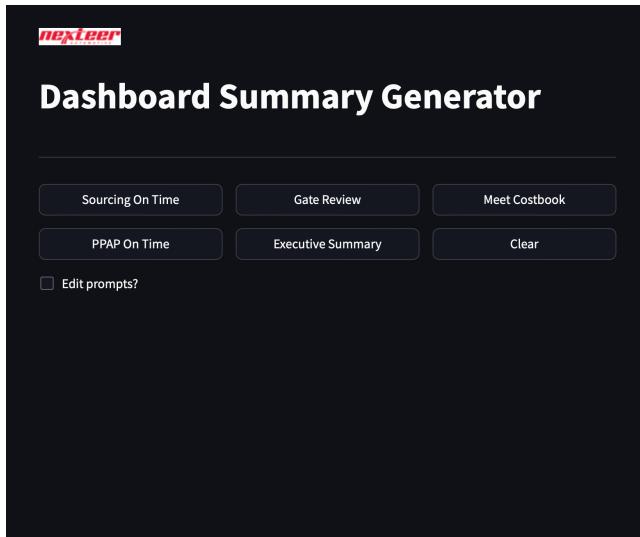


Automate analysis to generate summaries using Large Language Model (ChatGPT)

Input



Web App



Calling LLM from Backend by clicking generate button to get output summary

Output

Based on the available information, the performance of the KPI "Sourcing on Time" is not performing well. The overall percentage of on-time sourcing is 22.89%, which is significantly lower than the target of 59.26%.

The top 3 buyers with the highest counts of records are:
1. Jane Doe - 18 records
2. Adam Smith - 16 records

.....

Our Scope does not include...

- **Restructuring** the format of the Dashboards.
- **Transforming data** and working on Power BI **measure calculations**.
- **Integration** with Power BI

Two Types of large language models (LLMs)

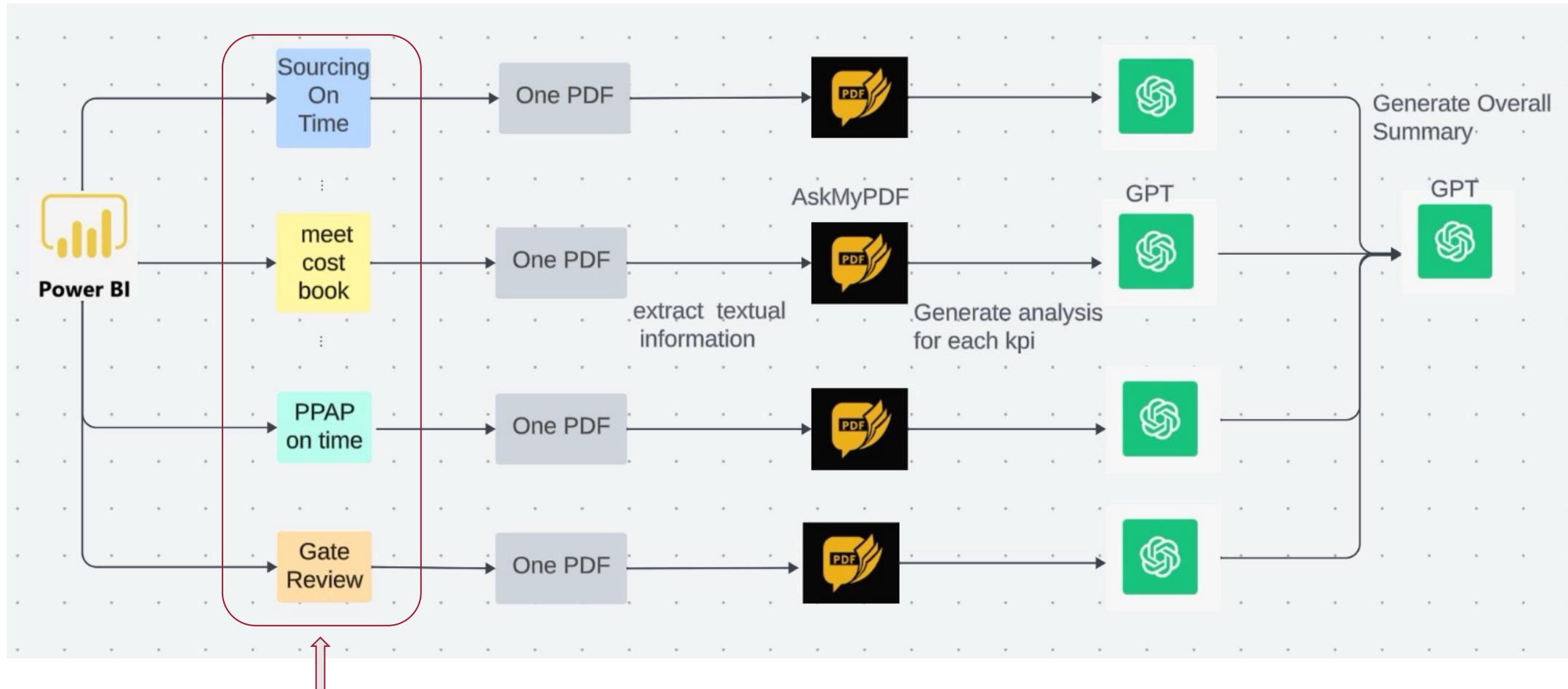
Base LLM

Predicts next word, based on
text training data

Once upon a time, there was a unicorn
that lived in a magical forest with
all her unicorn friends

What is the capital of France?
What is France's largest city?
What is France's population?
What is the currency of France?

Solution Architecture



KPI Metrics and
Drilldowns

Example Summary – Single KPI

Based on the available information, the performance of the **KPI "Sourcing on Time" is not performing well.** The overall percentage of on-time sourcing is XX.XX%, which is **significantly lower than the target** of XX.XX%. Additionally, this KPI has **been trending downward** since July.

The **top 3 buyers with the highest counts** of late records are:

1. Jane Doe - 18 records
2. Tom Smith - 16 records
3. Wendy Brown - 13 records

From the "Top 15 Aging by Record Number" table, **the status of the largest sourcing on-time delta** is open of **233 days**.

The **most common reasons for miss** in the "Sourcing on Time" KPI are:

1. Unexpected changes - negotiations, NBH, friction, etc.
2. GSM task delays - execution, strategy and supplier development, etc.
3. Engineering Changes - design changes, etc.

In summary, the performance of the "Sourcing on Time" KPI is below the target. The percentage of on-time sourcing is only XX.XX%, indicating a significant gap between the actual performance and the desired performance.

Example Summary - Overall

The company's overall performance is relatively strong, with high levels of performance in areas such as costbook performance, gate review on-time performance, and sourcing on-time performance. However, there are areas that require improvement, **such as meeting BOM cost targets on new pursuits and PPAP on-time performance.**

In terms of sourcing on-time performance, the company is currently below the target of 90%, with a current performance of 40.38%. There has been a slight decrease in performance from June to September, with a dip to 72.84% in June. The top contributors to missed deadlines include unexpected changes, GSM task delays, and engineering changes. It is evident that there **is a need for improvement in the sourcing process** to meet the target and ensure timely completion.

Gate review on-time performance is also below the target of 90%, with a current performance of 82.92%. There has been a decline in performance from June to September, reaching 86.49% in September. **A significant number of delays, with 149 held-late gate reviews, indicate that gate reviews are frequently delayed.** Improvement is necessary to ensure timely completion of gate reviews.

On the other hand, the company has achieved a high level of performance in meeting costbook targets, with a current performance of 96.43%. There has been consistent high performance throughout the year, with a significant improvement in September. The main contributors to variances are buyers exceeding costbook limits. Overall, **the company has performed well in this area, with only a slight dip in performance in August.**

In terms of PPAP on-time performance, the company is currently below the target of 90%, with a current performance of 75.39%. There is an overall upward trend from January to August, with the highest performance in August. The top contributors to missed deadlines include plant approval late, drawing revisions needed, and SQE/AQE approval late. While there has been some improvement, **the company still falls short of the target in this area.**

In conclusion, the company's overall performance is strong, with notable achievements in costbook performance and gate review on-time performance. However, there is room for improvement in meeting BOM cost targets on new pursuits and PPAP on-time performance. The sourcing process also requires improvement to ensure timely completion.

Testing

Hallucinations



Non-readability



Introduction + Background

Problem, Pain Points and Impact

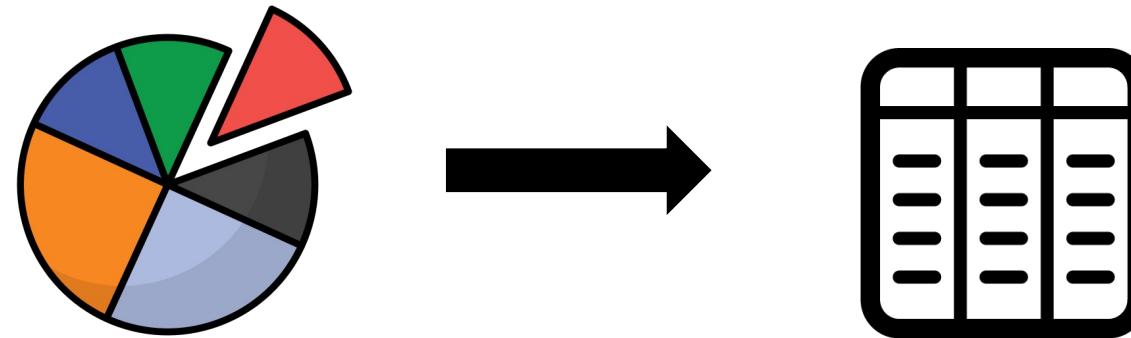
Project Overview

Demo

Lessons Learnt

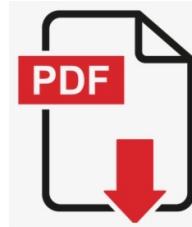
Way Forward

Step 1 – Ensure Correct Data Format



- Relevant data for each KPI is formatted in an LLM-readable format.
- Separate pages with key data for the LLM are added to Power BI.
- Tables can be added or removed to easily alter data used for summaries.

Step 2 – Export, Upload and Summarize



- Export as a PDF
- Place PDF in folder
- Summarize with the click of a button

Global KPI Dashboard CMU

Prod_GSM

Sourcing On Time RP (LLM View)

Meets CB RP (LLM View)

Gate Review (LLM View)

PPAP (LLM View)

CPI Data Prod

Trend

Slicer Page

Sourcing On Time Drilldown

PPAP Drilldown

Perfect Launch - Meets C...

Gate Review Drilldown

Global KPI Dashboard CMU

Search

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Sourcing On Time Performance (Target = 90%)

Sourcing On Time KPI %GT Count of RecordNumber	
LATE	59.62%
ON TIME	40.38%
Total	100.00%

Sourcing On Time Trend

Month	Performance
January	59.26%
February	59.26%
March	59.26%
April	59.26%
May	59.26%
June	59.26%
July	23.26%
August	28.92%
September	42.53%
Total	59.26%

Sourcing On Time Performance Count

Sourcing On Time KPI Count of RecordNumber	
LATE	62
ON TIME	42
Total	104

Sourcing On Time Reasons For Miss (Prev. Month)

ReasonForMiss	Count	Count of Title
Unexpected changes - negotiations, NBH, friction, etc.	56.25%	18
GSM task delays - execution, strategy and supplier development, etc.	21.88%	7
Delays due to low quality sourcing records submitted	12.50%	4
Program Timing - Born Late Records, Print Availability CCR, etc.	6.25%	2
Engineering Changes - design changes, etc.	3.13%	1
Total	100.00%	32

Sourcing On Time Reasons For Miss (Current Month)

ReasonForMiss	Count	Count of Title
Unexpected changes - negotiations, NBH, friction, etc.	52.46%	32
GSM task delays - execution, strategy and supplier development, etc.	21.31%	13
Engineering Changes - design changes, etc.	11.48%	7
Delays due to low quality sourcing records submitted	6.56%	4
Program Timing - Born Late Records, Print Availability CCR, etc.	6.56%	4
Total	100.00%	61

Count of Record Number by Buyer

Buyers.FullName	Count of RecordNumber	Avg Aging	Max Aging
SAMUEL FRANCO	15	115.80	274
CHRISTIAN ARMENDARIZ	9	-7.47	-7
ADRIANA NUNEZ	8	3.63	135
MONICA HERNANDEZ	7	132.29	283
MITZY CAMACHO	5	119.00	245
MOISES PICHARDO	4	119.50	185
CHRISTIAN PAEZ	3	65.50	83
FERNANDO RAZO	2	40.60	79
KATIA VELASCO	2	97.00	180
MIGUEL RUIZ	2	155.00	205
CHRISTIAN CASTELLANOS	1	264.00	264
Total	58	61.80	283

Top 15 Aging by Record Number

RecordNum	Program Number	Buyers.FullName	Sourcing On time	ReasonForMiss	Workflow.WorkflowStatus
20369	5529	MIGUEL RUIZ	205		Open
20369	5529a	MIGUEL RUIZ	205		Open
13902	6644	ADRIANA NUNEZ	99		Open
22332	6514	FERNANDO RAZO	79		Open
22044	5257	MIGUEL RUIZ	55		Open
22467	6658	SAMUEL FRANCO	26		Open
16171	6644	ADRIANA NUNEZ	25		Open
22211	6742	KATIA VELASCO	14		Open
20291	6658	SAMUEL FRANCO	-2		Open
22446	6861	MITZY CAMACHO	-7		Open
22447	6493	MITZY CAMACHO	-7		Open
22447	6494a	MITZY CAMACHO	-7		Open
22447	6494b	MITZY CAMACHO	-7		Open
22448	5393c	MITZY CAMACHO	-7		Open
22449	6493	CHRISTIAN ARMENDARIZ	-7		Open
22449	6493a	CHRISTIAN ARMENDARIZ	-7		Open
22449	6494a	CHRISTIAN ARMENDARIZ	-7		Open
22449	6494b	CHRISTIAN ARMENDARIZ	-7		Open
22450		CHRISTIAN ARMENDARIZ	-7		Open

Introduction + Background

Problem, Pain Points and Impact

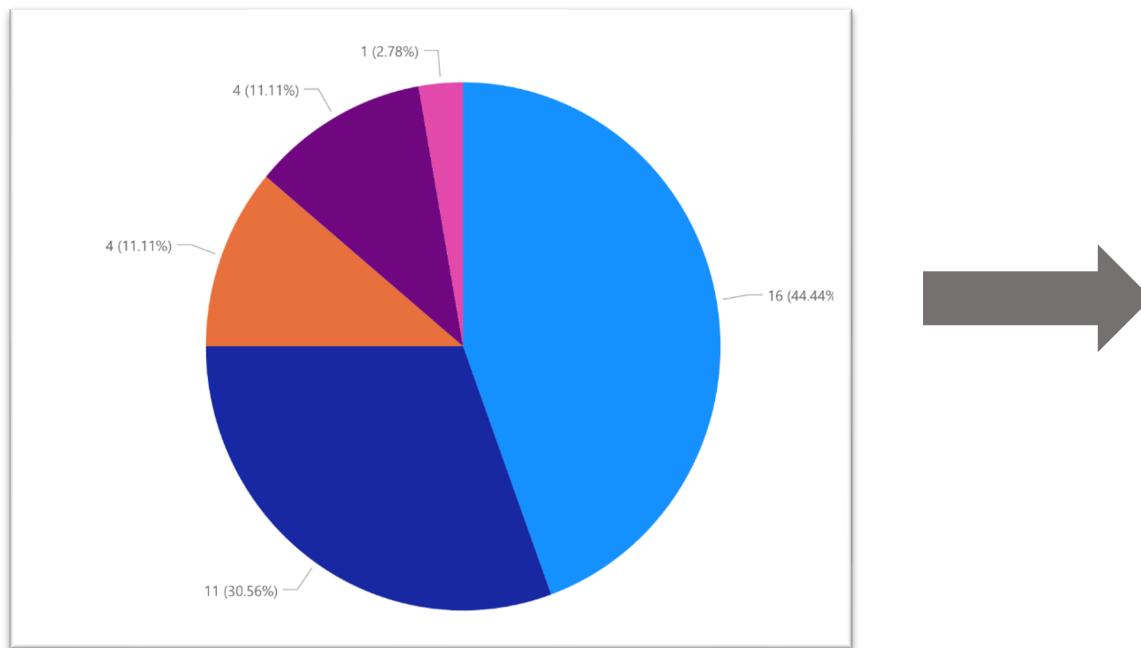
Project Overview

Demo

Lessons Learnt

Way Forward

Getting data in suitable format for Large Language Models



[Back to report](#) | **SOURCING ON TIME REASONS FOR MISS**

ReasonForMiss	Count
Engineering Changes - design changes, etc.	4
GSM task delays - execution, strategy and supplier development, etc.	10
Program Timing - Born Late Records, Print Availability CCR, etc.	4
Supplier task delays - nom letter sign-off	1
Unexpected changes - negotiations, NBH, friction, etc.	16
Total	35

Handling AI inaccuracies

Inconsistency in summary generation across different KPIs



Making sure that the input provided is **consistent** across KPIs & **prompts** are **detailed**

Hallucinations while summary generation by the model



Extensive testing – ran the program 100 times with randomized KPI data and implemented an automated string matching check

Generated summary might not meet the **standards** of the report outs



Constant **feedback** & **prompt iteration** from the stakeholders to improve the quality of the summary

Introduction + Background

Problem, Pain Points and Impact

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Lessons Learnt

Way Forward

Implement the prototype for all KPIs across all dashboards (e.g. Strategic)



Incorporating visualizations in summaries



*Seamless summary generation integration with PowerBI
to allow for one-platform, one-click summarization*



Improving the existing Business Intelligence Dashboard workflow to allow for quicker data refreshes and lesser missing data



In summary

- **Problem statement**

'Analysis Paralysis' on PowerBI is amplified by data overload and numerous interconnected KPIs.

- **Proposed Solution – (Proof of Concept)**

Automate analysis using Large Language Model (ChatGPT).

- **Impact**

Saves 20+ hours/month.

- **Way Forward**

Complete automation of diagnosing company performance on a click

Thank you